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Development and Initial Validation of the Mindful Self-Regulated Learning Scale (m-SRLS)

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DEVELOPMENT AND INITIAL VALIDATION OF THE MINDFUL SELF-REGULATED LEARNING SCALE (m-SRLS)

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Abstract

Modern mindfulness is a catch-all term. Just exactly what it looks like within the context of education and how it is taught vastly varies. As such, program fidelity and integrity is questioned. Here a definition of mindful self-regulated learning is proposed and the Mindful Self-Regulated Learning Scale (m-SRLS) is developed. This includes item generation and development, systematic testing of item performance, scale dimensionality, convergent and divergent validity, measurement invariance across groups and subgroups, and scale reliability over a series of five pilot studies and five primary studies using independent samples. The resulting m-SRLS is a context specific measurement tool that can be used to assess the effectiveness of secularized mindfulness training programs with specific focus on their utility in education.

Keywords: Mindful Self-Regulated Learning, Mindfulness, Education, Assessment, ESEM

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Chapter I: Introduction

Overview

Breathe in.

Notice the quality of the air as it passes through your nose in this moment:

the temperature, the sensation, the sound.

Breathe out.

Allow this simple function to spark your curiosity with a sense of gratitude and acceptance.

Breathe in.

Open yourself to the experience of breath as an anchor of your awareness. Whatever thoughts arise about what is next on your list or what happened earlier this morning, allow to drift gently off the edges of the mind. Come back to the breath.

Breathe out.

There is nothing to do and nowhere to be, aside from here and now.

Breathe in.

If your mind wanders off, just smile at it, bring it back here with compassion,

noticing all that arises without judgement.

Breathe out.

The above exercise reflects a type of direction that accompanies one of the most common mindfulness practices: guided meditation or mindful breathing. Practitioners are asked to sit or lay in a comfortable position and focus their attention on the breath. Reports on National Health Interview Survey data showed a threefold increase in this kind of meditation practice among US adults from 2012 to 2017 (Clarke et al., 2018). Its prevalence of use amongst US children has quadrupled (Wang et al., 2019). There has been swift movement to monetize this enthusiasm. In

2017 the mindfulness industry drew an estimated $1.2 billion in revenue and was projected to tip $2 billion in 2022 (Marketdata Enterprises, 2017). The top ten mindfulness apps alone generated $195 million in 2019 (Perez, 2019). By 2021, the global market size for these kinds of apps was valued at $1.75 billion and is projected to reach $6.89 billion by 2028 (Skyquest, 2022).

Mindfulness has thrived as an interest subject in both public and academic publications (Van Dam et al., 2018). The market bursts with apps, books, podcasts, and social media lifestyle pages that encourage everything from mindful breathing, eating, walking, and sleeping. These various programs come tagged with a healthy list of promised benefits for various aspects of users' psychological and physical well-being (Weare, 2019). The more popularity mindfulness gains, the further reaching and more targeted its related programs become. Nearly 22% of Fortune 500 companies implemented mindfulness programs at work in 2016 (Wolever et al., 2018), schools in the UK have introduced widespread mindfulness programs on a national scale (Magra, 2019), and health providers boast its benefits (Mayo Clinic Staff, 2020). Those that raise an eyebrow equate the spread and commercialization of mindfulness programs to the rise of "McMindfulness" (Walsh, 2016). The vagueness of the concept has allowed it to be tailored to consumer demands and branded to meet all manner of needs. There is a kind of mindfulness for everything. Some go as far as to attribute its popularity to intellectual illusion, calling mindfulness "the bottled water of the therapy industry" (Moloney, 2016). Secularized mindfulness has been further described as "an adolescent that thinks it knows everything and, indeed, certainly believes it knows more than its parent" (Dawson 2021, p. 145).

Program fidelity and integrity is questioned amongst the sweeping popularity of these programs in the public. This has resulted in a need for more rigorous evaluation tools. In education, this need is proliferated by the quick adaptation of school-based mindfulness

programs (SBMPs) at various levels of policy and implementation. Mixed evidence exists to support school-based mindfulness programs and the true utility of these programs is questioned (Odgers et al., 2022; Phillips & Mychailyszyn, 2022). In recent years, however, a primary mechanism of change espoused by SBMPs has emerged as the enhancement of self-regulated learning and subsequent psychological well-being and academic performance (Haydicky et al., 2012; Roeser et al., 2020). What remains in question is: do these programs accomplish this or has the rushed excitement left the field vulnerable to excessive noise?

Research in Mindfulness

Across 15,700 publications, the focus of mindfulness research has shifted from philosophical discussion (1916-1999) to therapeutic application (2000-2009) to validation, measurement, and adaptation of these programs across domains (2010 to 2019) (Lee et al., 2021). Various mindfulness-based interventions (MBIs) have produced evidence of psychological, physiological, and psychosocial benefits ranging from reduced stress, improvements in cognition, alleviation of chronic pain, increased emotional well-being, healthier interpersonal relationships, and even successful treatment of psychological disorders and addiction (see Creswell, 2017 for a review). Interest in the application of mindfulness training spans sustainable consumption (Fischer et al., 2017), workplace productivity (Bartlett et al., 2019), health behaviors (Gilbert & Waltz, 2010), and beyond. As mindfulness saturates popular culture, social scientists, neuropsychologists, educators, health practitioners, policy makers, and every day consumers are investing substantial resources in investigations that build the evidence base of the benefits of mindfulness, or rather the benefits of mindfulness intervention or training. This exponential hype is criticized (Van Dam et al., 2018). The explosion of interest and the

swift adaptation of mindfulness programs across broad contexts has surpassed the evidence of program fidelity and integrity (Crane & Hecht, 2018; Kechter et al., 2019).

When the extant evidence surrounding MBIs was mapped onto the National Institutes of Health (NIH) Stage Model, it revealed that existing evidence of these kinds of programs resides primarily in Stage I (intervention development and refinement), is lightly represented in Stage 0 (basic science) and Stage II (traditional efficacy testing), and mostly missing across Stage III (real-world efficacy testing), IV (effectiveness research), and V (dissemination and implementation research) (Dimidjian & Segal, 2015; Onken et al., 2014). There is concern that the grassroots spread of MBIs across contexts has outpaced evidence supporting the expanded diversity of the "warp and weft" (Crane et al., 2017). In some areas, MBIs have produced strong evidence for the efficacy in their treatment (see Kuyken et al., 2016), however there is an increased need to assess fidelity and integrity of the adaptations in other contexts. This is highlighted as a major concern in the field of education, where SBMPs have gained enthusiastic momentum (Emerson et al., 2020; Gould et al., 2016; Schussler et al., 2021).

Mindfulness Goes to School

Mindfulness has found itself many cheerleaders in education (Martin, 2018; Mussey, 2019) though there are others that remain more skeptical (Hyland, 2017; Reveley, 2016). Proponents suggest an urgent need to mobilize the spread of SBMPs (Jennings, 2016). However, the questions remain, does mindfulness belong in education and if so, what would that look like? McCaw (2020) gives a well-organized look at the both the thick and thin ways in which mindfulness practice has found its way into educational practice and beyond.

In Practice. Mindfulness in and as education manifests in diverse ways across primary, secondary, and post-secondary levels (Ergas & Hadar, 2019). The typical format of mindfulness

in education, and the most studied, is the mindfulness-based intervention (MBI). Most training programs in education are modeled off of the success of popularized clinical MBIs originating with Kabat-Zinn's Mindfulness Based Stress Reduction (MBSR; Kabat-Zinn, 1990). School-based mindfulness programs (SBMPs) continue to grow in number. They are composed and implemented by diverse professionals that range from psychologists to athletes to lawyers and more (Zenner et al., 2014). Most take on a 6 – 8-week structure, in which students are instructed by a practitioner in weekly classes to establish a practice and then encouraged to explore mindfulness through various aspects of daily life. The primary developers of these programs are private companies. Outsourced for implementation, they have been adapted as both intra- and extra-curricular activities (see Emerson et al., 2020 and Meiklejohn et al., 2012 for reviews).

Research directed towards evaluating the effects of SBMPs is often approached from a post-positivist perspective with aims at identifying causal mechanisms and scalable and generalizable results (Renshaw & Cook, 2017; Waters et al., 2015). The mindfulness education literature, like the clinical literature, is thus dominated by interest in randomized control trails or quasi-experimental studies as the gold standard for building an evidence base of positive learning outcomes related to mindfulness. These investigations are, however, difficult to implement (Weare, 2019). A range of studies have provided promising evidence that mindfulness training enhances executive control function, emotional self-regulation, and social-emotional learning competencies in students and teachers alike (Flook et al., 2010; Shahidi et al., 2017; Shapiro et al., 2008; Tarrasch, 2018; Zenner et al., 2014). A handful of studies also provide evidence of improved grades, study strategies, and test performance (Bakosh et al., 2015; Caballero et al., 2019; Franco Justo et al., 2011; Zeilhofer, 2023). Mindfulness has been shown to reduce test-anxiety and perceived stress levels (Cunha & Paiva, 2012; Dīkmen, 2021; Napoli et al., 2015).

This has, in turn, been linked to increased performance in both simulated and non-simulated high stakes testing in the college classroom and improvements on the GRE (Bellinger at al., 2015; Mrazek et al., 2013). Other studies have pointed to more mixed evidence of the mindfulness-achievement link (Baranski & Was, 2019; Calma-Birling & Gurung, 2017; McBride & Greeson, 2021; Tang et al., 2021)

Typical SBMP research follows a pilot level intervention model and these studies often lack active control conditions and rely on effect measures or self-report scales that may or may not be context relevant (Felver et al., 2016; Rosenkranz et al., 2019). This may be a symptom of the excitement for mindfulness in the classroom preceding the evidence of effects. The dose and variability in the delivery of these programs, the challenges defining mindfulness, the shortcomings of many studies to consider potential differences across subgroups, and the limitations in size and constitutions of study samples continues to be criticized (Tan, 2016). In response, some suggest a need for methodological approaches that help engage the mindfulness education research in important contextual and cultural considerations (McKeering & Hwang, 2019; Weare, 2019). Others call for a clear consensus in the definition and intention of mindfulness training in the educational setting (Broderick et al., 2021).

In Policy. Despite integrity and fidelity concerns for these programs, the promise of mindfulness to positively affect student learning and well-being has led to changes at the policy level internationally (Duff, 2021; McCaw, 2020). Some scholars argue for a shift in perspective from mindfulness *in* education to mindfulness *as* education and this has prompted the development of actual college level courses (Ergas & Hadar, 2021). In the United States, policy makers across the country are widely endorsing social emotional learning in school curriculum and the role of health and well-being of students supporting achievement is emphasized in the

Every Student Succeeds Act (Every Student Succeeds Act, 2015; National Association of State Boards of Education, 2021; Ryan, 2012; Temkin et al., 2021). In other countries, mindfulness itself is explicitly supported by policy. In the United Kingdom for example, The Mindfulness Initiative has endorsed the implementation of mindfulness programs in the criminal justice system, workplace, health, and education. The UK Mindfulness All-Party Parliamentary Group outlines the role of mindfulness in public policy (Mindfulness All-Party Parliamentary Group, 2015). In March 2021, The Mindfulness Initiative released a comprehensive guide for use by educators and implications of program implementation in schools (Weare & Bethune, 2021). At least six other national legislatures have implemented mindfulness training courses following the success of those in the British parliament (Bristow, 2019).

The cultural buy-in for the success and the wide-spread advocacy of these programs in education has also provided appealing funding opportunities for researchers. Some recent funding opportunities granted by the Institute of Education Sciences (IES) reflect this. One concerns the evaluation of the Cultivating Awareness and Resilience in Education program for special education teachers funded for just under 4 million dollars (Institute of Education Sciences, 2021 July). Another involves evaluating the efficacy of the MindUp, a SMBP, funded for 3.3 million dollars (Institute of Education Sciences, 2018 July). Yet another involves the creation of a scalable multimedia mindfulness training for youth, funded for just under 1.4 million dollars (Institute of Education Sciences, 2017 September).

In Theory & Measurement. Mindfulness research in education is framed within varying theoretical perspectives: 1) mindfulness related to well-being, physical, and mental health, 2) mindfulness related to social-emotional learning, 3) mindfulness related to sense of self and purpose, and 4) mindfulness related to cognitive function and academic performance (Ergas &

Hadar, 2019). In regard to the latter, resource dependency theories have been proposed to explain the relationship between mindfulness and academic achievement. Scholars suggest that mindfulness acts as a causal influence of self-regulation and is itself a practice of self-control (Hölzel et al., 2011; Lutz et al., 2008; Masicampo & Baumeister, 2007; Shapiro et al., 2006; Tang et al., 2015). Mindfulness has been incorporated in contemplative theories and pedagogy in education (Zajonc, 2016). Despite advances in theory research concerning the mindfulness-achievement link, there is concern for the inconsistency of the measurement of mindfulness and the need for a tool that can adequately evaluate change in mindfulness as it relates to its intended purpose in education (Grossman & Van Dam, 2011).

This concern stems from the absence of a precise and sweeping definition of secularized mindfulness and less than clear consensus in prior years regarding the utility of mindfulness in education. What should SBMPs actually do for our students and do the current instruments used to measure change in mindfulness after these programs reflect this? Roeser et al. (2020) suggest an answer to the first part of this question. After a review of 54 SBMPs, the authors formulated a theory of change in which the primary outcomes of these programs were determined as their ability to strengthen mindfulness and self-regulatory skills. Work is still needed, however, to bridge theories of self-regulated learning and mindfulness practice and situate mindfulness within a theoretical framework that allows for deeper exploration of secular mindfulness training as a tool for academic success.

Overview & Purpose of Study

Interest in mindfulness interventions in the classroom continues to grow and these programs are entering education policy (McCaw, 2020). With this comes a need to evaluate the efficacy of such programs with regard to observed changes in mindfulness itself and to situate

these practices within educational traditions and theory specific to education. The purpose of this study is to develop both theory and instrumentation to support a more practical definition of mindfulness and to provide an evaluative tool for educators assessing the effectiveness of these programs in the classroom. The current study aims to extend a definition of mindful self-regulated learning and to explore, create, and refine the Mindful Self-Regulated Learning Scale (m-SRLS).

Literature Review

Initial development of the scale will involve a comprehensive review of literature, including a thorough exploration of the definition of mindfulness, examination of the psychometric properties, strengths, and weaknesses of existing mindfulness scales, and an assessment of instrument need. The specific construct will be explored in the context of literature surrounding mindfulness, education, and self-regulated learning. A definition of mindful self-regulated learning will be presented as the convergence of existing theories. In addition, four pilot studies designed to generate initial items for the m-SRLS are presented and discussed.

Methods

The methods for this study are modeled off of best practices for scale development (Boateng et al., 2018). The current investigation involves the systematic testing of item performance, scale dimensionality, convergent and divergent validity, measurement invariance across samples and subgroups, and scale reliability. Five independent samples are used over two phases modeled by Boateng et al. (2018): 1) scale development and 2) scale evaluation.

Summary & Proposed Significance

Modern mindfulness is a catch-all term. What mindfulness looks like within the context of education and how it is taught vastly varies. The billion dollar mindfulness industry mines for

our enthusiasm and thrives off our quick cultural buy in for its impressive list of benefits: reducing our stress, helping us manage our emotions, making us more attentive, enhancing our relationships, and more. Evidence does exist to support the psychological and psychosocial benefits of mindfulness practice; however, the sweeping generalization of these benefits through the public has left us eager to adopt these practices without much concern for program fidelity. Policy makers continue to endorse social emotional learning in the school curriculum at national and state levels for good reason. Disparities in social emotional learning (SEL) competencies represent an opportunity gap for at-risk students and underserved populations in particular (Jaggers et al., 2019). As such, the door is wide open for mindfulness to find its way into the US education system as an avenue to support equitable student outcomes.

The growing popularity of mindfulness in the classroom affects education policy and allocation of research funding (McCaw, 2020). Practical measures of evaluation that can produce policy relevant data and support under-investigated programs that fall under the social emotional learning umbrella are needed (Williamson, 2021). A distinct challenge to the future of mindfulness education research is a lack of focus on the measurement of mindfulness itself, due to vague and differing conceptualizations of mindfulness as a latent construct as well as contextualization of the construct within education. These challenges in defining mindfulness have raised East-West tensions (Gethin, 2011; Grossman & Van Dam, 2011). In much modern mindfulness practice and research, originating Buddhist philosophy has been transformed to satisfy a contemporary Western curiosity and scientific approach. Given its proliferation and specific use in education interventions, there is a need to expand the current secularized definitions of mindfulness from which SBMPs have stemmed. The development of the Mindful Self-Regulated Learning Scale will allow for a context specific measurement tool that could be

used to assess the effectiveness of secularized mindfulness training programs with specific focus on their utility in education. In addition, this investigation will expand theoretical understanding of mindfulness in education.

In sum, this current investigation aims to:

1. Develop theory to support a succinct definition of secularized mindfulness within the educational context (mindful self-regulated learning);
2. Develop a practical, valid, and reliable tool for educators and policy makers to assess the effectiveness of school-based mindfulness programs (the Mindful Self-Regulated Learning Scale).

Chapter II: Literature Review

Overview

Chapter II addresses the major areas of contention in measuring mindfulness: defining the construct, using theory to support its use in education, and methodological concerns with existing measures of mindfulness. First, the historical background and transition of mindfulness from its Buddhist roots to academic secularization is explored. Next, the literature surrounding measuring mindfulness, existing limitations of current measures, and implications for further research are discussed. Initial investigations of student perceptions of mindfulness within the context of education are presented. A resulting discussion of the theoretical intersection of self-regulated learning theories and mindfulness follows. Finally, a set of scale items is generated through an iterative process involving inductive and deductive methods.

Defining Mindfulness

A History Lesson

Contemporary scholars agree that secularized mindfulness is rooted in Buddhist philosophy (Gethin, 2011). Buddhism is recognized as religion, empiricism, rationalism, and philosophy (Rajapakse, 1986). It encompasses nearly 2,500 years of history and five continents worth of diversity. To choose just one anchor within Buddhism as the origin of modern mindfulness is challenging at best and well beyond the scope of this paper to discuss (for more in-depth commentary see Husgafvel, 2016). The Pāli canon and Theravāda commentaries are the most attributed texts to secular mindfulness discussions in academic literature and will be the focus of this brief historical perspective (Bodhi, 2011).

The word mindfulness is a translation of the Pāli term *sati* (also *smrti* in Sanskrit) and was introduced in 1910 by T.S. Rhys Davids in his translation of the Mahāsatipaṭṭhāna Sutta.

Some contend this was a rather rough translation (Bodhi, 2000). From an etymological perspective, a closer translation to *sati* is remembrance or memory (Gethin, 2011). Rhys Davids himself recognized the difficulty in the original translation of *sati* within the context of Buddhism. He offered thought or mental activity as alternatives. The term mindfulness, however, ultimately stuck (Batchelor, 1997). Mindfulness is the essence by which the West has interpreted the Buddha's teachings on *sati*.

To conceptualize what it means to be mindful, it is helpful to partition the word into two more interpretable English words, *mind* and *full*. To define the *mind* is to distinguish it from the brain. Unlike the mind, the brain is a tangible organ. We can open a skull and hold it, weigh it, poke it, or otherwise interact with its matter. The mind, however, evades our touch. It is the mysterious realm of consciousness in which those things that cannot be directly held (or directly measured) exist: thought, perception, feeling, and imagination. The word *full* implies that some capacity has been reached, much as a cap is reached with liquid when filling a bottle with water. When we stitch together the words mind and full, what it means to be mindful can be described as:

thinking, feeling, perceiving and imagining at capacity.

With what and how are the not-so-simple philosophical questions that researchers, scholars, students, and teachers of mindfulness have attempted to answer across centuries.

It is noteworthy that mindfulness, or *sati*, within the Mahāsatipaṭṭhāna Sutta is not simply conceptualized as a trait of consciousness, but rather as a continuous practice (Nanamoli & Bodhi, 2001). In the Buddhist tradition, these practices are the foundation for freeing oneself of suffering and this is accomplished through the four frames of reference; *kāya* (body), *vedanā* (feeling), *citta* (mind), and *dhammas* (mental contents). The use of these frames of reference are

referenced to the basic practices of contemplation during meditation (Gunaratana, 1994). They informed the development of the mindfulness practices that are most recognizable today. For example, contemplations on *kāya* may include meditations that focus on the breath or walking meditations that focus on body sensation. Contemplations on *vedanā* involve de-centering from the judgment of pleasant/unpleasant feelings. Contemplations on *citta* might involve cultivating awareness of an ability to witness the mind's qualities. Contemplations on *dhammas* might involve focus on what is arising in the present moment.

From East to West

The journey of mindfulness from East to West has been paved by the interest of early Western psychologists. In 1939, Carl Jung was among the first to affirm this interest in a foreword for Japanese Zen teacher Daisetz Teitaro Suzuki's *Introduction to Zen Buddhism* (Jung, 1939). In this introduction Jung relates, "the illusion regarding the nature of self is the common confusion of the ego with self". (p. 13). Interest in mindfulness as a kind of Eastern psychotherapy and transcendental meditation grew parallel with counter culture social movements in the sixties (Watts, 1961). Over the next thirty years or so a gradual shift occurred that displaced the spiritual components of mindfulness practice (Harrington & Dune, 2015). It is at this point in time that Kabat-Zinn and his work at the Stress Reduction Clinic (founded in 1979) and Center for Mindfulness in Medicine, Health Care, and Society (founded in 1995) at the University of Massachusetts would solidify this shift with a clinical definition of mindfulness:

> "Mindfulness means paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally" (Kabat-Zinn, 1994, p. 4).

This definition of mindfulness was the spring board for the development of the major clinical MBIs. Kabat-Zinn's (1990) mindfulness-based stress reduction (MBSR) follows an 8-week model in which participants are guided through mindful movement, the body scan, and sitting meditation in a style of systematic instruction in which participants are guided to cultivate the practices in daily life. The MBSR program inspired other clinical programs like mindfulness-based cognitive therapy (MBCT; Segal et al., 2002) and countless other adaptations in diverse contexts (see Cullen, 2011). While it is clear that aspects of the four frames of reference (body, feeling, mind, mental contents) form the outline of the Kabat-Zinn definition, with the adaptation of Buddhist practices to clinical practice, mindfulness as it is understood in the West has grown out of its heritage and into a secularized form. It can be considered a distinct construct from *sati*. Scholars continue, however, to debate this distinction (Gethin, 2011). The term mindfulness has been operationalized multiple times, situated in domain specific ethos with somewhat varying adaptations and implications for practice, as well as implications for measurement (Grossman & Van Dam, 2011).

Defining Mindfulness in Education

Within the context of education, mindfulness made a somewhat quiet debut under the umbrella of contemplative education pedagogy. What is considered the reemergence of contemplative practices began in 1995 with the creation of the Center for Contemplative Mind in Society (CCMIS) (see Morgan, 2015). Sarath (2003) defines contemplative practices as "systematic methods of invoking heightened states of consciousness, or awareness" (p. 216). Bush (2010) further contextualizes contemplative epistemology to include "a suspension of disbelief (and belief) in an attempt to 'know' reality through direct observation, by being fully present in the moment" (p. 188). With the rise of contemplative theories and recommendations,

came the distinct need to further contextualize secularized mindfulness in the framework of education.

Ellen Langer's (1989) work was among the first to do so. She defines mindfulness in contrast to mindlessness as "a flexible state of mind in which we are actively engaged in the present, noticing new things and sensitive to context" (Langer, 2000, p. 220). She makes the case that mindful learning involves the active distinction of noticing new things and so promotes and enables critical thinking. Mindful learning is characterized as the creation of novel perspectives, openness to new perspectives, and implicit awareness of uncertainty or awareness of multiple points of view. Langer and Moldoveanu (2002) further distinguish Western mindfulness as a social-cognitive mindfulness. This draws heavily from Bandura's social cognitive theory of self-regulation in which behavior is "extensively motivated and regulated by the ongoing exercise of self-influence" by self-monitoring, judgment, and affective reaction (Bandura, 1991, p. 248). Mindfulness has also been addressed from an information processing framework, both as a form of inhibition and concept refinement, as an attributional trait of consciousness, as a function of self-regulation, and as a metacognitive practice (Bishop et al., 2004; Brown & Ryan, 2003; Kabat-Zinn, 2003; Kudesia, 2019; Shapiro et al., 2006). Many of these definitions have been molded to best fit the theoretical frameworks that attempt to explain some of the desired outcomes of mindfulness within the domain ethos.

A Component Perspective

The struggle to provide a precise secularized definition of mindfulness in the educational context and beyond is in the delineation of its characteristic parts. Definitions of mindfulness have conceptualized these parts in slight variations. To summarize, the Kabat-Zinn (2003) definition places mindfulness in a clinical framework and characterizes it as a mental state of

"paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment" (Kabat-Zinn, 2003, p. 145). Langer (2000) grounds mindfulness in a social-cognitive perspective through an emphasis on novelty seeking, novelty production, engagement, and flexibility. Brown and Ryan (2003) use self-determination theory to support the idea of mindfulness as a distinct construct from self-reflexive consciousness (see Baumeister, 1999) in its ability to capture a "quality of consciousness that is characterized by clarity and vividness of current experience and functioning…in contrast to the mindless, less 'awake' states of habitual or automatic functioning that may be chronic for many individuals" (p. 823). Bishop et al. (2004) propose a two-component model of mindfulness as 1) "the self‐regulation of attention so that it is maintained on immediate experience, thereby allowing for increased recognition of mental events in the present moment" and 2) "adopting a particular orientation toward one's experiences in the present moment, an orientation that is characterized by curiosity, openness, and acceptance" (p. 232). Shapiro and colleagues (2006) position mindfulness practices under three distinct mechanisms: intention, attention, and attitude (IAA). This IAA definition of mindfulness is characterized by a quality of re-perception. All of the above definitions of mindfulness point towards its function as a distinct aspect of consciousness and the intertwinement of cognitive and emotional awareness and attention.

Measuring Mindfulness

Measuring mindfulness has proved challenging in predictable ways. Direct observation of mindfulness is not possible. The practice of mindfulness does not "look" like anything in particular that might be codified or counted. This limitation has made predictive outcomes of mindfulness practice the typical focus of measurement for inquiring researchers. Research has emphasized whether hypothesized benefits of mindfulness are observed in treatment groups

versus not observed in control groups. The measurement of these effects has taken many forms. Physiological markers of behavior such as urine and blood tests or changes in salivary cortisol levels as an indicator of stress, health, and well-being have been used (Sanada, 2016). The effects of mindfulness have also been measured through standardized cognitive measures assessing various aspects of information processing speed, working memory, and attention. Some examples of these tasks are the forward/backward digit span test, Stroop test, computer adaptive n-back task, or operation span tasks (Chiesa et al., 2011). In addition, the effects of mindfulness have been measured as neural correlates in specific areas of the brain associated with higher order functioning. Gotink et al. (2016) provide a review of these kinds of functional magnetic resonance imaging (fMRI) studies.

The measurement of mindfulness itself, however, has proved difficult from a psychometric point of view. Diary methods in which participants keep practice logs and comment on their experience have been used (Hargus et al. 2010; Kerr et al., 2011). These methods are exhaustive, require substantial time from participants, and laborious coding from researchers which renders them impractical in many circumstances (Bartlett & Milligan, 2015). Mindfulness self-report scales provide an easier to implement measuring tool and many have been created in response (Baer, 2011). Self-report scales allow for the mapping of unobservable phenomenon onto effect indicators, often behavior frequencies, that are theoretically linked to a construct (DeVellis, 2017). They are cost effective and easy to implement in many research contexts. The majority of existing mindfulness self-report measures have been developed and tested within the Western clinical psychology domain. They are based on descriptions of mindfulness that have been circulating the literature since its emergence as a construct of interest

two decades ago (Baer et al., 2009). Table 1 provides a non-exhaustive list of popular mindfulness self-report scales.

Scale Range and Use

Since their development, self-report measures remain the widest used tools to assess mindfulness in research across domains (Sauer et al., 2013). They are used in a variety of contexts and within a broad scope of research purposes such as mediation studies further exploring mechanisms of mindfulness with other psychological indicators (Coffey & Hartman, 2008), studies assessing the effectiveness of new or novel applications of MBIs (Cavanagh et al.. 2018; Krägeloh et al. 2018), and studies in which mindfulness serves as a predictor variable (Klainin-Yobas et al., 2016). Most of these instruments reflect the anticipated psychological outcomes of mindfulness that followed the skills taught in the early clinical MBI format and have also provided an opportunity to further investigate the dimensions of the mindfulness construct (Baer et al., 2009). Most inventories have also been designed to reflect a general tendency to be mindful in which mindfulness is conceptualized as a dispositional trait (examples in Table 1 include the FMI, MASS, FFMQ, and CAMS-R). Scales reflective of state-level mindfulness have also been designed (TMS and SMS) and mindfulness has been conceptualized in instrumentation as a set of skills that may be developed with practice and time (KIMS).

Psychometric Properties of Existing Scales. A summary of the psychometric properties of existing mindfulness scales is provided in Table 2. Each scale is presented in further depth concerning their development and brief descriptions of their function.

Table 1

Existing Mindfulness Scales & Dimensions

Authors	Measure	Hypothesized Dimensions	Item Example
Buchheld et al. (2001)	Freiburg Mindfulness Inventory	Mindful presence Nonjudgmental acceptance Openness to new experiences Insight	*I watch my feelings without getting lost in them.*
Brown & Ryan (2003)	Mindful Awareness Attention Scale	Uni-dimensional awareness to present moment experiences	*I find it difficult to stay focused on what's happening in the present*
Baer et al. (2004)	Kentucky Inventory of Mindfulness Skills	Observing Describing Acting with awareness Nonjudgmental acceptance	*I'm good at thinking of words to express my perceptions, such as how things taste, smell, or sound.*
Lau et al. (2006)	Toronto Mindfulness Scale	Curiosity Decentering	*I was more concerned with being open to my experiences than controlling or changing them*
Baer et al. (2006)	Five-Facet Mindfulness Questionnaire	Observing Describing Acting with awareness Nonreactivity Nonjudgment	*When I do things, my mind wanders off and I'm easily distracted.*
Feldman et al. (2007)	Cognitive and Affective Mindfulness Scale-Revised	Attention Present-focus Awareness Acceptance	*I am preoccupied by the future.*
Chadwick et al. (2008)	Southampton Mindfulness Questionnaire	Mindful observation Non-aversion Nonjudgment Letting come(go)	*Usually, when I have distressing thoughts or images, in my mind I try to push them away.*

Cardaciotto et al. (2008)	Philadelphia Mindfulness Scale	Awareness Acceptance	*When I shower, I am aware of how the water is running over my body*
Tanay & Bernstein (2013)	State Mindfulness Scale	State mindfulness of bodily sensations State mindfulness of mental events	[In the past 15 minutes] *I was aware of what was going on in my mind.*
Bergomi et al. (2014)	Comprehensive Inventory of Mindfulness Experience	Inner awareness Outer awareness Acting with awareness Openness Acceptance Decentering/Nonreactivity Insight Relativity of thoughts	*I notice sounds in my environment, such as birds chirping or cars passing.*
Pirson et al. (2018)	Langer Mindfulness Scale	Novelty seeking Novelty producing Engagement	*I am rarely alert to new developments.*

Table 2

Psychometric Properties of Existing Mindfulness Scales

	FMI	**MASS**	**KIMS**	**CAMS-R**	**SMQ**	**TMS**	**FFMQ**	**PHLMS**	**SMS**	**CHIME**	**LMS**
Trait/State	Trait	Trait	Trait/ State	Trait	Trait	State	Trait	Trait	State	Trait/ State	Trait
# of Items	30	15	39	12	16	13	39	20	21	37	14
# of Response Categories	4	6	5	4	7	5	5	5	5	6	7
# Factors	4	1	4	4	1	2	5	2	2	8	3
α reported	.80 –.94	.82	.76 –.91	.74 –.77	.89	.86 –.87	.75 – .91	.81 –.85	--	.70 – .86	.65 –.90
Factor correlations *r*	.48 –.60	--	.09 –.34	.23 –.89	--	.26	.15 –.34	-.06	--	.18 –.72	--

Note. Where data was unavailable or unclear '--' is indicated. FMI = Freiburg Mindfulness Inventory; MAAS = Mindful Awareness Attention Scale; KIMS = Kentucky Inventory of Mindfulness Skills; TMS = Toronto Mindfulness Scale; FFMQ = Five-Facet Mindfulness Questionnaire; CAMS-R = Cognitive and Affective Mindfulness Scale-Revised; SMQ = Southampton Mindfulness Questionnaire; PHLMS = Philadelphia Mindfulness Scale; SMS = State Mindfulness Scale; CHIME = Comprehensive Inventory of Mindfulness Experience; LMS = Langer Mindfulness Scale

Frieberg Mindfulness Inventory. The Frieburg Mindfulness Inventory (FMI; Buchheld et al., 2001) was developed within the Buddhist perspective of mindfulness. The construct definition provided describes mindfulness as "the moment-to-moment attentional, unbiased observation of phenomenon in order to perceive and to experience how it truly is, absent of emotional or intellectual distortion" (Solé-Leris, 1994, p. 26). Items were generated from insight meditation literature and input from expert meditators. Original items were written in German and later translated to English (Walach et al., 2006). The final scale contains 30-items designed to assess mindfulness across four dimensions: mindful presence, non-judgmental acceptance, openness to experiences, and insight. Items are measured on a four-point Likert scale that ranges from *rarely* to *almost always* and a total score is produced. Initial factor analysis was conducted using principal components analysis with varimax rotation. The four-factor structure did not hold across samples and the authors interpreted item cross-loadings as evidence for a one-factor solution, despite having set out to explore mindfulness as a multidimensional concept. The four-factor structure was found to be unstable across additional studies (Leigh et al., 2005; Walach et al. 2006). A 14-item short form of the scale was developed in which items with low correlations were removed, though this short form reflects similar item loading disparities (Kohls et al., 2009). In addition, a Rasch analysis of the short form revealed sizeable floor and ceiling effects and a favorable bifactor model (Sauer et al., 2011). Both forms of the FMI have been recommended for use solely in populations with previous meditation experience due to particular item wording concerns (Baer, 2011). Construct validity of the FMI, however, has been questioned as higher scores on the FMI have been associated with increased alcohol and tobacco use (Belzer et al., 2013; Leigh et al., 2005).

Mindful Awareness Attention Scale. The Mindful Awareness Attention Scale (MAAS; Brown & Ryan, 2003) was created to measure a unidimensional mindfulness as "present-centered attention–awareness" by assessing frequency differences in mindful states over time (p. 824). It consists of 15 negatively worded items measured on a six-point Likert scale that ranges from *almost always* to *almost never* and produces a total score. Initial items were deductively generated and later reduced through examining ratings from expert evaluators and pre-testing. Items were eliminated that had skewed or kurtotic distributions, did not demonstrate a full range of response alternatives, or that were not rated consistently "good" amongst experts. Any items reflecting acceptance, trust, empathy, or gratitude were eliminated and final items were selected to reflect mindlessness. A one-dimensional factor structure was retained through exploratory and confirmatory factor analyses and replicated in additional studies (Carlson & Brown, 2005; MacKillop & Anderson, 2007). However, one study questions the functionality of some items as indicators of a single latent factor (Cordon & Finney, 2008). Scale authors found evidence of convergent validity through positive correlations with openness to experience, emotional intelligence, and well-being. Evidence for discriminant validity included a negative relationship between scores on the MASS and self-monitoring, as well as negative correlations with rumination and social anxiety (Brown & Ryan, 2003). The MASS was found to discriminate between advanced meditators and beginners, though it may not discriminate well between novice meditators and those with no experience (MacKillop & Anderson, 2007). The negative wording of its item statements has opened the MAAS to criticism and challenges to its construct validity (Rosch, 2007; Van Dam et al., 2010). Concerns are that lapses in attention do not necessarily reflect the opposite and that this response bias may not be accounted for in the reverse scoring of items (Grossman, 2011). The scale may represent an altogether separate latent construct as

demonstrated through differences observed in positively wording the items (Höfling et al., 2011). Furthermore, an item response theory analysis revealed a failure of most items to differentiate between differing levels of mindfulness (Van Dam et al., 2010).

Kentucky Inventory of Mindfulness Skills. The Kentucky Inventory of Mindfulness Skills (KIMS; Baer et al., 2004) measures mindfulness as a multidimensional trait that consists of a set of behavioral skills derived from Dialectical Behavior Therapy (DBT; Linehan, 1993). Items were generated to reflect four categories of mindfulness practices: observing, describing, acting with awareness, and accepting without judgment. These four facets are considered unique. Five clinical practitioners of DBT and six graduate students with at least one course completion of DBT and one year of DBT skill group leadership were asked to classify and then rate how well initial items fit within the four categories and also rate item quality. An initial set of 77 items was reduced to 39 following examination of item total and inter-item correlations. Items are measured on a 5-point Likert scale that ranges from *never or very rarely true* to *always or almost always true* and both a total score and subscale scores are produced. Principal axis factoring with oblique rotation yielded an initial nine factor solution. The scree plot indicated a four-factor solution. Authors chose to favor the scree plot solution due to the potential over-estimation of factors using eigenvalues greater than one. Subsequent confirmatory factor analysis was conducted using a parceling approach to overcome sampling inadequacy and a hierarchical four-factor model was retained. Other studies have suggested a correlated four-factor structure is more appropriate (Baum et al., 2010). Even still, the factor structure has demonstrated instability cross culturally (Christopher et al., 2009). Scale authors report evidence for convergent validity in positive correlations between the KIMS and openness to experience and emotional intelligence. They report evidence for discriminate validity in negative correlations with

experiential avoidance and alexithymia (Baer et al., 2004). Researchers point out the plausibility that skills taken from DBT may not be representative of mindfulness outside of the therapeutic context (Park et al., 2013).

Cognitive and Affective Mindfulness Scale – Revised. The Cognitive and Affective Mindfulness Scale Revised (CAMS-R; Feldmen et al., 2006) was developed in response to flaws in the initial Cognitive and Affective Mindfulness Scale which demonstrated low internal consistency and instability in its factor structure. It attempts to measure mindfulness as "mindful approaches to thoughts and feelings" regardless of meditation experience (p. 181). The scale consists of 12 items rated on a 4-point Likert scale that ranges from *rarely/not at all* to *almost always* and a total score is produced. Items were generated deductively by a "group of researchers with expertise in mindfulness meditation, emotion regulation, and questionnaire development" (p. 179). The authors took a structural equation modeling approach for testing preliminary models versus the traditional EFA. CFA revealed one second-order latent factor authors labeled mindfulness and four first-order latent factors: attention, present-focus, awareness, and acceptance. However, subscales have demonstrated low internal consistency and scale authors recommend the use of the total score only (Feldman et al., 2006). The CAMS-R positively correlated with FMI and MASS as well as with measures of plan rehearsal, cognitive flexibility, adaptive emotion regulation, problem analysis, and well-being. It is negatively correlated with measures of rumination, worry, thought suppression, symptoms of distress, brooding, experiential avoidance, and stagnant deliberation (Feldman et al., 2006). The original CAMS was intended to measure mindfulness specific to the treatment of depression yet items retained in the CAMS-R may be more related to measures of psychological distress other than measures of mindfulness (Baer et al. 2006; Bergomi et al., 2013; Thompson & Waltz, 2007).

Southampton Mindfulness Questionnaire. The Southampton Mindfulness Questionnaire (SMQ; Chadwick et al., 2008) was first introduced as the Mindfulness Questionnaire. This 16-item scale was designed to measure mindfulness as an assessment of awareness of distressing thoughts and images. Items are measured on a 7-point Likert scale ranging from *strongly disagree* to *strongly agree* producing a total score. Item stems begin with "Usually, when I have distressing thoughts or images…" and are followed with a mindfulness related response. These responses are conceptualized across four bipolar constructs "(1) decentered awareness of cognitions as mental events in a wider context or field of awareness versus being lost in reacting to them, (2) allowing attention to remain with difficult cognitions versus experiential avoidance, (3) accepting difficult thoughts/images and oneself, versus judging cognitions and self, and (4) letting difficult cognitions pass without reacting versus rumination/worry" (p. 452). A one-dimensional factor was suggested by principal components factor analysis and the single factor solution accounted for less than 50% of the variance. The SMQ was positively correlated with the MASS and pleasant mood ratings. In addition, it appropriately discriminated between meditators and non-meditators and showed sensitivity to MBI training. The scale may be limited, however, to the investigation of relationships between mental health problems and mindful awareness in clinical settings rather than the assessment of mindfulness in daily life (Bergomi et al., 2013).

Toronto Mindfulness Scale. The Toronto Mindfulness Scale (TMS; Lau et al., 2006) was developed to "assess the subjective experience of a mindfulness state retrospectively in reference to mindfulness meditation techniques designed to evoke the mindfulness state" (p. 1447). The scale consists of 13 items that are administered to respondents immediately following a brief mindfulness exercise and are designed to assess the quality of the experience with the

mindfulness exercise. Items were deductively generated by the researchers to reflect the two-component Bishop et al. (2004) definition of mindfulness. Items are measured on a 5-point Likert scale that ranges from *not at all* to *very much* and a total score is produced. Exploratory factor analysis utilizing maximum likelihood estimation and oblimin rotation revealed a two-factor mindfulness solution. A CFA produced mixed effects for the two-factor structure and two items were eliminated to maintain goodness of fit. The two retained factors were labeled Curiosity and Decentering. There has been some discussion that the Curiosity factor may pertain to a conceptualization of mindfulness within the literature that is narrowed to the mindfulness taught in MBSR clinical programs It may therefore be less generally and more specifically applied in clinical contexts (Bergomi et al., 2013). The sensitivity of the TMS to detect changes pre- and post- MBI training has, however, been questioned (Eyles et al., 2015; Klein et al., 2015; Thompson & Walz, 2007). A trait version of the TMS has also been developed (Davis et al., 2009).

Five-Facet Mindfulness Questionnaire. The Five-Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) consists of 39 items that were empirically rather than theoretically constructed. It was developed through the factor analysis of 112 pooled items from the MAAS, KIMS, FMI, CAMS-R, and SMQ. The authors reasoned that combining the items in existing scales would provide greater dimensional understanding of mindfulness as a construct. Items are measured on the same 5-point scale as the KIMS and range from *never or very rarely true* to *very often or always true*. An initial EFA revealed a 26-factor solution, however the 5-factor solution made evident in the scree plot was retained. Principal axis factoring with oblique rotation was conducted in a second EFA specifying 5 factors and 39 items were retained that held the highest loadings on the factors. Confirmatory factor analysis with maximum likelihood

estimation was conducted using item parcels rather than individual items much like the KIMS. The use of parceling risks masking multidimensionality and measurement invariance (Bandalos & Finney, 2001; Hall et al., 1999; Little et al., 2002). A hierarchical 5-factor structure was suggested, however notably the *Observe* factor demonstrated non-significant loading on the overall mindfulness construct. This was unexpected. The other four facets were identical in factor structure to the KIMS and some express concern that the KIMS was overrepresented in the empirical analysis of items, given that it is the longest scale (Bergomi et al., 2013). Subsequent investigation suggests item parceling may not have inflated model fit, but may have obscured psychometric properties of some items. A shortened form was suggested that reflects a higher order two-factor structure in which the five facets load on two factors: Self-regulated Attention and Orientation to Experience (Tran et al., 2013). Scores on four of the facets, all but Acting with Awareness, significantly correlate to meditation experience in the expected direction and all facets correlate positively with measures of psychological well-being and negatively with psychological symptoms (Baer et al., 2008). The effective use of the FFMQ in evaluating change in mindfulness across varying MBIs, however, is mixed (Carmody & Baer, 2008; Goldberg et al., 2016). This highlights the challenges of the universality of mindfulness questionnaires to measure diverse program change. Some facets of mindfulness may not be addressed across all program types (Baer et al., 2009). A revision of the scale to address some of its psychometric issues, particularly those related to method effects, resulted in the Balanced Inventory of Mindfulness-Related Skills designed to shift the conceptualization of mindfulness back to a set of skills rather than a trait (BIMS; Van Dam et al., 2018; Padmanabham et al., 2021).

Philadelphia Mindfulness Scale. The Philadelphia Mindfulness Scale (PHLMS; Cardaciotto et al., 2008) consists of 20 items that were designed to measure mindfulness based

on definitions of mindfulness proposed by Kabat-Zinn (1994) and Bishop et al. (2004) that reflect two dimensions of mindfulness: present-moment awareness and attention. Items were generated deductively by "clinical psychology faculty and graduate students familiar with the construct of mindfulness and mindfulness-based psychotherapies" (Cardaciotto et al., 2008, p. 5). These items were rated by six experts based on how well they fit with the two proposed dimensions and the content validity coefficient was used to determine item retention. Items are measured on a 5-point Likert scale that ranges from *never* to *very often* and respondents are asked to rate the items on the frequency that they experienced them within the past week. Principal axis factoring using promax rotation revealed a 17-factor solution and examination of the scree plot resulted in the retention of two factors. Twenty items were retained for the two-factor solution and subjected to CFA. Some have criticized the PHLMS for narrowly conceptualized dimensions (Bergomi et al., 2013) In addition, the attention subscale items are negatively worded. Like criticisms of the MASS, the reverse scoring of items may challenge construct validity and the subscales were found to be uncorrelated (Van Dam et al., 2010).

State Mindfulness Scale. The State Mindfulness Scale (SMS; Tanay & Bernstein, 2013) was designed to measure state mindfulness across 21 items. Items are measured on a 5-point Likert scale that ranges from *not at all* to *very well*. Statements reflective of a respondent's level of attention and awareness are preceded with the prompt "There is a list of statements below. Please use the rating scale to indicate how well each statement describes your experiences in the past 15 minutes. (First) Please describe what you were doing during these 15 minutes period." The mindfulness construct was framed within a Buddhist conceptualization as well as informed by the two-component model definition of mindfulness proposed by Bishop et al. (2004). From the integration of these conceptualizations, scale authors proposed a two-level model of state

mindfulness. The first level focused on "the objects of mindful attention" and the second level focused on the "qualities of mindfulness as a meta-cognitive state" (Tanay & Bernstein, 2013, p. 1287). This conceptual model was designed to support a unidimensional mindfulness. Items were deductively generated and refined through iterative expert feedback in which existing trait mindfulness items were reworded to suit the present-tense. Principal axis factor analysis with an oblique rotation revealed a two-factor solution. Subsequent CFA analysis revealed a higher order two-factor solution composed of one higher-order state mindfulness factor and two first-order factors of state mindfulness of mind and state mindfulness of bodily sensations. Limited association between the SMS and trait mindfulness has been noted as well as unexpected relationships between meditators and non-meditators which challenges its validity (Bravo et al., 2018).

Comprehensive Inventory of Mindfulness Experience. The Comprehensive Inventory of Mindfulness Experience (CHIME; Bergomi et al., 2014) was developed through an empirical approach to scale development, like that of the FFMQ, to again try and develop a scale that encompasses all of the existing facets of mindfulness. The two-component Bishop et al. (2004) definition was used as the guiding construct definition in which mindfulness is seen as the "self-regulation of attention so that it is directed in the present moment and a particular orientation involving curiosity, openness, and acceptance" (Bergomi et al., 2013, p. 20). Upon review of items across eight existing mindfulness inventories, the authors suggested nine aspects of mindfulness: (1) observing, attending to experiences, (2) acting with awareness, (3) nonjudgment/acceptance of experiences, (4) self-acceptance, 5) willingness and readiness to expose oneself to experiences/non-avoidance, (6) non-reactivity to experience, (7) non-identification with own experiences, (8) insightful understanding, and (9) labeling/describing.

Original items were generated in German for each aspect by the authors and reduced to four items per aspect through "consultation with meditation naïve individuals" to aid in the item interpretation (p. 21). Some items were left verbatim from existing questionnaires. Respondents are instructed to relate the items to the past two weeks on a 6-point Likert scale that ranges from *almost never* to *almost always*. A correlational 8-factor model was retained. Translation of the scale to Dutch has revealed that 7+2 correlational and hierarchical factor models in which the *Inner Awareness* and *Outer Awareness* factors load on one *Awareness* factor also provide a reasonable fit (Cladder-Micus et al., 2019).

Langer Mindfulness Scale. The Langer Mindfulness Scale (LMS; Pirson et al., 2018) consists of 14 items designed to assess a socio-cognitive mindfulness defined as "an active mindset characterized by novel distinction–drawing that results in being 1) situated in the present, 2) sensitive to context and perspective, and 3) guided (but not governed) by rules and routines" (p. 169). Rather than approach the construct from the clinical perspective, the scale authors situate socio-cognitive mindfulness as a Western perspective. Their intention was to create a more relevant mindfulness research tool for organizational contexts. Items were generated deductively from existing literature on the hypothesized subconstructs of novelty seeking, novelty production, engagement, and flexibility. Items are measured on a 7-point Likert scale that ranges from *strongly disagree* to *strongly agree*. An initial EFA and CFA were conducted and items reduced through examination of factor loadings. A four-factor structure was retained. Subsequent CFAs with five independent samples led to further item reduction and elimination of the *Flexibility* factor. A three-factor model was retained that included novelty seeking, novelty producing, and engagement. The four-factor structure with the original 21-items was tested in additional studies and found to be unstable. A two-factor solution composed of

mindfulness and mindlessness factors has been suggested (Haigh et al., 2011). The LMS correlated positively with measures of openness to new experience, the need for cognition, humor, and the MASS and FFMQ. It correlated negatively with measures of the need for structure, neuroticism, negative affect, and the need for vacation (Pirson et al., 2018). Concurrent and incremental validity studies of the LMS with other measures of mindfulness suggest that the LMS measures a distinct construct from the other mindfulness questionnaires (Siegling & Petrides, 2014).

Issues Measuring Mindfulness in Education

The fidelity, efficacy, and heterogeneity of MBIs in education is questioned (Emerson et al., 2020; McKeering & Hwang, 2019; Zenner et al., 2014, Schussler et al., 2021). Separating the wheat from the chaff has therefore proved difficult and scholars continue to question the integrity of these programs (Crane et al., 2017). The use of the above scales in evaluating the efficacy of varying school-based MBIs, however, could pose threats to measurement accuracy. Of primary concern is the construct validity of these scales in the context of education and the specificity of what they measure. The adequacy of these existing scales in assessing responsiveness to school based MBIs is questioned here.

Context Specific Definitions and Scales

Scale development begins with clear articulation of the construct of interest. A construct is a conceptual term that hypothetically describes an actual phenomenon (Netemeyer et al., 2003). Latent constructs, like mindfulness, provide particular challenges to accurate measurement. A measure can be defined as an observed score gathered to quantify a construct and the relationship of the measure to the construct is assumed accurate in its representation (Edwards & Bagozzi, 2000; DeVellis & Thorpe, 2021). The statistical techniques that

accompany scale development (e.g., Classical Test Theory; Lord & Novick, 1968; Factor Analysis; Harman, 1976; Kim & Mueller, 1978; Reliability and Validity; Nunnally, 1978) hinge on the assumption that the measure is reflective of the construct rather than causal of it. If the measures are truly reflective, it is possible to map them onto the construct with a degree of confidence. The more abstract the construct of interest, the more difficult it is to generate items that are truly reflective. This is why researchers concerned with scale development have long emphasized the importance of pre-testing (Hinkin, 1998).

Do Existing Instruments Measure the Same Mindfulness? As described, the wide range of definitions of mindfulness have contributed to the development of numerous scales that target mindfulness from distinct perspectives. Just how well those scales represent general mindfulness is questioned (Bergomi et al., 2013; Grossman, 2011). There are advantages to defining a construct with more context specificity (Devellis, 2017). A general set of items may take on fundamentally different meaning in different contexts. Offenbächer et al. (2011) compared the concepts of ten mindfulness instruments using the International Classification of Functioning (ICF). The different scales' items demonstrated considerable diversity with 50% relating to body function, 22% related to activity and participants, and 28% relating to contextual factors. With respect to measuring mindfulness in education, items like *When I do things, my mind wanders off and I'm easily distracted* from the FFMQ may be interpreted differently with the addition of an educational setting. For example: *When I do things in class, my mind wanders off and I'm easily distracted*. It is plausible that a person may not be easily distracted in their day to day doing of "things", but that they feel they are easily distracted by "things" when they are in a classroom.

Diversity in mindfulness scales can be beneficial for mindfulness research because there are inherent limitations to content relevance across operational definitions. In large part, the diverse scale development in mindfulness has been a response to changing measurement contexts. The LMS (Pirson et al., 2018) seeks to do this for organizational contexts. The LMS is the only scale discussed here to situate mindfulness within a distinct Western theoretical perspective. Emphasis is placed on novelty seeking, however, which is not a central tenant of most MBIs. The openness to new experience that the LMS measures has emerged as a distinct construct from the openness factors captured by other mindfulness measures (Karl & Fischer, 2020). Considering the application of mindfulness in education most often takes on the MBI model, it may follow that conceptualizing mindfulness within both Eastern and Western definitions may better capture the multidimensional nature of the construct within differing contexts.

Scholars have suggested that the continued development of more context-specific mindfulness questionnaires may aid in the overall conceptual understanding of mindfulness and mark a sign of maturity in the field (Krägeloh et al., 2019). Some examples of context specific mindfulness scales include the Interpersonal Mindfulness in Parenting scale (Duncan et al., 2009), the Athlete Mindfulness Questionnaire (Zhang et al., 2017) and the Mindfulness in Teaching Scale (Frank et al., 2016). A shortcoming of the use of existing measures in evaluating change in mindfulness for students is the absence of context-specificity in both the construct definition and the scale items. Given the heterogeneity between mindfulness questionnaires, exploring and defining the construct of mindfulness within education could lead to the generation of more context-specific items and, in turn, enhance the responsiveness of the

instrument to address change in mindfulness as it relates to educational outcomes. In addition, attention to context-specificity may help reduce unwanted sources of error variance.

Content Relevant Items

Methodological emphasis on content validity in the item development stage across mindfulness inventories has been under-emphasized. Researchers have relied on deductive methods of item generation prompted by the scale authors' understanding of mindfulness and consultation with experts (Krägeloh et al., 2019). For example, initial items for the FMI were developed by combing through "a substantial English and German language book and magazine literature dealing with insight meditation; periodicals; and the writings of numerous experts on Buddhism and mindfulness from around the globe" (Buchheld et al., 2001, p. 15). Eight people considered experts in insight meditation then evaluated the items, at which point items were reduced. The researchers gave the scale to a group of 100 meditation retreat attendees (who reported an average of five years of insight meditation experience) at the beginning and also at the end of the retreat. The authors noted that the scale developers were also the teachers of this retreat.

There are methodological concerns demonstrated here. In the case of the FMI, the construct was defined solely by the researchers' understanding of the literature, items were deductively generated and given to a small number of experts (as is common practice). Yet the items were tested amongst a niche population under the direct influence of the researchers themselves. It is not surprising that later investigations of the scale's validity revealed that individuals without mindfulness experience misunderstood items (Belzer et al., 2012). The top-down approach to item generation can lead to conceptual and semantic misunderstanding of items and subsequent inaccuracy in measurement, of particular concern with abstract or

multidimensional concepts like mindfulness (Devellis, 2017). Recommended best practices in scale development suggest the inclusion of both deductive and inductive approaches in item generation (Boateng et al., 2018).

There are further concerns amongst scholars on whether semantic misunderstanding of items can be overcome in the measurement of mindfulness. The validity of all self-reported mindfulness is threatened by item-wording and response shift effects that lead to measurement invariance (Grossman, 2008; Grossman, 2011). Meaningful responses to mindfulness items may require a degree of mindfulness and initial decreases in scores may be seen before increases are (Erisman & Roemer, 2012). It is suggested that future mindfulness scale item construction emphasize semantic clarity and the creation of unambiguous items to help attenuate these misunderstandings and response shift bias (Saur et al., 2013). A bottom-up process that is initially more informed by the population of interest, over deductive adaptations from literature, may help with overall item understanding and response accuracy (Krägeloh et al., 2019). Understanding what mindfulness looks like within education is a necessary first step in building an integrative theoretical foundation for its use in and as education.

Developing the Construct of Mindfulness in Education

The current investigation aims to develop instrumentation that is informed by the limitations of current mindfulness self-report measurement tools in assessing responsiveness of mindfulness interventions in education. The first steps of scale development outlined by McCoach et al. (2013) involve a thorough review of literature that (a) specifies the purpose, (b) confirms no existing measurements are suitable, (c) provides an initial definition of the construct, and (d) specifies any dimensions of the domain if appropriate. Typical scale development proceeds from here with item generation. In consideration of the specific content validity

concerns raised, here a further step to domain identification is taken by assessing the perceptions of the construct from the target population. A combination of top-down and bottom-up approaches is used to develop the construct of mindfulness within education and a subsequent item pool. Qualitative and quantitative investigations assist in the development of items that are both supported within the context and culture of education (i.e., what do students actually think mindfulness is and what do they think it does for them) and connected with well-developed existing theory. This is based on best practices for item generation described by Boateng et al. (2018).

To begin, a theoretical foundation for mindful self-regulated learning is developed through existing literature. To confirm its relevance, participant perceptions of mindfulness in the educational context are explored through semi-structured interviews and compared with theoretical expectations of the construct. The generality of the views obtained in these interviews are scrutinized through an online survey (recommendations by Kvale, 2007). Finally, initial items are generated and tested amongst experts in the field and in cognitive interviews with students.

Defining the Construct Through Existing Literature

Purpose of the Instrument. A first step to defining the construct domain is identifying the purpose of the instrument. In their brief published by Robert Wood Johnson in collaboration with Penn State University, Roeser et al. (2020) reviewed 54 of the most rigorous evaluation studies of school based MBIs. These studies spanned two decades and involved 13,000 students across grades K-12. In alignment with the Bishop et al. (2004) and Shapiro et al. (2006) definitions of mindfulness, they define mindfulness as: "(1) a natural mental state, and also (2) an educable skill that, with sustained practice, can become (3) an enduring mental trait"

involving “two interrelated dimensions: (1) the self-regulation of attention and (2) a balanced mental attitude” (p. 4). Their review of SBMPs results in a theory of change in which high quality program implementation and good program “fit” within the education context fosters “student engagement [that] may lead to the development of mindfulness and self-regulation skills” (p. 6). The proximal outcomes and value of these programs within education is determined as their ability to strengthen students’ mindfulness and self-regulatory skills to “help students manage emotions, reduce stress and distress, and improve feelings of well-being” (p. 6). An instrument that can assess these programs along this theory of change is missing. A critical gap exists in assessing mindfulness programs and this has often led to an overreliance on indirect measures of mindfulness (Grossman & Van Dam, 2011). The purpose of this new instrument is to develop a tool that can measure change as pertained to the utility of mindfulness programs in education: mindful self-regulated learning.

Mindfulness, Self-Regulation, and Self-Regulated Learning. Western secularized mindfulness in the context of education may less resemble the mindfulness conceptualized in clinical MBI literature and rather resemble a more specific kind of enhanced self-regulation, mindful self-regulated learning. It is well accepted that self-regulation plays an important role in mindfulness practice. Many theorists include self-regulation as a mechanism of mindfulness (Bishop et al., 2004; Hölzel et al., 2011; Shapiro et al. 2006; Tang et al., 2015; Vago & Silbersweig, 2012). Within the contemplative tradition, the value of mindfulness practices has been presented as “education in awareness” in which the “cultivation of awareness and willful self-regulation are preconditions for deep learning” (Roeser & Peck, 2009, p. 119).

Self-Regulation. The word regulate implies control or an ability to change. At a cellular level, the human body is in a constant state of regulation to ensure the appropriate standards for

sustaining our lives are met in any given moment. Without an automatically self-regulating body, we would be required to spend every ounce of our mental energy monitoring everything from our temperature to our blood flow. Regulation at the social and psychological level can be seen in a similar way with the added caveat of agency. Self-regulation, or self-control, refers to "a change to bring thinking and behaviour [sic] into accord with some often consciously desired rule, norm, goal, ideal, or standard" (Forgas et al., 2009, p. 4). In one of the most notable investigations of the importance of this ability, toddlers that demonstrated greater abilities to delay gratification were more likely to be successful in their social and work lives later on (Mischel et al., 1988; Shoda, et al., 1990). In addition, amongst other things, the ability to self-regulate helps people perform better in sports, reduces unhealthy risk-taking behavior, strengthens interpersonal relationships, and fosters success in education and goal-attainment (Baumeister et al., 1998; Duckworth & Seligman, 2005; Finkell & Campbell, 2001; Wolfe & Johnson, 1995). Untangling the conscious (top-down) and unconscious (bottom-up) processes involved in self-awareness may not be possible (Bargh & Chartrand, 1999). Self-regulation operates at both the level of our awareness and in unconscious goal-fulfillment (Friese et al., 2009). People exert self-regulatory effort to control thought, control emotion, control behavior, and control motivation in service of both long-term and short-term goals (Forgas et al., 2009). The ability to regulate in this way is important for many learning processes.

Self-Regulated Learning. In 1986, researchers gathered at the American Educational Research Association annual meeting defined self-regulated learning (SRL) as, "the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning process" (Zimmerman, 2008, p. 167). SRL is a self-directed process in which students engage in their learning experience through adaptive skills to attain their goals. It

requires planning, performing, and reflecting on learning tasks. Similar to mindfulness research, SRL theories extend across multiple paradigms of cognition, affect, and behavior (Panadero, 2017). There are many high-quality models of SRL that, while interrelated, vary across their phases and subprocesses, how they conceptualize the role of metacognition, motivation, and emotion within the model, the structure of the process as top-down, bottom-up, or automatic, and the inclusion of context (for reviews see Puustinen & Pulkkinen, 2001; Sitzmann & Ely, 2011; Panadero, 2017).

SRL has been theorized under both component and process level models (Schunk & Greene, 2018). Component theories distinguish cognitive, metacognitive, and motivational competencies as enduring attributes of a person that total the parts of self-regulation and are generally prospectively and retrospectively assessed through self-report measures (Boekaerts, 1997; Wirth & Leutner, 2008). SRL theory is also approached under behavioral models with a focus on delay of gratification, reappraisal strategies, and identification of cognitive structures grounded in information processing theory (Mischel et al., 2010; Scheier & Carver, 1988). These models consist of linear control systems with multilevel hierarchies and branches that account for affective attributions.

How well people monitor their own cognition, discriminate between well-learned versus less well-learned knowledge, and how well they are able to implement strategies towards reaching their learning goals has obvious implications for the field of education. As such, the broad extent to which self-regulation is essential to learning has been studied extensively across behaviors, emotions, and cognitions of learners (Baumeister & Vohs, 2004; Boekaerts et al., 2000; Butler & Winnie, 1995; Efklides, 2011; Hoyle, 2010; Zimmerman 1989). Components of self-regulation are considered dynamic and linked in a complex interplay via feedback loops and

recursive relations (Boekaerts, 2011; Efklides, 2011; Pintrich, 2000; Pintrich, 2004; Winne & Hadwin, 2008; Zimmerman, 2000). Though theories differ in their central components, self-regulated learning consists of "monitoring, controlling, and regulating cognition and monitoring, controlling, and regulating other factors that can influence learning such as motivation, volition, effort, and the self-system" (Pintrich et al., 2000, p. 45).

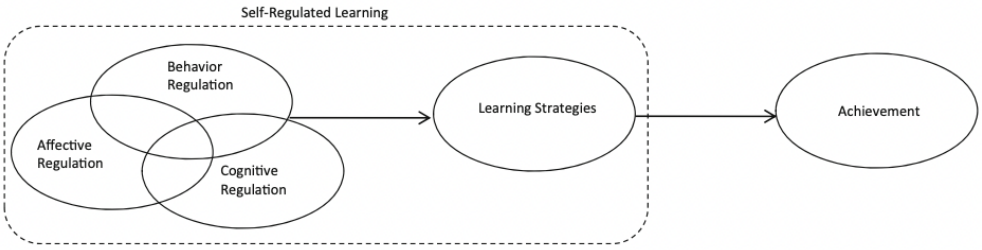
Regulatory resources have been described as finite in their capacity, in a similar way to muscles that fatigue over repeated use (Baumeister et al., 1998; Schmeichel & Baumeister, 2004). This resource dependency theory, and its so termed ego-depletion effect, has been demonstrated in a multitude of dual task studies that span a various self-control tasks and is also sensitive to task complexity (Baumeister et al., 2007; Hagger et al., 2010; Schmeichel et al., 2003; Schmeichel, 2007; Vohs & Heatherton, 2000). In education, stress and anxiety from academic examination can impair self-control and self-control is empirically linked with academic success in the form of standardized test scores, educational attainment, and course grades (Duckworth & Seligman, 2005; Duckworth et al., 2019; Oaten & Cheng, 2005). In this way ego-depletion negatively affects knowledge retrieval and subsequent performance and grades (Bertrams et al., 2013; Englert & Bertrams, 2016; Englert & Bertrams, 2017; Englert et al., 2017).

The integrated SRL model (iSRL) bridges the resource dependency theory and SRL component theories (Ben-Eliyahu & Bernacki, 2015). In the iSRL model, behavior regulation (environmental regulation and time planning), affective regulation (reappraisal and suppression), and cognitive regulation (focus and metacognition) interact to precede learning strategies (surface versus deep processing, organizing, and engagement) employed to optimize achievement (Ben-Eliyahu & Linnenbrink-Garcia, 2015). Self-regulation is taken as both a

context specific and limited resource (Ben-Eliyahu & Bernacki, 2015). Coping with bottom-up processes like anxiety and stress or navigating social situations in the learning environment depletes the shared cognitive energy resource necessary for self-regulation in learning tasks. The iSRL model embodies a dynamic ecological assets lens in which "the interaction between one's environment and learning depends on the extent to which non-learning aspects deplete regulatory strength" (Ben-Eliyahu & Bernacki, 2015, p. 7). The processes that influence emotions, behaviors, and cognitions are taken together as the forms of self-regulated learning. The framework proposed to investigate iSRL is shown in Figure 1.

Figure 1

Framework for Investigating iSRL



Note. iSRL = integrated self-regulated learning. Figure taken from "Addressing complexities in self-regulated learning: A focus on contextual factors, contingencies, and dynamic relations" by A. Ben-Eliyahu & M.L. Bernacki, 2015, *Metacognition and Learning, 10*(1), 1–13.

The explanatory power of resource dependency theories gained the attention of mindfulness researchers seeking theoretical underpinnings to a mindfulness-achievement link in education (Friese et al., 2012; Masicampo & Baumeister, 2007). Mindfulness training both enhances affective regulation and increases working memory in ways that interact with the

efficient processing of information (Jha et al., 2010; Masicampo & Baumeister, 2007). Mindfulness has been shown to increase behavioral self-regulation (Chatzisarantis & Hagger, 2007; Evans et al. 2009), attentional self-regulation (Napoli et al., 2005), and emotional self-regulation (Philippot & Segal, 2009; Tang et al., 2015).

Is Mindfulness Just Another Form of Self-Regulation? Mindfulness and self-regulation may differ in their orientation towards goals. The practice of mindfulness hinges on the notion of non-attachment and immersion in the present moment. Goals are a future oriented response. Wherein mindfulness could be described as a runner out for a jog every day with no aim or specific objective, self-regulation could be described like a runner out for a jog, armed with their heart monitor and tracking watch, with an aim to increase their performance in preparation of some goal-fulfillment. However, the oxymoronic nature of mindfulness is not lost. Not having a goal can, in itself, be a goal. Even so, literature separates mindfulness and self-regulation into distinct constructs in which mindfulness has been described as a particular form of self-regulation. It is conscious attention that amplifies feedback through a quality of intention that is impartial. Shapiro and Schwartz (2000) describe this in an intentional systemic mindfulness (ISM) model as a kind of self-regulation that involves a "dynamic, continual process of expanding and redefining intention" (p. 264).

The mechanisms of mindfulness, intention, attention, and awareness (IAA) are conceptualized by a unique quality of re-perception (Shapiro et al., 2006). The IAA model components closely resemble the affective, behavioral, and cognitive regulation components of the iSRL model of self-regulation. The difference between self-regulation or self-control training and mindfulness training, however, lies in reperceiving and intention. Reperceiving differs from the classic understanding of reflection in most iterative SRL models in its commitment to non-

judgment. This may serve students in particular. Internal state awareness has been shown to negatively correlate with rumination, depression, and anxiety, whereas these variables positively correlate with self-reflection (Anderson et al., 1996). Krishnamurthi (1953) framed this as problematic in education decades before: “Instead of awakening the integrated intelligence of the individual, education is encouraging him to conform to a pattern and so is hindering his comprehension of himself as a total process” (p. 16). Reperception rather “allows one to deeply experience each event of the mind and body without identifying with or clinging to it” (Shapiro et al, 2006, p. 379). Practice of this, similar to the concept of cognitive defusion within Acceptance Commitment Therapy, is thought to shift the experience of the “self as content” to the “self as context” and foster deeper awareness of consciousness (Hayes et al., 1999). This quality of mindfulness may allow for more adaptive affective, behavioral, and sustained attentional self-control and energize these processes in the service of goals over and above self-control training alone (Elkins-Brown et al., 2017). Focus on the “goal” of present moment awareness paired with the intention to continuously reframe cognitions and emotions with acceptance and non-judgement could enhance flexibility in strategy use.

Investigations in cognition and neuroscience suggest that reperceiving creates conditions that both strengthen top-down processes, akin to executive functions (EFs) like inhibition, cognitive flexibility, and sustained attention (Miyake et al., 2000) and lessen bottom-up interferences like anxiety and stress (Zelazo & Lyons, 2012). Reperceiving is similar to the concept of reappraisal (Gross & John, 2003) which is an important aspect of metacognition and self-regulated learning as the ability to observe and refine cognitions (Winnie & Hadwin, 1998). Mindfulness, however, is a particular form of enhanced self-regulation (Hölzel et al., 2011; Lutz et al., 2008; Masicampo & Baumeister, 2007; Shapiro et al., 2006; Tang et al., 2015; Zhou et al.,

2023). It both enhances conflict monitoring while strengthening positive reappraisal, nonreactivity, and exposure, extinction, and reconsolidation (Carver & Scheier, 2011; Hölzel et al., 2011; Vohs & Baumeister, 2004). This is also observed in the process model of emotion-regulation, where mindfulness is thought to act as an agent of cognitive change through the reappraisal of emotive stimuli and non-judgement (Garland et al., 2011; Gross, 1998). It is proposed here that mindful self-regulated learning manifests a quality of mental flexibility in students' orientations towards goals and deployment of self-regulated learning strategies. Research suggests that mindfulness training encourages greater balance in feedback evaluation from the environment over cognitive schemas that are characterized as rigid (Teasdale, 2003).

Mindful Self-Regulated Learning. Literature surrounding mindfulness and its specific relationship to self-regulated learning and achievement in education is limited and mixed. In one study, mindfulness as measured by the MASS did not reveal positive relationships with effort management, metacognitive strategies, intrinsic motivation regulation, or deep cognitive strategies, key components in Boaekarts (2011) model of SRL (Opelt & Schwinger, 2020) . Results led authors to suggest that mindfulness is most relevant to "emotional and affective self-regulated learning variables" (p. 11). A correlation and cluster analysis study examined the relationship between the facets of mindfulness described by the FFMQ, the Motivated Strategies for Learning Questionnaire (MSLQ), and a subset of items from the Goal-Setting Questionnaire (Hillgaar, 2011). Results revealed those that scored highly on self-focused attention and attitudes of nonjudgement were better able to act on learning strategies, more satisfied by their goals, and had less test anxiety over those that scored highly on self-focused attention, but did not adopt accepting attitudes. The *active* adjustment of emotion (metaemotion) and behavior (metabehavior) is as important as the refinement and monitoring of cognition (metacognition) in

optimizing self-regulated learning (Ben-Eliyahu & Bernacki, 2015; Ben-Eliyahu & Linnenbrink-Garcia, 2015). Researchers have found that the consolidation of newly learned material best occurs in situations of enhanced positive affect in which negative affect and stress is minimized (Fredrickson, 2001; Greenberg et al., 2003). Higher levels of dispositional mindfulness positively associate with achievement related self-regulation and more balanced and positive achievement emotions. In addition, levels of dispositional mindfulness indirectly predict achievement emotions through achievement related self-regulation (Howell & Buro, 2011). Mindfulness training has been shown to increase optimism, moderate positive academic emotions, and reduce procrastination (Asani et al., 2023; Rad et al., 2023). In another study of athletes, individuals who scored higher on a dispositional mindfulness scale were shown to also score higher on flow dispositions of challenge–skill balance, clear goals, concentration, sense of control, and loss of self-consciousness. The more mindful individuals demonstrated greater mental skill adoption in sport practice, reporting higher responses to attentional control, emotional control, goal setting, and self-talk (Kee & Wang, 2008).

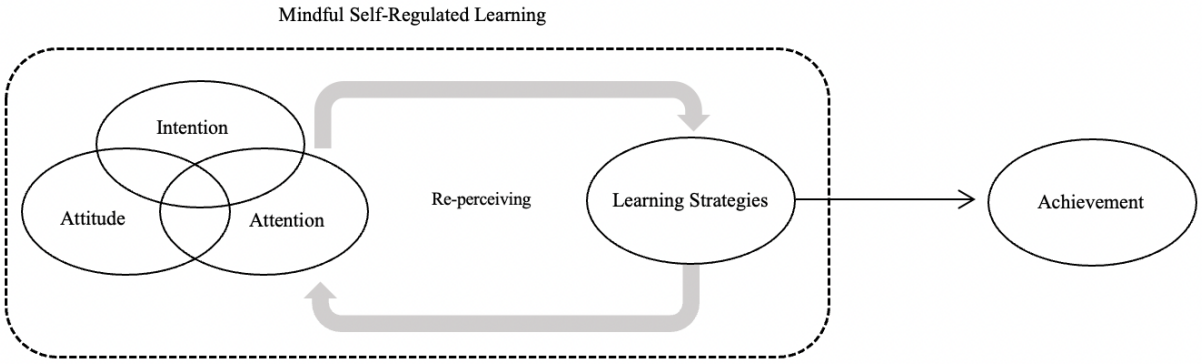
Mindful self-regulated learning differs from other self-regulated learning models in its unique orientation towards goals. Emphasis is less on immediate goal-attainment and more on the goal of reperceiving cognitions, emotions, and behaviors. Reperception acts as a particular form of metacognition that promotes a shift in perspective in which thoughts and feelings are transformed into an "object" rather than a "subject" (Shapiro et al., 2006). Attitudes directed towards experience are therefore flexible and less reliant on context-dependent schemas and scripts. Mindfulness may represent a higher order metacognition in which there is a level of awareness about thinking about thinking (see Jankowski & Holas, 2014). This non-directive state of mind is in contrast to goal-oriented modes of processing or that of "being" versus "doing"

(Segal et al., 2002; Williams, 2010). The "being" state cultivated through mindfulness training takes on a distinct neural mode of self-reference that is the self in the present moment opposed to the self across time (Farb et al., 2007). Increased engagement in a neural modes of self-focus that is present-centered as opposed to narrative-centered has implications for reducing anxiety (Segal et al., 2002). Intention brought to a quality of present-moment awareness and coupled with a non-judgmental, open, and accepting attitude interact together to facilitate the enhanced self-regulation of thoughts, emotions, and behaviors.

Consider the iSRL investigative framework re-modeled as a mindful self-regulated learning framework (m-SRL) using the IAA mechanisms of mindfulness described by Shapiro and colleagues (2006) in Figure 2.

Figure 2

Theoretical m-SRL Model



Note. m-SRL = mindful self-regulated learning. Figure adapted from "Addressing complexities in self-regulated learning: A focus on contextual factors, contingencies, and dynamic relations" by A. Ben-Eliyahu & M.L. Bernacki, 2015, *Metacognition and Learning, 10*(1), 1–13.

In this reframed theoretical model, continual reperceiving of intention, attention, and attitude facilitate adaptive, present moment learning strategies which in turn facilitate achievement related goals. Mindful self-regulated learning is defined as:

> the adaptive and active self-monitoring of one's thoughts, feelings, and behaviors, characterized by a quality of re-perception and acceptance, in the conscious service of the learning process.

This definition bridges theories of self-regulated learning and mindfulness (Shapiro et al., 2006; Zimmerman, 2008). A mindful self-regulated learner is expected to monitor their cognitions and emotions with an intentional present-moment awareness that is accepting and nonjudgmental. Increases in mindful self-regulated learning are assumed observable after mindfulness training.

Intention. Intention implies both purpose and personal vision. Behavioral intentions are described as "instructions that people give to themselves to behave in certain ways" (Triandis, 1980, p. 203). Intentions have been studied extensively under theories of reasoned action and planned behavior (Azjen, 1985, 1991). They serve as proximal indicators of behavior and have also been studied as key components in motivation. Self-determination theory distinguishes between autonomous intentions, those that are internally directed, and normatively controlled intentions, those that are pressured by external control (Deci & Ryan, 1991; Ryan & Deci, 2000). Autonomous intentions are associated with stronger attitude-intention and intention-behavior relationships (Sheeran et al., 1999). These are the types of intentions characterized by mindful states and have been shown to facilitate a strong intention-behavior relationship (Chatzisarantis & Haggar, 2007). Shapiro (1992) investigated the role of intention in long term meditators. The reasons why people meditate were dynamic and evolved in quality along a continuum from self-

regulation, to self-exploration, to self-liberation. The role of intention in mindful self-regulation is emphasized as a purposeful orientation to learning that is flexible and dynamic.

Attention. A key component of mindfulness is attention that is characterized by focus on the present-moment experience. Attention is often subdivided into three components: alerting, orienting, and conflict monitoring (Peterson & Posner, 2012; Posner & Petersen 1990). These interrelated components support sustained attention, selective attention, and executive functions. Neurocognitive evidence involving the attention network test (ANT) suggests that long-term meditation improves conflict monitoring, orienting, and alerting. MBIs and short-term mindfulness interventions have shown rather mixed effects (Prakash, 2020; Tang et al., 2015). The most promising evidence suggests mindfulness training increases conflict monitoring. Improvements on the Flanker or Stroop task after mindfulness training have been observed across several RCTs (Ainsworth et al., 2013; Becerra et al., 2017; Felver et al., 2017; Quan et al., 2018; Tang et al., 2007). Even still, reviews of meditation and mindfulness research suggests that mindfulness training works on four primary faculties, "(a) the development of conflict monitoring related to the continuous detection of mind wandering, (b) attention switching related to disengagement of distracting stimuli and redirection of attention to target objects, (c) selective attention related to the inhibition of cognitive processes different from the focus of concentration, and, as the practice advances, (d) increasing levels of sustained attention" (Chiesa et al. 2011, p. 452; Lutz et al. 2008).

Attitude. The affective quality of mindfulness is a non-judgmental and accepting attitude. This emotional frame of reference positively associates with self-efficacy and self-compassion (Iskender, 2009). Self-compassion reduces self-blame that can interfere with self-regulation and help-seeking (Terry & Leary, 2011). In the context of learning, a mindful student would not

judge themselves harshly and this may lead to increased persistence (Evans et al., 2009). The attitude of nonjudgement and acceptance facilitates speedier emotional recovery after emotional interference such as stress and anxiety, less emotional reactivity, as well as willingness to sit in discomfort (Arch & Graske, 2006; Ortner et al., 2007). In the context of clinical psychology, the attitude component of mindfulness is involved in "preventing or counteracting ruminations and other cognitive interlock phenomena that precipitate negative mood and promote emotional avoidance" (Philippot & Segal, 2009, p. 295). Self-judgement plays an important role in self-efficacy beliefs central to successful SRL (Zimmerman, 1989). A quality of nonjudgement may lead to greater self-acceptance and an ability to accept mistakes that leads to an increased openness to help and resilience that influences task-focused interpretation and self-focused interpretation (Boekaerts & Niemivitra, 2000 ; Keye & Pidgeon, 2013). Mindfulness, as measured with the FFMQ, is associated with positive reappraisal and has been shown to positively associate with academic self-efficacy after perceived failure (Hanley et al., 2015). Authors suggest that the affective qualities of mindfulness may foster more resilient students. This is aligned with research that suggests that mindfulness improves coping capacities critical for academic success (Caldwell et al., 2010).

Student Perceptions of Mindfulness in Education

Participant perceptions of mindfulness in the educational context were explored through semi-structured interviews. The goal was to investigate whether the mindful self-regulated learning construct deduced from existing literature was also observed in student conceptualizations and expectations of mindfulness training. Participants (12.5% male, 81.3% female, 6.3% non-binary) were conveniently sampled university students (18.8% Black/African American, 18.8% Asian, 31.3% Hispanic/Latino, 31.3% White) registered for classes and

participating in a study for research credit. The sampling of college students was considered appropriate in order to first investigate mindfulness as a construct within education. Student enrollment status and active education experience was particularly relevant to this study. The sample ($N = 16$) was within the recommended number for this type of data collection made by Creswell (2007) and consisted of eleven graduate students and five undergraduate students. When asked if they had ever practiced mindfulness before, 10 responded yes, four responded unsure, and two responded no. The participants were also asked how frequently they practiced mindfulness on a scale of 1– *never* to 5 – *all of the time*. Out of the sample, two responded that they often practice mindfulness, seven responded that they sometimes practice mindfulness, six responded that they rarely practice mindfulness, and one responded that they never practice mindfulness. Individual participants met with a researcher for 30-60 minutes and responded to a set of questions designed to address three primary research questions:

1) How do university students define and experience mindfulness?

2) What are the perceived benefits of mindfulness practice? and

3) What are the perceived benefits of mindfulness practice specifically in the context of education?

Non-free form talk opportunities were included. The interview protocol can be found in Appendix A. Audio-recorded interviews were transcribed using Otter.ai (2021) and manually checked by the researcher.

Table 3 provides illustrative responses to the first research question. Responses were coded along the IAA axioms to help align participant responses to the dimensions of mindfulness recognized in existing literature. Student definitions of mindfulness most commonly

incorporated an attention to present-moment experience, second to which students reflected an element of intention and third, an attitude of non-judgment and acceptance.

Table 3

How University Students Define Mindfulness

Illustrative Responses	Thematic Code
[Mindfulness is] processing the moment as it comes.	Attention to Present-Moment Awareness
Mindfulness, the first thing that comes to mind is, let's say is clearing, just being able to have a clear thought process.	Intention Attention to Present-Moment Awareness
Mindfulness is being more aware of the journey. Whereas reflection is more aware of that destination.	Attention to Present-Moment Awareness
To me, mindfulness is being aware of your emotions while you're feeling them, what they are, and using those to maybe try to resolve or do something with those emotions…it's not letting your emotions just autopilot you.	Attention to Present-Moment Awareness Intention Attitude of Nonjudgment and Acceptance
Well, I think it's just to be able to not be so judgmental about certain things and not being so close minded or immediately shutting something down.	Attitude of Nonjudgment and Acceptance
I think, like [it's] a concentrated effort to be in the moment, like 'I am seeing this right now', 'this is how I'm perceiving everything', 'this is what's going on right now'.	Intention Attention to Present-Moment Awareness
It is about noticing things more closely. Yeah, like trying to be present to not get like swept away in my thoughts.	Attention to Present-Moment Awareness
It looks like being kind and quiet inside, maybe closing your eyes and looking inside yourself.	Attention to Present-Moment Awareness
Being aware of your feelings and how you control and regulate them and how they affect others.	Intention Attention to Present-Moment Awareness

General and specific student perceptions of the benefits of mindfulness practice are provided in Table 4. Participant responses were coded across affective, cognitive, and behavioral (related to intention) regulation. Responses reflected student beliefs that mindfulness training would help them regulate or "control" various thoughts, feelings, and intentions related to academic behaviors such as studying, applying feedback, test-taking, and general focus. This aligned with the definition of mindful self-regulated learning proposed in the literature review: the adaptive and active self-monitoring of one's thoughts, feelings, and behaviors, characterized by a quality of re-perception and acceptance, in the conscious service of the learning process.

Table 4

General and Specific Benefits of Mindfulness Practice Perceived by University Students

Illustrative Responses	Thematic Code
I think of stress relief and stress management, being, I guess involved in, like what you're doing as well being aware of how you're interacting with it.	Affective regulation Behavior regulation (Intention)
I've been able to resolve emotional conflict a lot faster when I'm able to express where I'm coming from to another person...I also find myself being a lot more organized in, like, what's the work tasks and like things that I have to do.	Affective regulation
My thoughts are not racing, and I feel just a little bit more calm.	Cognitive regulation Affective regulation
We can regulate ourselves too much to the point where we disconnect ourselves from feeling those emotions. And I think that is a bad thing, but mindfulness is I guess the idealized form of that term.	Intention regulation
Mindfulness helps with confidence. Definitely helps you to not feel so indecisive about things, about your decisions because you've thought that through, I guess, mindfulness is like thinking things through, you know, very deep way of thinking things through.	Affective regulation Cognitive regulation

Realistically, like we're judged all the time, or at least that feels like it. And mindfulness helps either being able to take whatever criticism and, you know, use it in a positive way or to be able to ignore judgment from other people that isn't constructive that isn't good for us. Being able to reflect on that and decide what, I guess, what feedback or what criticism we want to actually internalize and keep.	Affective regulation Behavior regulation (Intention)
It makes me feel empowered, and I can be responsible for myself.	Affective regulation Behavior regulation (Intention)
If I practice mindfulness then, I study properly.	Behavior regulation (Intention
Mindfulness helps you be aware that you know, it's actually for your benefit to be in this class.	Behavior regulation (Intention)
When you think about tests, you think about anxiety, you feel anxious, yeah, yeah.… Mindfulness helps you kind of have a little bit more control of that.	Affective regulation
It helps maybe like say to myself, 'well, it's not so bad if I don't get the greatest grade' or something like that, then 'I can still do this'.	Affective regulation
If I'm being really stressed out about a project, I can take the time to identify what part of it is stressing me out.	Affective regulation
[It helps] to be aware of those distractions because I get sidetracked, so easily.	Cognitive regulation Behavior regulation (Intention)
If [a student] practices mindfulness, he will know his limitations for the class, but also doesn't let that overwhelm him, doesn't let that emotionally be his cap.	Affective regulation
When I was in high school, for example, I, I kind of just, I was a very impulsive person, just sort of like, allowing myself to be carried away by just sort of like whatever, you know. And that really tanked my grades back, but like I said earlier, like, like [mindfulness] keeping your brain organized and tidy, really helped me because it's not like I got smarter or the work got easier or anything like that, but it felt more like I was able to manage the emotion that went along with doing the work, and that felt like I could take on more.	Affective regulation Behavior regulation (Intention) Cognitive regulation
Mindfulness helps a lot in resolving interpersonal conflict, which is very important for sort of maintaining a community here.	Affective regulation Behavior regulation (Intention)
Accepting mistakes. I feel like that's part of the academic process, but like it's hard for me to accept that I'm making mistakes.	Affective regulation
It at least helps me focus better on other stuff so I'm not wasting as much time trying to get myself started.	Cognitive regulation

I will just have more power to focus [on] the current school work project or task without being influenced by how I felt about it in the past.	Cognitive regulation Affective regulation
I imagine I would see probably students being better committed and not practicing procrastination as much... To actually be able to sit down and just do what I was supposed to do instead of not doing it or doing everything else that I wasn't supposed to.	Behavior regulation (Intention)
Actually, I want[ed] to give up everything after coming here because this is [I am] the first person in my family to come here [to the US]. But after following mindfulness, I think, 'Okay, no, I can be doing well'. So, I can be motivated myself… Yeah, it can change my mind.	Affective regulation Behavior regulation (Intention)
I just think like the more present you are when you take in information and engage, the probably better you retain it.	Cognitive regulation

Interview responses were transformed into a set of 50 simplified statements reflecting student perceived benefits of mindfulness in education. These statements began with the stem *Mindfulness training would help me to* followed with an indicator statement conveyed in the interviews. These 50 statements were given to an additional convenient sample (N = 135) of university students (9.6% Black/African American, 0.7% American Indian/Alaskan Native, 18.5% Asian, 3% Native Hawaiian/Pacific Islander, 28.9% Hispanic/Latino, 37% White, 2.2% Other) to assess the generality of the views obtained in the interviews. The sample consisted of graduate (45.9%) and undergraduate (54.1%) students (27.4% male, 71.1% female, 1.5% non-binary) enrolled in classes and participating in a study for research credit. Of the 135 participants, 74.1% reported that they had practiced mindfulness before, 11.9% reported they had not, and 14.4% reported that they were unsure. The participants were also asked how frequently they practiced mindfulness on a scale of 1- *never* to 5 – *all of the time*. Of the sample, 4.4% reported they practice mindfulness all of the time, 21.5% often, 39.3% sometimes, 21.5% rarely,

and 8.9% never. Participants rated the extent to which they agreed with each of the 50 mindfulness statements on a 7-point Likert scale that ranged from 1 – *strongly disagree* to 7-*strongly agree*. Results are reported in Table 5. Mean responses to item statements ranged from 4.79 to 5.98, indicating a general agreement across all statements. Taken together, the results of the two exploratory studies provide support that mindfulness within education may closely resemble a kind of enhanced self-regulation.

Table 5

Percentage Agreement of Student Perceptions of Mindfulness

Mindfulness training would help me:	Percentage (%) of students (N = 135)						
	Strongly Disagree	**Disagree**	**Somewhat Disagree**	**Neither Agree Nor Disagree**	**Somewhat Agree**	**Agree**	**Strongly Agree**
To pay attention during class lectures.	1.5	0	1.5	4.4	20.7	48.1	23.7
To focus when I take tests.	.7	0	.7	3.0	25.5	35.6	34.8
To be more aware of my distractions when I study.	.7	2.2	1.5	1.5	20.7	39.3	34.1
To concentrate when the teacher is talking.	1.5	0	2.2	2.2	23.0	45.9	25.2
To notice when I am on auto-pilot in class.	1.5	0	2.2	6.7	22.2	37.8	29.6
To organize my thoughts.	0	0	3.0	.7	17.0	42.2	37.0
To slow down my thoughts when they are racing.	0	0	3.7	5.2	19.3	35.6	36.3
To be aware of times I am procrastinating.	0	0	2.2	4.4	16.3	40.7	36.3
To be more productive.	0	0	.7	3.7	17.8	38.5	39.3

To notice when my thoughts interfere with my ability to learn.	0	0	2.2	3.7	14.8	43.7	35.6
To clear my mind when I am taking a test.	.7	1.5	3.0	5.9	22.2	36.3	30.4
To notice when I get distracted by my phone or computer in class.	.7	.7	3.0	6.7	20.0	38.5	30.4
To keep trying when I want to give up on an assignment.	0	3.0	8.1	10.4	18.5	32.6	27.4
To be more aware of other student's experiences.	.7	1.5	9.6	9.6	21.5	30.4	26.7
To organize which assignments I need to do first.	0	2.2	1.5	5.9	24.4	34.1	31.9
To stay on top of my schoolwork.	0	1.5	1.5	4.4	18.5	42.2	31.9
To build better relationships with other students and teachers.	0	2.2	5.9	9.6	22.2	35.6	24.4
To feel in control of my education.	0	.7	3.7	8.1	23.0	30.4	34.1
To recognize when I need help on whatever I am working on.	0	1.5	1.5	5.2	22.2	32.6	37.0
To be less bored in class.	1.5	7.4	11.9	15.6	31.1	18.5	14.1
To feel a sense of purpose behind my education.	1.5	1.5	3.0	8.1	25.2	32.6	28.1
To apply my teacher's feedback.	0	1.5	4.4	8.1	21.5	36.3	28.1

To manage my workload.	0	0	3.0	3.0	18.5	37.0	38.5
To stay motivated in my classes.	0	1.5	2.2	9.6	22.2	34.1	30.4
To feel part of a community.	.7	5.2	10.4	17.0	23.7	24.4	18.5
To connect my personal goals to my academic goals.	0	1.5	2.2	5.9	23.0	37.8	29.6
To recognize which things I need to study more.	0	2.2	1.5	3.0	20.0	44.4	28.9
To feel empowered in my education.	.7	1.5	3.0	5.2	27.4	29.6	32.6
To feel more comfortable interacting with other students.	0	5.9	6.7	13.3	22.2	26.7	25.2
To not worry about the future.	4.4	3.0	9.6	8.9	18.5	34.1	21.5
To adjust my attitude towards classes I do not enjoy.	1.5	3.7	9.6	8.1	26.7	32.6	17.8
To feel less anxious about failing.	3.0	3.7	9.6	4.4	22.2	31.9	25.2
To re-evaluate my feelings about my grades.	1.5	3.7	4.4	11.9	20.7	34.1	23.7
To be aware of my limitations.	0	1.5	2.2	9.6	22.2	34.1	30.4
To feel more confident in my ability to succeed.	.7	1.5	2.2	5.9	14.1	41.5	34.1
To remember what is important when I get stressed.	0	0	2.2	6.7	14.8	37.0	39.3

To re-evaluate my judgements when I feel overwhelmed.	0	0	3.0	5.2	14.1	41.5	36.3
To be more confident in my answers when the teacher calls on me.	1.5	4.4	7.4	7.4	27.4	31.9	20.0
To look at stressful classes in new ways.	0	2.2	7.4	5.2	24.4	41.5	19.3
To resolve negative feelings about school when they arise.	0	3.0	5.2	9.6	20.7	34.1	27.4
To identify when I am feeling stressed.	.7	1.5	2.2	6.7	16.3	36.3	36.3
To feel more comfortable speaking in class.	2.2	9.6	5.9	8.1	28.1	27.4	18.5
To calm down when I am stressed about school.	0	1.5	5.2	1.5	21.5	34.8	35.6
To not second guess myself when taking a test.	.7	2.2	10.4	10.4	22.2	31.9	22.2
To notice my reactions to things I am learning.	0	3.0	.7	7.4	23.0	40.7	25.2
To have an open mind to things I don't agree with.	.7	.7	2.2	5.9	20.7	36.3	33.3
To try new ways of studying.	0	1.5	3.0	9.6	28.9	25.6	21.5
To be open to different ways of learning.	0	.7	3.7	10.4	11.9	45.2	28.1

To change my thoughts when I start to worry during a test.	.7	0	3.7	3.7	28.1	37.8	25.9
To let go of my judgments of past academic performance.	1.5	0	2.2	10.4	25.2	35.6	25.2

Phase I Item Generation & Content Relevance

An initial item pool for the Mindful Self-Regulated Learning Scale (m-SRLS) was developed through the inductive use of student perceptions of mindfulness in education and deductive generation of items by the scale author based on the construct definition and informed by existing literature. This item pool consisted of 60 items, twice the approximate length of the desired final scale (recommendations by Boateng et al., 2018). This item pool was composed of statements pertaining to student perceptions of the construct provided in Table 5 that were altered into item form and additional deductively generated statements. The inclusion of word-for-word stems from interview responses was chosen to help capture the lived experience of mindful self-regulated learning by the target population, students.

The 60 initial items were subjected to evaluation by six experts in the field that had two or more peer-review publications related to mindfulness. Of them, two reported 10+ years of both personal experience and research publication experience in mindfulness, two reported 10+ years of personal experience with 6–10 years of research publication experience, one reported 2-5 years of personal experience with 1–2 years of publication experience, and one reported less than a year of personal experience, but 6–10 years of research publication experience with mindfulness. A four-point Likert-scale was used to evaluate content relevance that ranged from *1-Not Relevant, 2-Somewhat Relevant, 3-Quite Relevant, and 4-Highly Relevant*. In addition, experts were given opportunity to comment in an open ended response. Content validity indices (CVI) were calculated at the item level (I-CVI) by computing the number of experts that gave a rating of 3 or 4 and dividing it by the total number of experts to yield a proportion of agreement on relevance for each item (Polit & Beck, 2006). Next, a modified kappa ($\kappa*$) statistic was computed for each item where,

$$\kappa^* = \frac{ICVI - \rho_c}{1 - \rho_c}$$

ρ_c is the probability of a chance occurrence using the formula for a binomial random variable,

$$\rho_c = \left[\frac{N!}{A!\,(N-A)!}\right].5^N$$

and N = number of experts and A = number of experts that agree on good relevance (rating of 3 or 4). Evaluation criteria for modified kappa, using guidelines described in Cicchetti and Sparrow (1981) and Fleiss (1981) were used to evaluate item relevance. Values < .40 indicate poor relevance, .40 to .59 indicate fair relevance, .60 –.74 indicate good relevance, and > .74. indicate excellent relevance.

There was a failure of agreement across many items. One expert indicated in an open-ended response comment, "The challenge I had while sorting item salience was that the description of mindful self-regulated learning has an active component…some items that clearly addressed intention or attitude had no active/action component. It was therefore not possible to determine whether they represented simple awareness of something of mindful awareness." In light of the compelling feedback and less than adequate agreement amongst experts, a substantial item revision took place. Original items were retained based on the modified kappa criteria that indicated excellent to good relevance and items of fair relevance were revised to more appropriately capture a level of meta-awareness and action that would relate to mindfulness-specific orientations. For example, the item *I am critical of my performance in class regardless of my effort* was revised to *When I feel critical about my academic performance, I take a step back to look at it in a different way.* Items that indicated poor relevance were discarded at this stage. In addition, eight newly created items were added to ensure equitable item-factor ratios in further testing. Table 6 shows full item revisions and decisions.

Table 6

Initial Item Relevance Assessment & Revisions

Initial Item	# of Experts Rating 3 or 4	[a]I-CVI	[b] κ*	[c]Evaluation	Item Revision or Decision
It is easy for me to make adjustments to a study plan if it is not working.	4	.67	.57	Fair	I try something different or new when my study strategies are not working.
It is hard for me to decide what assignments to do first.	4	.67	.57	Fair	I get hung up thinking about what I would rather be doing when I am working on assignments for class.
I recognize when my thoughts interfere with my ability to learn.	6	1.00	1.00	Excellent	Retain
I have a clear idea of what I want to learn when I go to class.	2	.33	.12	Poor	Discard
My thoughts scatter when I am called on in class.	4	.67	.57	Fair	I get anxious to share my thoughts when I am called on in class.
When I view instructional materials or listen to a lecture, it is easy to focus.	4	.67	.57	Fair	It is easy to maintain my focus on class lectures/instructional materials.
I actively make connections with what I learn in class to my own life.	4	.67	.57	Fair	I make an effort to engage with what I learn in class by making connections to my own life.
If I lose focus during class, I remind myself why I am there.	4	.67	.57	Fair	If I lose concentration during class, I remind myself why I am there to help me stay present.
When I start to worry about failing, I can't change my mind.	4	.67	.57	Fair	Worrying about failing or doing poorly in class distracts me from learning.

I feel a sense of purpose behind my education.	0	0	0	Poor	Discard
When I start to feel stressed about school, my thoughts run away from me.	5	.83	.81	Excellent	Retain
I try to build relationships with my classmates and teachers.	2	.33	.12	Poor	Discard
I am critical of my performance in class regardless of my effort.	4	.67	.57	Fair	When I feel critical about my academic performance, I take a step back to look at it in a different way.
I worry about what other students think of me.	2	.33	.12	Poor	Discard
When I realize I don't understand something, I seek help right away.	4	.67	.57	Fair	I am open to help from others when I don't understand the class material.
Often I will avoid my school work without trying to.	4	.67	.57	Fair	I notice when I want to avoid my school work and try to change my attitude towards it.
I re-evaluate my own judgements about my learning often.	5	.83	.81	Excellent	Retain
I often miss important parts of lectures because I am thinking about other things.	6	1.00	1.00	Excellent	Retain
I have a hard time applying feedback from my teacher.	4	.67	.57	Fair	I can apply feedback from my teachers and peers without feeling judged.
I can re-set my attention when I find myself off-task.	4	.67	.57	Fair	I purposefully re-set my attention when I find myself off-task.
When a class is harder than I expected, I adjust my goals.	4	.67	.57	Fair	I get caught up in how I think I should be doing in class.
I tend to give up quickly when I get overwhelmed by schoolwork.	4	.67	.57	Fair	I tend to give up when a class gets hard

I shift my focus back when I find myself procrastinating.	5	.83	.81	Excellent	Retain
I get overwhelmed easily when I am learning something new.	4	.67	.57	Fair	I am quick to judge myself when I do not immediately get something right.
When an assignment is hard, I tend to give up on it quickly.	3	.50	.27	Poor	I appreciate the process of learning something new even when it is challenging.
I have an open mind to things I do not agree with in class.	4	.67	.57	Fair	I purposefully keep an open mind to things I do not agree with in class.
If I start to get nervous about an exam, I can easily pause and reset.	5	.83	.81	Excellent	Retain
I take time to notice how I feel about good and bad grades.	3	.50	.27	Poor	Discard
My education is in my control.	2	.33	.12	Poor	Discard
I recognize when I lose focus in class and can bring my attention back.	6	1.00	1.00	Excellent	Retain
When I take tests, I get stuck on difficult questions.	4	.67	.57	Fair	I remain calm when I come across a hard question on a test.
I tend to zone out when I don't understand something.	4	.67	.57	Fair	I tend to zone out in class lectures when the topic gets complex.
When I don't get the grade I want, I tell myself I should be doing better.	2	.33	.12	Poor	Discard
My emotional reactions often get in the way of my ability.	4	.67	.57	Fair	My emotional reactions often get in the way of my ability to learn.
I feel comfortable speaking in class.	1	.17	.08	Poor	Discard
Once I get stressed about school, I have difficulty letting that feeling go.	4	.67	.57	Fair	In moments I feel stressed about school, I can't let that feeling go.

I feel confident in my ability to learn, even when it is something that challenges me.	4	.67	.57	Fair	When I get an answer wrong, I remind myself of my ability to learn.
My thoughts are hard to organize when the teacher calls on me.	2	.33	.12	Poor	Discard
In group projects, I find it easy to interact with others.	1	.17	.08	Poor	Discard
I will adjust my attitude in class when I get overwhelmed.	4	.67	.57	Fair	When I get overwhelmed with school, I let those feelings pass without judging them.
It takes a long time for me to resolve negative feelings about school when they arise.	4	.67	.57	Fair	I can distance myself from negative feelings I experience about school when they arise.
I am afraid I'll have the wrong answer when a teacher calls on me.	2	.33	.12	Poor	Discard
I notice my reactions to things I am learning.	6	1.00	1.00	Excellent	Retain
When I am in class, I can concentrate on what the teacher says.	4	.67	.57	Fair	During class lectures, it is easy to bring my attention back to the teacher when my thoughts wander.
I feel like I am part of a community in class.	1	.17	.08	Poor	Discard
When I study, I clear my environment of distractions.	1	.17	.08	Poor	Discard
I often find myself on auto-pilot in class.	5	.83	.81	Excellent	Retain
I clearly recognize what things I need to study more.	4	.67	.57	Fair	I clearly recognize what things I don't understand and take actions to study them more.

I find it difficult to set flexible goals for myself in school.	4	.67	.57	Fair	I set flexible goals for myself in my classes and change them when necessary.
I take time to notice how I feel when I am in class.	6	1.00	1.00	Excellent	Retain
I can slow down my thoughts when they are racing.	4	.67	.57	Fair	I can slow down my thoughts when they are racing in class.
When I am in class, I multi-task.	1	.17	.08	Poor	Discard
When I feel stressed about school, I shut down.	0	0	0	Poor	Discard
I feel like I have no choice but to succeed in my classes.	1	.17	.08	Poor	Discard
When I am struggling in class, I periodically visit my big picture goals.	4	.67	.57	Fair	When I am struggling in class, I periodically revisit the reasons why I am in school to help me stay focused.
I am aware of my distractions when I am studying.	6	1.00	1.00	Excellent	Retain
It is hard for me to concentrate during class lectures.	1	.17	.08	Poor	Discard
I observe my feelings about my grades without judgement.	6	1.00	1.00	Excellent	Retain
I worry about future assignments or tests.	4	.67	.57	Fair	I worry about future assignments or tests when I should be focusing on something else.

Note. [a]I-CVI item level content validity index calculated by the number of experts that gave a rating of 3 or 4 and dividing it by the total number of experts to yield a proportion of agreement on relevance for each item.

[b]κ^* adjusted kappa designating agreement on relevance: $\kappa^* = \text{I-CVI} - \rho_c / 1 - \rho_c$

[c]Evaluation criteria for adjusted kappa described in Cicchetti & Sparrow (1981) and Fleiss (1981): Poor < .40; Fair = .40 to .59; Good = .60–.74; Excellent > .74.

The 51 revised, retained, and added items were subjected to a second round of evaluations by an independent sample of experts in the field ($N = 4$) who had two or more years of research experience with mindfulness or self-regulated learning. Of these additional experts two reported 6–10 years of personal experience with 6–10 years of research publication experience, one reported 2–5 years of personal experience with 10+ years of research publication experience, and one reported less than a year of personal experience, but 10+ years of research publication experience. I-CVIs and modified kappa statistics were calculated. A total of 39 items were retained that showed good to excellent modified kappa values. Results are provided in Table 7. Two of the retained items were revised to eliminate the use of compound statements per expert recommendation. The item *I set flexible goals for myself in my classes and change them when necessary* was changed to *I set flexible goals for myself in my classes that I change when necessary* and the item *I clearly recognize what things I don't understand and take actions to study them more* was changed to *When I recognize I don't understand something, I take actions to study it more*.

Table 7

Second Item Relevance Assessment & Revisions

Item	# of Experts Rating 3 or 4	[a]I-CVI	[b] κ*	[c]Evaluation	Item Revision or Decision
I try something different or new when my study strategies are not working.	4	1.00	1.00	Excellent	Retain
I get hung up thinking about what I would rather be doing when I am working on assignments for class.	2	.50	.20	Poor	Discard
I recognize when my thoughts interfere with my ability to learn.	4	1.00	1.00	Excellent	Retain
I get anxious to share my thoughts when I am called on in class.	1	.25	.25	Poor	Discard
It is easy to maintain my focus on class lectures/instructional materials.	3	.75	.67	Good	Retain
I make an effort to engage with what I learn in class by making connections to my own life.	3	.75	.67	Good	Retain
If I lose concentration during class, I remind myself why I am there to help me stay present.	3	.75	.67	Good	Retain

Worrying about failing or doing poorly in class distracts me from learning.	2	.50	.20	Poor	Discard
When I start to feel stressed about school, my thoughts run away from me.	2	.50	.20	Poos	Discard
When I feel critical about my academic performance, I take a step back to look at it in a different way.	4	1.00	1.00	Excellent	Retain
I revisit my reasons for being in class to help me make the most of it.	2	.50	.20	Poor	Discard
I easily adapt my schedule to accommodate my workload.	1	.25	0	Poor	Discard
I check in regularly about why I am in school .	3	.75	.67	Good	Retain
I actively participate in my education.	2	.50	.20	Poor	Discard
I change my perspective when my expectations for a class are not met.	3	.75	.67	Good	Retain
I am open to help from others when I don't understand the class material.	4	1.00	1.00	Excellent	Retain
I accept myself when I do not immediately understand something .	3	.75	.67	Good	Retain
I take a deep breath to relax when I start to feel under pressure.	3	.75	.67	Good	Retain
I tend to get side-tracked by my thoughts in class.	3	.75	.67	Good	Retain

I notice when I want to avoid my school work and try to change my attitude towards it.	4	1.00	1.00	Excellent	Retain
I re-evaluate my own judgements about my learning often.	3	.75	.67	Good	Retain
I often miss important parts of lectures because I am thinking about other things.	2	.50	.20	Poor	Discard
I can apply feedback from my teachers and peers without feeling judged.	2	.50	.20	Poor	Discard
I purposefully re-set my attention when I find myself off-task.	4	1.00	1.00	Excellent	Retain
I get caught up in how I think I should be doing in class.	2	.50	.20	Poor	Discard
I tend to give up when a class gets hard.	1	.25	.25	Poor	Discard
I shift my focus back when I find myself procrastinating.	3	.75	.67	Good	Retain
I am quick to judge myself when I do not immediately get something right.	3	.75	.67	Good	Retain
I appreciate the process of learning something new even when it is challenging.	3	.75	.67	Good	Retain
I purposefully keep an open mind to things I do not agree with in class.	3	.75	.67	Good	Retain
If I start to get nervous about an exam, I can easily pause and re-set.	3	.75	.67	Good	Retain

I recognize when I lose focus in class and can bring my attention back.	4	1.00	1.00	Excellent	Retain
I remain calm when I come across a hard question on a test.	3	.75	.67	Good	Retain
I tend to zone out in class lectures when the topic gets complex.	2	.50	.20	Poor	Discard
My emotional reactions often get in the way of my ability to learn.	3	.75	.67	Good	Retain
In moments I feel stressed about school, I can let that feeling go.	3	.75	.67	Good	Retain
When I get an answer wrong, I remind myself of my ability to learn.	3	.75	.67	Good	Retain
When I get overwhelmed with school, I let those feelings pass without judging them.	4	1.00	1.00	Excellent	Retain
I make an effort to be kind to myself when school gets stressful.	3	.75	.67	Good	Retain
I can distance myself from negative feelings I experience about school when they arise.	3	.75	.67	Good	Retain
I notice my reactions to things I am learning.	4	1.00	1.00	Excellent	Retain
During class lectures, it is easy to bring my attention back to the teacher when my thoughts wander.	3	.75	.67	Good	Retain
I often find myself on auto-pilot in class.	3	.75	.67	Good	Retain

I clearly recognize what things I don't understand and take actions to study them more.	3	.75	.67	Good	When I recognize I don't understand something, I take actions to study it more.
I set flexible goals for myself in my classes and change them when necessary.	3	.75	.67	Good	I set flexible goals for myself in my classes that I change when necessary.
I take time to notice how I feel when I am in class.	4	1.00	1.00	Excellent	Retain
I can slow down my thoughts when they are racing in class.	4	1.00	1.00	Excellent	Retain
When I am struggling in class, I periodically revisit the reasons why I am in school to help me stay focused.	4	1.00	1.00	Excellent	Retain
I am aware of my distractions when I am studying.	3	.75	.67	Good	Retain
I observe my feelings about my grades without judgement.	4	1.00	1.00	Excellent	Retain
I worry about future assignments or tests when I should be focusing on something else.	3	.75	.67	Excellent	Retain

Note. [a]I-CVI item level content validity index calculated by the number of experts that gave a rating of 3 or 4 and dividing it by the total number of experts to yield a proportion of agreement on relevance for each item.

[b]κ^* adjusted kappa designating agreement on relevance: $\kappa^* = \text{I-CVI} - \rho_c / 1 - \rho_c$

[c]Evaluation criteria for adjusted kappa described in Cicchetti & Sparrow (1981) and Fleiss (1981): Poor < .40; Fair = .40 to .59; Good = .60–.74; Excellent > .74.

Additional feedback from experts provided in an open-ended response opportunity included that “some conjunctions made it difficult to answer question – assuming some type of frequency scale will be used, if so, words like 'often' could add to the confusion – auto-pilot can be interpreted as good (e.g., I'm in the flow) or bad (e.g., I missed the last 2 minutes of the lecture)”. Another expert described, “some questions use specific ‘mindfulness’ language that may not be clear to those who have not been exposed to it.” This feedback was noted and items were flagged for additional review.

To further assess content validity and address the extent to which the items are interpreted accurately, cognitive interviews were conducted with university students with the 39 items retained. Cognitive theory points to the value of interviewing techniques such as “think alouds” and “verbal probing” to aid in the quality of and interpretability of participant responses to items generated (Beatty & Willis, 2007; Jobe & Mingay, 1989). The primary goal of this kind of pre-testing is to guard the instrument from measurement error related to problems in how items are interpreted across respondents and to identify problems with items that are misunderstood or confusing. Participants (N = 15) consisted of ten undergraduate and five graduate students (73.3% female and 26.7% male) registered for classes at the University of Nevada, Las Vegas (46.7% Hispanic, 33.3% White, 6.7% Asian, 6.7% Native Hawaiian/Pacific Islander, 6.7% Other). Participants were asked if they had ever practiced mindfulness before (yes = 4, no = 3, unsure = 8) and how frequently they currently practice mindfulness (never = 2, rarely = 6, sometimes = 6, often = 1).

Participants were administered a draft of the Mindful Self-Regulated Learning Scale (m-SRLS) and a demographic questionnaire. They were provided the construct definition, as well as descriptions of the subscales. Items were grouped by subscale. Respondents were asked to

verbalize the mental processes involved in their responses to all of the items. This includes, but was not limited to, elaboration on chosen responses, consideration of item relevance, interpretations of meaning and reports of difficulty in understanding, and any suggestions or improvements to confusing items (Beatty & Willis, 2007). Participants were asked to both "think out loud" and asked direct probing questions to elaborate on the nature of how well items are performing. The interviews took place following repeated efforts to minimize any item problems between each round, per optimal recommendation (Willis, 2005).

Through this process, 39 items were reduced to 32. Items were eliminated that participants felt they misunderstood, were unclear, were irrelevant, were over-reliant on mindfulness specific terminology or idiomatic terminology (i.e. "auto-pilot"), or were deemed redundant to another more preferred item. In addition, words were changed or added within items to enhance both their contextual understanding and relevance to the active component of the construct definition per student recommendations. For example *I can distance myself from negative feelings I experience about school when they arise* was changed to *I accept negative feelings I experience about school as they arise*. A full description of all item changes that took place at this stage is available in Appendix B. The 32 item m-SRLS scale retained is provided in Appendix C.

Chapter II Summary

Providing a precise definition of secularized mindfulness has challenged scholars. As a result, existing self-report measures of mindfulness span a broad range of conceptualizations. There is concern that these instruments measure distinct aspects of mindfulness. A comprehensive review of literature and consideration of student perceptions of mindfulness in education brought forward a distinct construct: mindful self-regulated learning. Mindful self-

regulated learning is defined as the adaptive and active self-monitoring of one's thoughts, feelings, and behaviors, characterized by a quality of re-perception and acceptance, in the conscious service of the learning process. An iterative process of inductive and deductive methods led to the generation of 32 items that may best capture mindful-self-regulated learning.

Statement of Problem and Research Questions

To date an education-specific, context-relevant mindfulness self-report instrument has yet to be developed. There is need for this development to advance the evaluation of school-based mindfulness programs as well as to aid further investigations into the mechanisms underlying mindfulness in relation to its utility in education. The dimensions of mindful self-regulated learning and initial tests of validity and reliability of the scale across different populations, subgroups, and stability over time are investigated here through the following research questions:

1. What is the factor structure underlying the m-SRLS scale?
2. Does the m-SRLS relate in the anticipated ways to measures that should or should not be related?
3. Does the m-SRLS perform the same across different groups at different times?
4. Does the m-SRLS perform the same across the same group at different times?

There are four primary hypotheses:

Hypothesis 1. The m-SRLS will be best fitted to a correlated three-factor model (intention, attention, attitude) in which items are allowed to cross-load but are constrained as close to zero as possible.

Hypothesis 2. The m-SRLS will positively correlate with constructs that relate closely (e.g., metacognitive self-regulation, self-control) and negatively correlate with constructs that would

infer the absence of mindful self-regulated learning (e.g., difficulties in emotion regulation, mind wandering).

Hypothesis 3.1 The m-SRLS will perform the same across different samples and subgroups of biological sex.

Hypothesis 3.2 The m-SRLS will perform differently with mindfulness experience as a continuous covariate and will perform the same with age as a continuous covariate.

Hypothesis 4. The m-SRLS will demonstrate subscale reliability across the same group at two different times.

Chapter III: Methods

Overview

Methods for this study are modeled off best practices for scale development and validation provided by Boateng et al. (2018) and consist of three phases: 1) item development, 2) scale development, and 3) scale validation. The item development phase was implemented as pilot studies that were described in the previous chapter. The scale development phase consists of survey administration, item reduction, and extraction of factors. The scale validation phase consists of further tests of dimensionality, tests of initial construct validity including convergent and discriminant validity, measurement invariance testing, and tests of reliability. Methods provided are organized by phase and study.

Phase II Scale Development: Study 1, Study 1R & Study 2

Design and Purpose

Phase II consisted of studies designed to reduce the number of items and explore the initial factor structure of the scale. In Study 1, the instrument was administered online and item reduction analysis was used to identify poorly performing items that needed to be eliminated or modified to ensure the functionality of the scale. This was repeated in a larger second sample in Study 1R. The purpose of these studies was to refine the scale further and determine whether the optimal number of factors present in the data matched the apriori three-factor structure deduced from theory. In Study 2, the emergent factor structure was tested using exploratory structural equation modeling (ESEM) using Mplus 8.8 Models (Muthén & Muthén, 2017).

Study I Item Reduction & Initial Factor Exploration

Participants. The Study 1 sample consisted of 283 undergraduate students (70% female and 30% male) registered for classes and participating in research studies for extra credit.

Detailed demographics are provided in Table 8. A 10:1 ratio of respondents to items is the recommended heuristic sample size for initial item reduction in scale development using factor analysis (Nunnally, 1978). Other recommendations in the literature suggest a sample size minimum of 300 – 450 (Guadagnoli & Velicer, 1988). With 32 initial items, an initial sample of at least 320 was hoped for to account for the error-prone nature of exploratory factor analysis. Regardless of heuristics, larger sample sizes reduce measurement error, produce more stable and replicable factor structures, and reflect closer to the true population (Costello & Osborne, 2005; MacCallum et al., 1999). Study 1 was thus considered exploratory.

Table 8

Sample Characteristics Across Studies

	Study 1	Study 1R	Study 2	Study 3	Study 4
N	283	400	800	800	152
n	271	388	790	788	118
Age, mean years	21.8	24.8	23.2	23.5	21.4
% Sex					
Male	30.0	43.3	35.4	36.1	22.4
Female	70.0	56.8	64.6	63.9	77.6
% Ethnicity/Race					
Black/African American	12.0	11.3	9.3	9.8	7.9
American Indian/Alaskan Native	0.4	0.3	1.4	0.4	--
Asian	18.7	15.0	13.1	12.0	11.8
Native Hawaiian/Pacific Islander	2.8	--	0.5	0.1	2.0
Hispanic or Latino	31.1	10.3	11.3	11.0	30.9
White (Non-Hispanic Origin)	27.2	58.8	59.6	59.5	32.9
Two or More Races	6.4	4.5	3.9	5.9	13.2
Other	1.4	--	1.0	0.4	1.3
% Year of Study					
1st Year	44.2	9.0	8.1	7.9	19.7
2nd Year	25.4	21.8	21.3	21.8	36.8
3rd Year	21.6	31.0	29.0	32.6	28.9
4th Year	7.8	30.3	32.9	30.9	7.9
5th + Year	1.1	8.0	8.8	6.9	6.6

Procedures. Participants completed the 32-item m-SRLS via an online survey platform. In addition, demographic information was collected and participants were asked to rate their experience with mindfulness. Responses were recorded using the survey software Qualtrics XM (2022). Participants who consented to data collection were prompted to respond to all items, though able to drop out of the study with no repercussions. In addition, response times were collected. Upon completion, participants were granted research credit for their classes.

Materials.

Demographic Questionnaire. This form requested participant age, year in school, gender, biological sex, and race/ethnicity. In addition, participants were asked to rate their experience with mindfulness practice on a scale of 0–10 with 0 indicating no experience at all and 10 indicating expertise.

m-SRLS Version 1. The Mindful Self-Regulated Learning Scale (m-SRLS Version 1) consists of 32 items developed and retained from Phase I. All items are measured on 7-point Likert scale following recommendations by Krosnick and Presser (2009) and range from 1- *very untrue of me* to 7- *very true of me*. Participants are prompted: *Below are a set of statements about some general learning experiences in school. Using the 1-7 scale provided, please rate each of the following statements with the number that best describes your own opinion of what has been most true of your recent experiences in school.* The scale is provided in Appendix C.

Data Quality Decisions. Data were examined for quality before subject to analyses. Data were considered for deletion that were provided by rushed responses (those two standard deviations below the mean response time), those responses with zero variability (i.e., respondent answered 7 for all items) and those that failed a completely automated public Turing test to tell computers and humans apart (CAPTCHA), a type of challenge-response authentication test

named after Alan Turing's (1950) work. The median survey response time was 3 minutes and 26 seconds. Of the 283 responses, 271 were retained for analyses.

Data Analyses. Given the complexity of the psychological construct, an initial study exploring the factor structure and informing further scale refinement was important to the assessment of the scale's conceptual breadth. At this stage of data reduction EFA is considered a useful method for refinement (Anderson & Gerbing, 1988; Conway & Huffcutt, 2003; Floyd & Widaman, 1995). No single approach for addressing item reduction and initial extraction of latent factors is entirely satisfactory and as such a holistic approach was taken that involved multiple steps of examining scale reliability, conducting EFAs, scrutinizing individual item descriptives, and examining the theoretical permissibility of items and factors.

Patterns of inter-item correlations and corrected item-total correlations were examined to assess the extent items were related to other items and the total scale score. Within-dimension correlations should be higher than across-dimension correlations. Items with low inter-item and corrected item-total (< .30) correlations were scrutinized for potential deletion (Tabachnick & Fidell, 2007). In addition, the Kaiser-Meyer-Olkin Test of Sampling Adequacy, a measure between 0 and 1 that indexes the proportion of variance in the data that may be common variance, was calculated as a measure of suitability for factor analysis assumptions (Kaiser, 1974). Cronbach's (1951) alpha was computed as an index of internal consistency due to its preference in published reporting.

Exploratory factor analysis (EFA) with maximum likelihood estimation was used to identify the number of factors underlying the data and explain the interrelationships between items and factors. Due to contention in accuracy across individual methods (Zwick & Veliver, 1986), a holistic approach to factor retention was used. The number of factors to retain in the

initial unrotated solution was decided across convergence of Kaiser's (1960) criterion, in which only factors with eigenvalues are greater than 1 are retained, Catell's (1966) scree method and Horn's (1965) parallel analysis in which factors less than the mean eigenvalues or approximate the 95th percentile values of parallel sets are retained.

Item descriptives (mean scores, standard deviations, and skewness/kurtosis values), factor loadings, and cross-loadings were collated to help identify potential items for deletion from the identified factor solution. This is in line with several researchers' recommendations (Clark & Watson, 1995; DeVellis, 2017; Hinkin, 1998; MacKenzie et al., 2011; Stanton et al., 2002). Items exhibiting substantial cross-loadings or items that loaded significantly on a different factor than expected were evaluated for deletion, however moderate cross-loadings were expected to reflect construct-relevant multidimensionality and this was taken into account. Comrey and Lee's (1992) heuristics for loading strength were used to interpret item loadings (> .71 excellent, > .63 good, > .55 good, > .45 fair, and < .32 poor).

Study 1 Revised (Study 1R) Initial Factor Exploration in a Larger Sample

Participants. Study 1R consisted of an independent pre-screened sample of 400 (56.8% female, 43.4% male) registered users of Prolific.co (2022), an online platform used for behavioral research that was developed by graduate students from Oxford and Sheffield Universities. Prolific.co has demonstrated high data quality that is similar to Amazon Mechanical Turk (2022), but it offers more relevant prescreening options for this particular study (Peer et al., 2017). Participants were prescreened across the following criteria: participants were (1) over 18 years of age, (2) US residents, (3) fluent in English, (4) currently students, (5) currently an undergraduate student, and (5) had a study approval rating of 95% . Study approval ratings refer to the rate which participants have been approved for study completion rather than rejected in

their previous study participations. Valid rejections include participants who finish the study two standard deviations below the average response time, participants that skip crucial questions that are critical to the research question, participants that fail attention checks, or participants that objectively demonstrate subpar effort. Detailed demographics are provided in Table 8.

Procedures. Participants completed the 32-item revised m-SRLS from Study 1 (m-SRLS Version 2) via an online survey platform. In addition, demographic information was collected and participants were asked to rate their experience with mindfulness on a 0 - 10 scale. Responses were recorded using the survey software Qualtrics XM (2022). Participants who consented to data collection were prompted to respond to all items, though able to drop out of the study with no repercussions. Response times were also collected. Upon completion, participants were compensated $1 to approximate a $12/hour wage.

Materials.

Demographic Questionnaire. This form requested participant age, year in school, gender, biological sex, and race/ethnicity. In addition, participants were asked to rate their experience with mindfulness practice on a scale of 0 – 10 with 0 indicating no experience at all and 10 indicating expertise.

m-SRLS Version 2. The Mindful Self-Regulated Learning Scale (m-SRLS Version 2) consists of 32 items retained and/or modified from Study 1. All items are generated on a 7-point Likert scale following recommendations by Krosnick and Presser (2009). It is provided in Appendix D, where item changes are indicated in italics.

Data Quality Decisions. Data were examined for quality before subject to analyses. Data were considered for deletion that were provided by rushed responses (those two standard deviations below the mean response time), those responses with zero variability (i.e., respondent

answered 7 for all items) and those that failed a CAPTCHA. The median survey response time was 3 minutes and 17 seconds. Of the 400 responses, 388 were retained for analyses.

Data Analyses. Study 1 data analyses were repeated.

Study 2 Initial Tests of Dimensionality

Participants. The Study 2 sample consisted of an independent pre-screened sample of 800 (64.6% female, 35.4% male) registered users of Prolific.co (2022) that were prescreened across the following criteria: participants were (1) over 18 years of age, (2) US residents, (3) fluent in English, (4) currently students, (5) currently an undergraduate student, (5) had a study approval rating of 95% and (6) had not participated in previous related studies. Detailed demographics are provided in Table 8.

Procedures. Participants completed the 21-item revised m-SRLS (m-SRLS Version 3), demographic questions, and were asked to rate their experience with mindfulness on a 0 – 10 scale. Responses were recorded using the survey software Qualtrics XM (2022). Participants who consented to data collection were prompted to respond to all items, though able to drop out of the study with no repercussion. Response times were also collected. Upon completion, participants were compensated $1 to approximate a $12/hour wage.

Materials.

Demographic Questionnaire. This form requested participant age, year in school, gender, biological sex, and race/ethnicity. In addition, participants were asked to rate their experience with mindfulness practice on a scale from 0 – 10 with 0 indicating no experience at all and 10 indicating expertise.

m-SRLS Version 3. The Mindful Self-Regulated Learning Scale (m-SRLS) implemented in this study consists of 21 items retained from Study 1R. All items are generated on a 7-point

Likert scale following recommendations by Krosnick and Presser (2009). It is provided in Appendix E.

Data Quality Decisions. Data were examined for quality before subject to analyses. Data were considered for deletion that were provided by rushed responses (those two standard deviations below the mean response time), demonstrated zero variability (i.e., respondent answered 7 for all items), and those that failed CAPTCHA. The median survey response time was 2 minutes and 39 seconds. Of the 800 responses, 790 were retained for analyses.

Data Analyses. Prior to running main analyses, data were screened for normality and skewness and kurtosis values evaluated (Tabachnik & Fidell, 2007). Patterns of inter-item correlations and corrected item-total correlations were examined and Cronbach's alpha (1951) was computed as an index of internal consistency due to its preference in published reporting. However, because errors are likely to be correlated and the assumption of at least tau-equivalence is unlikely to hold, model-based composite reliability estimates based on McDonald's (1970) coefficient omega (ω) were also calculated (Dunn et al., 2014; Raykov, 2002; Sijtsma, 2009).

Confirmatory factor analysis (CFA) and exploratory structural equation modeling (ESEM) with maximum likelihood estimation with robust standard errors (MLR) was used to test the factor structure of the m-SRLS across a series of measurement models using Mplus 8.8 Models (Muthén & Muthén, 2017). The MLR estimator was chosen above robust weighted least squares estimation (WLSMV). With five or more ordered categorical response options (seven in this study), when data is treated as continuous, bias resulting in underestimation of factor loadings, and parameter standard areas is non-trivial (Rhemtulla et al., 2012). Therefore, the less computationally intense MLR estimation technique which is robust to non-normality and non-

independence of observations, as well as better at handling missing data, was preferred. ESEM incorporates features of both EFA and CFA to allow for a dynamic interaction between factors. Rather than restrict cross-loadings to 0, as in a traditional CFA, the ESEM model allows them to vary, though will constrain them as close to 0 as possible (Asparouhov & Muthén, 2009; Marsh et al., 2014; Morin, 2023). Considering it is unlikely that factors composing a multidimensional scale are unrelated, the ESEM approach offers greater measurement quality without sacrificing model fit. Incorporating cross-loadings into the model both protects against inflated factor correlations and provides a more accurate depiction of systematic measurement error (Asparouhov & Muthén, 2009; Marsh et al., 2009; Morin et al., 2013). It is unlikely that items reflecting mindful self-regulated learning exist within unrelated factors. Thus, ESEM, appeared most relevant for assessing the psychometric properties of the scale.

The following competing measurement models were tested:

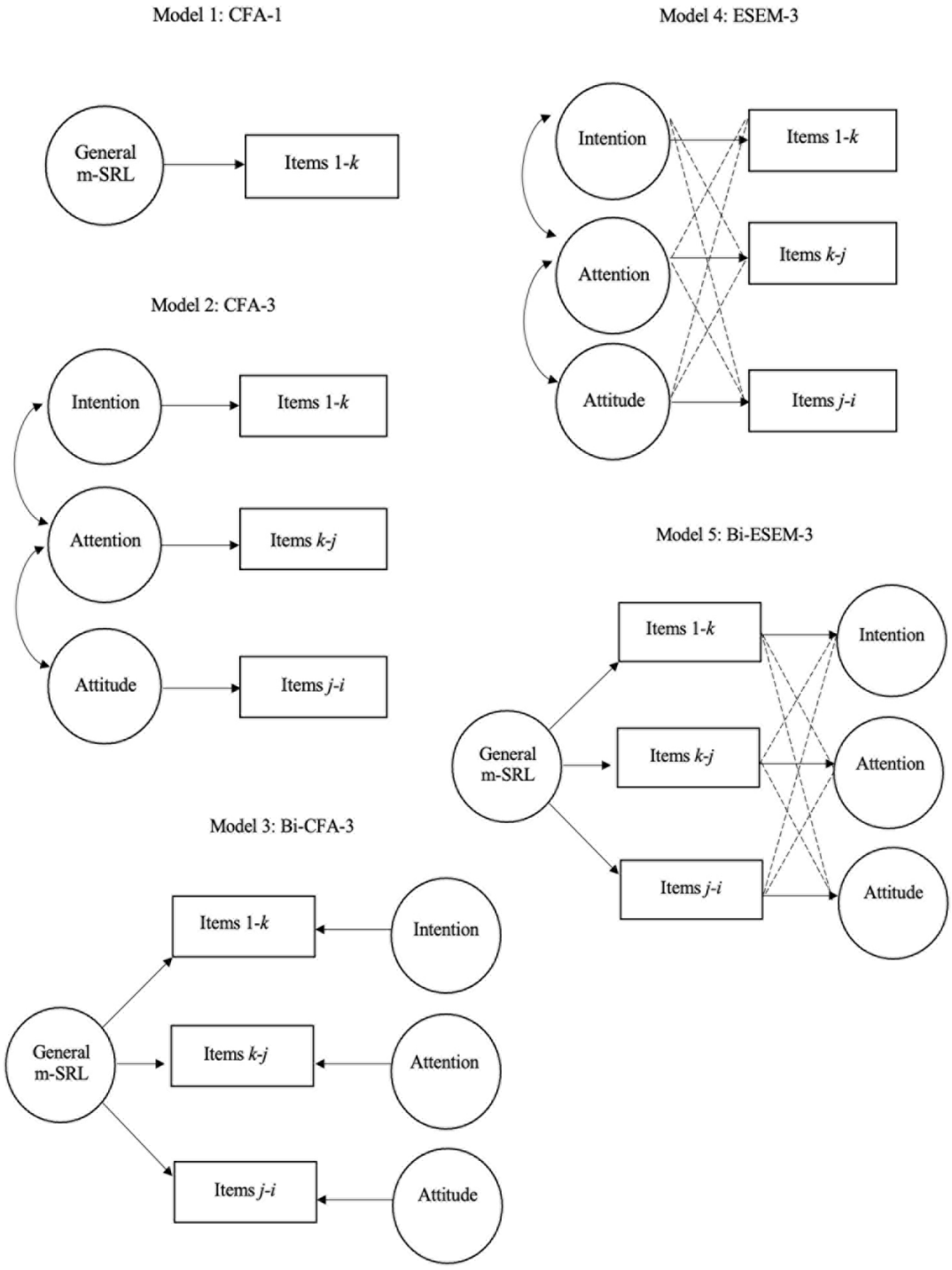
1. Uni-dimensional model in which all items were specified to load onto one mindfulness factor, with one item fixed to 1 and the factor mean fixed to 0, following a fixed-mean-referent-loading approach to identification (CFA-1);
2. Correlated three-factor CFA model in which each item was specified to load onto the hypothetical factor it was designed to measure (intention, attention, and attitude), with correlations among the three factors freely estimated, the first item of each factor fixed to 1 and the factor means fixed to 0 (CFA-3);
3. Bifactor CFA model in which items were specified to load onto a hypothetical general mindfulness factor as well as one of the three hypothetical domain-specific factors, with the relationships between specific and general factors constrained to 0 and the variances for the factors constrained to 1 (Bi-CFA-3);

4. Three-factor ESEM model in which each item was specified to load onto the hypothetical factor it was designed to measure (intention, attention, and attitude), with cross-loadings permitted but targeted to be as close to 0 as possible and factor variances fixed to 1 (ESEM-3);
5. Bifactor ESEM model with three orthogonal specific factors in which all items were specified to load on a hypothetical general mindfulness factor as well targeted to load on three hypothetical specific factors in which cross-loadings were permitted but targeted to be as close to 0 as possible (Bi-ESEM-3).

Models 1-5 are illustrated in Figure 3 below:

Figure 3

Hypothetical m-SRL Measurement Models to be Tested



In line with research recommendations, the CFA models were first fitted to the data and then compared to the ESEM models (Alamer & Marsh, 2022; Marsh et al., 2009). In the case that a CFA model produced adequate and similar fit to the ESEM model, the more parsimonious CFA model would be retained. Bifactor and higher-order models assume a general factor that exists simultaneously with specific factors. With respect to construct-relevant psychometric multidimensionality, bifactor models are preferred unless strong conceptual justifications suggest higher-order structure (Alamer, 2021; Gignac, 2016; Howard et al., 2018). Investigation of the current scale lacks justification in which a second-order factor only has an indirect effect on the indicators through first-order factors, therefore these models are not tested in the current study (Chen et al., 2006; Alamer, 2022).

Model fit evaluation involved inclusive consideration of fit indices and the theoretical consistency and admissibility of parameter estimates, including examination of the magnitude of the standardized cross-loadings in ESEM models. The χ^2 test is limited as a test of exact fit, can be oversensitive to minor model misspecifications given even moderate-sized samples, and rarely fits data of samples over 200 (Barrett, 2007; Bentler, 2007; Chen et al., 2008). As such, researchers have suggested examining the ratio of the chi-square values to relative degrees of freedom, with larger ratios indicating poorer fit and ratios of 3:1 or lower indicating better fit (Jöreskog & Sörbom, 1993; Tabachnick & Fidell, 2007). A series of other fit indices were also considered in examining model fit: the root mean square error of approximation and its confidence interval (RMSEA; Steiger, 1990) $\leqslant$ .050 and .080 for close and reasonable fit, the comparative fit index (CFI; Bentler, 1990) and Tucker-Lewis Index (TLI; Tucker & Lewis, 1973) $\geqslant$ .900 and .950 for acceptable and excellent fit (Hu & Bentler, 1999), and the standardized root mean square residual (SRMR) < .08. In addition, the Akaike Information

Criteria (AIC; Akaike, 1987), the Bayesian Information Criteria (BIC; Hu & Bentler, 1999), and the sample size-adjusted BIC (SABIC; Sclove, 1987) were evaluated.

For model comparisons, a sequential strategy was adopted from Morin et al. (2020) and Alamer and Marsh (2022) in which CFA and ESEM models are compared starting with the standard models and progressing to the bifactor models when adequate fit is observed. Similar degrees of fit are evident when changes in CFI and TLI (ΔCFI, ΔTLI) are $\leqslant$ .01 and changes in RMSEA (ΔRMSEA) are $\leqslant$ .015 (Chen, 2007; Cheung & Rensvold, 2022). In addition, lower values of AIC, BIC, and SABIC reflect better model fit. In the evaluation of CFA and ESEM models, ESEM models are preferred when factor correlations are reduced (Howard et al., 2016; Marsh et al., 2009; Morin et al., 2020). The comparison criteria were considered alongside parameter estimates, statistical conformity, and theoretical adequacy in line with guidelines across multiple researchers (Fan & Sivo, 2009; Marsh et al., 2009; Morin et al., 2016). Magnitudes of loadings were interpreted along conventions recommended by Comrey and Lee (1992) in which loadings are excellent if they are above .71, very good if between .63 and .70, good if between .55 and .62, fair if between .44 and .33, and poor if below .32. It has been suggested that loadings on target factors should be greater than .50, but are acceptable between .30 and .50 (Alamer, 2022). Items loading in this range were evaluated for construct relevance. Cohen's (1988) conventions were used for interpretation of factor correlations.

Phase III Scale Evaluation: Study 3 & Study 4

Design and Purpose

Phase III consisted of two additional studies. Study 3 involved determining whether, upon administration at a different point in time and with two independent samples, the scale items could be fitted to the model retained in Study 2. In addition, initial tests of reliability and

construct validity were conducted. Establishing construct validity involves assessing the extent to which a scale behaves against established measures in the appropriate theoretical ways (DeVellis & Thorpe, 2021). Patterns of correlations were observed across measures that should and should not positively relate, convergent and discriminant evidence respectively. Apriori hypotheses included that mindful self-regulated learning would correlate positively with constructs that relate closely to elements of mindful self-regulated learning (e.g., self-control, metacognitive self-regulation) and correlate negatively with constructs that would infer the absence of mindful self-regulated learning (e.g., test anxiety, difficulties in emotional regulation, mind wandering). In addition, tests of measurement invariance across pooled samples from Study 2 and Study 3 were conducted, including examination of the subgroups gender and mindfulness experience. Study 4 examined test-retest reliability.

Study 3 Construct Validity & Measurement Invariance

Participants. The Study 3 sample consisted of an independent pre-screened sample of 800 (63.9%% female, 36.1% male) registered users of Prolific (2022) that were prescreened across the following criteria: participants were (1) over 18 years of age, (2) US residents, (3) fluent in English, (4) currently students, (5) currently an undergraduate, (5) had a study approval rating of 95%, and (6) had not participated in previous related studies. Detailed demographics are provided in Table 8.

Procedures. Participants completed an online survey that consisted of the 21-item m-SRLS and a series of other measures selected to establish preliminary convergent and discriminant validity. In addition, demographic information was collected including self-reported mindfulness experience on a 0 – 10 scale. Responses were recorded using the survey software Qualtrics XM (2022). Participants who consented to data collection were prompted to respond to

all items, though they were able to drop out of the study with no repercussions. Response times were also recorded. Participants were compensated $3 at the full completion of the 10 –15 minute study, which approximated a $12/hour wage.

Materials.

Demographic Questionnaire. Participant age, year in school, biological sex, gender, and race/ethnicity were requested. In addition, participants were asked to rate their experience with mindfulness practice on a scale from 0–10 with 0 indicating no experience at all and 10 indicating expertise.

m-SRLS Version 3. The Mindful Self-Regulated Learning Scale (m-SRLS Version 3) implemented in this study consists of 21 items retained from Study 1R. All items are generated on a 7-point Likert scale following recommendations by Krosnick and Presser (2009). It is provided in Appendix E.

FFMQ. The Five-Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) is a 39-item scale designed to assess trait mindfulness across five facets: observing, describing, acting with awareness, nonreactivity, and nonjudging. It was developed to measure change in mindfulness in clinical patients receiving Dialectical Behavior Therapy and was compiled through an exploratory factor analysis of five existing mindfulness scales. It is among the most frequently used scales in mindfulness intervention research (Gherardi-Donato et al., 2020). It is expected that high trait mindfulness will positively correlate with mindful self-regulated learning. Items are scored on a 5-point Likert scale ranging from “never or very rarely true” to “very often or always true”. The scale demonstrates acceptable internal consistency with alphas for subscales ranging from .67 to .93. A list of items is found in Appendix F.

MSLQ Subscales. The Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al. 1991) consists of 81 items and fifteen scales designed to measure college student motivational orientations and learning strategies. Scales can be taken together or implemented separately. Two subscales of the MSLQ have been chosen. The first is the affective component text anxiety scale which consists of 5 items designed to assess worry, cognitive concern, and emotional arousal when taking a test. Individuals who practice mindfulness experience lower levels of rumination (Ramel et al., 2004), state and trait anxiety, and stress (Shapiro et al., 1998). It is expected that higher levels of affective test anxiety will negatively correlate to mindful self-regulation. The second subscale is the metacognitive self-regulation scale which consists of 12 items designed to measure the planning, monitoring, and regulating of self-regulatory activities. A central quality of mindfulness is the reperceiving of present moment experience. Re-perception "allows one to deeply experience each event of the mind and body without identifying with or clinging to it" (Shapiro et al., 2006, p. 379). This quality of mindfulness may allow for more adaptive affective, behavioral, and sustained self-control and energize these processes in the service of goals over and above self-control training alone through a quality of awareness (Elkins-Brown et al., 2017). It is expected that higher levels of metacognitive self-regulation will positively associate with higher levels of mindful self-regulated learning. Both the test anxiety and metacognitive self-regulation subscales demonstrate strong internal consistency (alpha .80 and .79 respectively) and are measured on a 7-point Likert scale ranging from "not at all true of me" to "very true of me". A list of items is found in Appendix G.

DERS-18. The Difficulties in Emotion Regulation Scale Short Form (DERS-18; Victor & Klonsky) is an 18-item short version of the 36-item DERS (DERS; Gratz & Roemer, 2004). It is designed to assess emotion dysregulation across six subscales: awareness, clarity, strategies,

nonacceptance, goals, and impulse. In the process model of emotion-regulation, mindfulness is thought to act as an agent of cognitive change through the reappraisal of emotive stimuli and non-judgement (Garland et al., 2011; Gross, 1998). It is expected that higher levels of difficulty in emotion regulation will associate negatively with mindful self-regulated learning. The DESR-18 demonstrates high internal consistency across subscales and overall, alpha .91. Items are scored on a 5-point Likert scale ranging from "almost never" to "almost always" and higher scores indicate greater difficulties unless reverse scored. A list of items is found in Appendix H.

MWQ. The Mind Wandering Questionnaire (MWQ; Mrazek et al., 2013b) is a 5-item scale designed to measure spontaneous and deliberate mind wandering as the interruption of task-focus by task-unrelated thought (Mrazek et al., 2013a). Reduced mind wandering has been attributed to decreased activation of the brain's default network, an area associated with resting-state, and self-generated thought such as future imagination. Decreases in default network activation are also supported by an interaction with executive control (Andrews-Hanna et al., 2014). Mindfulness practices are concerned with engagement with present moment experiences and have been cited to reduce mind wandering (Mrazek et al., 2013a). It is expected that higher levels of mind wandering will be negatively correlated with mindful self-regulated learning. Items on the MWQ demonstrate strong internal consistency, alpha 0.85, and are measured on a 6-point Likert scale ranging from "almost never" to "almost always". Higher scores are indicative of greater mind wandering. A list of items is found in Appendix I.

BSCS. The Brief Self-Control Scale (BSCS; Tangney et al., 2004) is a 13-item short form of the 36-item Self-Control Scale designed to measure dispositional self-control as the tendency to be disciplined and abrogate impulses. Scholars suggest that mindfulness acts as a causal influence of self-regulation and is itself a practice of self-control (Hölzel et al., 2011; Lutz et al.,

2008; Masicampo & Baumeister, 2007; Shapiro et al., 2006; Tang et al., 2015). It is expected that higher levels of self-control will positively correlate to mindful self-regulated learning. Items demonstrate strong internal consistency, alpha 0.85, and are measured on a 5-point Likert scale ranging from "not at all like me" to "very much like me" (Tangney et al., 2004). Higher scores are indicative of more self-control. A list of items is found in Appendix J.

Data Quality Decisions. Data were examined for quality before subject to analyses. Data were considered for deletion that were provided by rushed responses (those two standard deviations below the mean response time), those responses with zero variability (i.e., respondent answered 7 for all items), and those that failed CAPTCHA. The median survey response time was 10 minutes and 30 seconds. Of the 800 responses, 788 were retained for analyses.

Data Analyses. Tests of dimensionality and reliability from Study 2 were repeated with the new sample. Initial assessments of convergent and divergent validity were made through examining the strength of the total scale and subscale correlations with theoretically related measures (Furr, 2017). To account for Type I and Type II error due to the large number of correlations calculated, only those with $p < .01$ were considered significant. Cohen's (1988) conventions were used for interpretation of correlation strength. In addition heterotrait-monotrait ratio of correlations (HTMT) values were calculated as the arithmetic mean of the heterotrait-heteromethod correlations (between scale item correlations) divided by the geometric mean of the monotrait-heteromethod correlations (within scale item correlations) (Henseler et al., 2015). The HTMT method has produced higher specificity rates for discriminant validity compared to the Fornell-Larcker criterion (Fornell & Larcker, 1981) and cross-loadings criteria (Chin, 1998). HTMT values range from 0 to 1 with values below .85 indicative of sufficient discriminate

validity (Henseler et al., 2015; Voorhees et al., 2016). These values will be reported as additional evidence of discriminant validity among similar constructs.

To verify the extent to which the retained model was replicated beyond random error, measurement invariance tests were also performed. These tests are designed to evaluate whether the instrument behaves the same across different groups. Samples from Study 2 and Study 3 were used to test multiple group measurement invariance across the extended taxonomy of Marsh et al. (2009). This includes testing 13 levels of invariance in which different combinations of parameters are constrained to equal. Six primary levels of measurement invariance are of particular interest: configural invariance, weak (metric or pattern) invariance, strong (scalar) invariance, strict (residual) invariance, latent variance covariance invariance, and latent means invariance (Meredith, 1993; Millsap, 2011; Vandenberg & Lance, 2000; Widaman & Olivera-Aguilar, 2023).

The configural model serves as the baseline model from which to test subsequent nested models of multiple group invariance. In this model, groups are assumed to have the same factor structure. No constraints are placed on any parameters. Weak invariance tests the equivalence of factor loadings by constraining them to be equal across groups. Strong invariance tests the equivalence of item intercepts along with factor loadings and is the prerequisite for comparing group means. Strict invariance tests the equivalence of item uniquenesses (error) in addition to item intercepts and factor loadings. The establishment of strict invariance permits manifest scores to be compared in meaningful ways. Latent variance-covariance invariance tests the equivalence of the factor variance-covariance matric across groups in addition to the factor loadings which may establish whether the conceptual domain across groups is constant. Latent means invariance constrain group mean differences to be 0 in combination with other parameter

constraints. It should be noted that models of partial invariance may also be explored in which subsets of parameters are specified invariant and others allowed to freely vary.

Fit indices of increasingly restrictive, partially nested, invariance models were examined for goodness-of-fit. When a nonsignificant change in fit is evident between models, ΔCFI/TLI are $\leqslant$ .01 and ΔRMSEA $\leqslant$ .015 , the more constrained model is supported (Chen, 2007; Cheung & Rensvold, 2002). If strong measurement invariance is observed across the Study 2 and Study 3 samples, the data will be pooled to maximize the available sample size and multiple group measurement invariance will be assessed across biological sex (female, male) .

In addition, differences across age and mindfulness experience, as measured on a 0 - 10 scale, were explored. The mindfulness experience and age invariance tests followed the multiple indicator multiple causes (MIMIC; Jöreskog & Goldberger, 1975) model in which only tests for invariance of intercepts and latent means are appropriate. In these models, mindfulness experience and age were treated as covariates. In the MIMIC model, latent variables are predicted by single indicator grouping variables akin to a multivariate regression model. In this way non-invariance of item intercepts or monotonic differential item functioning (DIF) can be tested. The primary limitation of the MIMIC model is that it assumes invariance of the factor loadings and the factor variance-covariance matrix. It can, however, accommodate continuous predictors which is an important advantage over traditional multiple group invariance testing that require continuous variables to be recoded into two or more groups (MacCallum et al., 2002; Morin et al., 2013). Here, the MIMIC model can be conceptualized as a multivariate regression in which mindful self-regulated learning, estimated with the m-SRLS, is influenced by the continuous covariate (age or mindfulness experience).

Three MIMC models were used to examine the presence of monotonic DIF: (Model 1) a null effects model in which predictor variables have no effect (paths constrained to 0) on the latent variables or item intercepts, (Model 2) a saturated model in which predictor variables have an effect on the item intercepts (paths freely estimated) while paths to the latent variables are constrained to 0, and (Model 3) an invariant intercept model in which predictor variables have an effect on the latent variables (paths freely estimated) while paths to item intercepts are constrained to 0. Comparison of Model 1 and Model 2 indicates whether item responses are influenced by the predictors. Comparison of Model 1 and Model 3 indicates whether the predictors influence the latent factors. Comparison of Model 2 and Model 3 indicates whether the influence of the predictors on the items is fully explained by the latent factors. If Model 3 provides a substantial improvement of fit compared to Model 2, monotonic DIF is evident and partial models may be explored (Morin et al., 2013).

Study 4 Test-Retest Reliability

Participants. The Study 4 sample consisted of an independent sample of 152 undergraduate students (77.6% female and 22.4% male) registered for classes and participating in research studies for extra credit. Of these 152 students, 118 completed the study at both timepoints. Detailed demographics are provided in Table 8.

Procedures. Participants completed the 20-item m-SRLS via an online survey platform at two time points, 1 week apart. In addition, participants answered demographic questions and were asked to rate their experience with mindfulness practice on a 0 – 10 scale. Responses were recorded using the survey software Qualtrics XM (2022). Participants who consented to data collection were prompted to respond to all items, though they were able to drop out of the study

with no repercussions. Response times were also collected. Upon completion of the study, participants were granted research credit for their qualifying classes.

Materials.

Demographic Questionnaire. Participant age, year in school, biological sex, gender, and race/ethnicity were requested. In addition, participants were asked to rate their experience with mindfulness practice on a scale from 0 – 10 with 0 indicating no experience at all and 10 indicating expertise.

m-SRLS. The Mindful Self-Regulated Learning Scale (m-SRLS) consists of the final 20 items retained from Study 2 and Study 3. All items are generated on a 7-point Likert scale following recommendations by Krosnick and Presser (2009). The final m-SRLS scale is provided at the end of the discussion.

Data Quality Decisions. Data were examined for quality before subject to analyses. Data were considered for deletion that were provided by rushed responses (those two standard deviations below the mean response time), responses with zero variability (i.e., respondent answered 7 for all items), those that failed CAPTCHA, and those that completed the survey at only one timepoint. Completion of the scale at both timepoints was deemed necessary for temporal comparison. The median response time for completing the m-SRLS at the first timepoint was 2 minutes and 13 seconds. The median survey response time for completing the m-SRLS at the second timepoint was 1 minute and 55 seconds. Of the 152 students who completed the survey at the first timepoint, thirty-four failed to complete the study at the second timepoint. These cases were deleted from further analyses. All of the 118 complete cases passed further data quality checks and were retained for analyses.

Data Analyses. Intra-class correlation (ICC) coefficients for each subscale and the total scale score were calculated between measurement times using single-measurement, absolute agreement, two-way random effects models to examine how constant scores remain across occasion (Shrout & Fleiss, 1979). In addition, 95% confidence intervals were reported. An ICC is an estimation of the proportion of variance in a set of scores that is attributable to the true score variance and can range from 0 (indicating no reliability) to 1 (indicating perfect reliability). Good test-retest reliability will be determined by ICC values > .75. Those > .90 will be interpreted as excellent (Koo & Li, 2016). Considering it is unlikely that participant responses should change over one week, this was considered an appropriate time interval for an initial assessment of temporal stability.

Chapter IV: Results

Results for are organized by study. The following hypotheses were tested:

Hypothesis 1. The m-SRLS will be best fitted to a correlated three-factor model (intention, attention, attitude) in which items are allowed to cross-load but are constrained as close to zero as possible.

Hypothesis 2. The m-SRLS will positively correlate with constructs that relate closely (e.g., metacognitive self-regulation, self-control) and negatively correlate with constructs that would infer the absence of mindful self-regulated learning (e.g., difficulties in emotion regulation, mind wandering).

Hypothesis 3.1 The m-SRLS will perform the same across different samples and subgroups of biological sex.

Hypothesis 3.2 The m-SRLS will perform differently with mindfulness experience as a continuous covariate and will perform the same with age as a continuous covariate.

Hypothesis 4. The m-SRLS will demonstrate subscale reliability across the same group at two different times.

Studies 1, 1R, and 2 test hypothesis 1. Study 3 tests hypotheses 2 and 3. Study 4 tests hypothesis 4.

Study 1 Results

Prior to the main analyses, the data were screened for multivariate assumptions (normality, linearity, homogeneity, and homoscedasticity). Item skewness values ranged from -1.05 to .98 and kurtosis values ranged from -.89 to 1.55, indicating reasonable normality (Tabachnick & Fidell, 2007). Bartlett's test indicated correlation adequacy, $\chi^2_{(496)} = 257.10$, $p < .001$, and the KMO test indicated sampling adequacy, MSA = .87.

Corrected item-total correlation values (the correlation between each item and the total scale score when that item is excluded) were scrutinized and items were flagged for deletion that did not correlate well with the overall scale when excluded. In addition, "alpha if item deleted" values were examined. Given that over reliance on this method may lead to loss of criterion validity (Raykov, 2008), at this stage items were only considered for deletion that did not meet a minimum value item-total correlation of .30 and that also increased the overall scale alpha. Based on this criteria, one item (Item 26) was excluded from further analyses. The remaining items possessed item-total correlation values that ranged from .32 to .68.

EFA with maximum likelihood estimation and Geomin rotation was conducted. Kaiser's criterion (Kaiser, 1960), the scree test (Cattell, 1966), and parallel analysis (Horn, 1965) were used together to decide how many factors to retain. Results of these methods varied with suggested factor retention between one and four. Also considered with respect to scientific utility in factor retention was the interpretability of these factors and the amount of variance explained (Brown, 2006; Tabachnick & Fidell, 2007). Using a combination of all of these criteria, a three-factor solution was chosen to examine initial item patterns and identify misfitting items.

Patterns of rotated loadings from the three-factor EFA were compiled with descriptive statistics in contingency tables and grouped by the factor they were written to load on to aid in the interpretation of misbehaving items (see Appendix K for Tables A2–A5). Items 21, 27, and 29 loaded weakly on all factors. Items 3, 5, 8, 20, 23, 26 loaded moderately and significantly on unanticipated factors, but did not load significantly on their intended factors. In addition, items 11 and 13 exhibited cross-loadings that were greater than .32 and close in value to loadings on their intended factor. Of these eleven misbehaving items, six were intended to measure the Attention construct, leaving just four items in this subscale that loaded together. At this point it

was determined that a more substantial item revision needed to take place before items could be truly considered for elimination. This was to ensure conceptual breadth across the item dimensions. These revision decisions are discussed.

Study 1 Results Summary

Close examination of the misbehaving items revealed that those items that were intended to load on the Attention factor lacked an element of present moment verbiage to hold them together in conceptual clarity. This may have been implied in student evaluations of the items for content validity because the students were provided the subscale definition and could have therefore confirmed its belonging by association. Of the Attention items, the four items that loaded strongly together exhibited both present-moment verbiage and a specific educational context. For example, “If I lose my concentration while reading, I can bring my attention back.” The six other items lacked either one, or both of these criteria. For example, “I can slow down my thoughts when they are racing.” The decision was made to make subtle revisions to these six misbehaving Attention items and conduct the study again with a second independent sample. Validity is an ongoing process and revisions at this early stage were considered important to support both the interpretability of the scale and to achieve a more simple structure (DeVellis & Thorpe, 2021). This greater attention to content concerns and conceptual clarity at the front end of scale development should support a better and more refined measurement instrument moving forwards.

Item revisions are presented in Table 9 .

Table 9

Study 1 Item Revisions

Item #	Item	Revision
2	I recognize when my thoughts interfere with my ability to learn.	*I recognize when my thoughts interfere with my ability to understand something in class.*
5	It is easy to maintain my focus on class lectures or instructional materials.	None
8	I re-orient my attention when I find myself off-task.	*I re-orient my attention when I find myself off-task from class assignments.*
11	I shift my focus back when I find myself procrastinating.	*If I get distracted while studying, I can easily shift my focus back.*
14	If I lose my concentration while reading, I can bring my attention back.	None
17	During class lectures, it is easy to re-focus when my thoughts wander.	None
20	I can slow down my thoughts when they are racing.	*When I am taking a test, it is easy to manage distracting thoughts.*
23	I am aware of things that distract me when I study.	*When I study, I am aware of the things that distract me as they happen.*
29	I notice my reactions to things I am learning.	*While I am in class, I notice my immediate reactions to things I am learning.*
31	I re-direct my thoughts when I get side-tracked in class.	None

Study 1R Results

Prior to the main analyses, the data were screened for multivariate assumptions. Item skewness values ranged from -.97 to 0.60 and kurtosis values ranged from -1.01 to .65, indicating reasonable normality (Tabachnick & Fidell, 2007). Bartlett's test indicated correlation adequacy, $\chi^2_{(496)} = 588.51$, $p < .001$, and the KMO test indicated sampling adequacy, $MSA = .94$. Corrected item-total correlation values were calculated. Item 26 was again flagged for deletion

based on its low value of .15. Remaining items possessed item-total correlation values that rangedStu from .35 to .71 and a scale alpha of .92.

EFA with maximum likelihood estimation and Geomin rotation was conducted. Kaiser's criterion (Kaiser, 1960), the scree test (Cattell, 1966), and parallel analysis (Horn, 1965) were used together to decide how many factors to retain. Also considered with respect to scientific utility in factor retention was the interpretability of these factors and the amount of variance explained (Brown, 2006; Tabachnick & Fidell, 2007). There were five eigenvalues greater than one, though notably the fourth and fifth factor only contributed another 3% of the variance explained. The scree test and parallel analysis suggested a three-factor solution, which is also supported by theory. Given this convergence, the three-factor solution was retained and item patterns were scrutinized to identify items for deletion.

As with the previous study, patterns of rotated loadings from the three-factor EFA were compiled with descriptive statistics in contingency tables and grouped by the factor they were written to load on (see Appendix L for Tables A6–A8). Items were deleted one at a time and subjected to subsequent EFAs after each deletion based on the following criteria: Round 1) items deleted that did not load significantly on any factor (Item 30), Round 2) items deleted that loaded moderately and significantly on an unintended factor, but non-significantly and weakly on their intended factor (Items 2, 3, 8, and 29), Round 3) items that exhibited significant cross-loadings that were larger than their primary factor loadings (Item 13), Round 4) items that exhibited significant cross-loadings that were at the approximate same strength as their primary factor loadings (Items 12, 15, 19, 25).

An EFA with maximum likelihood estimation and Geomin rotation was rerun with the retained 21 observed variables. To ensure that the three-factor solution was the optimal fit,

competing one, two, three, and four-factor models were examined. For model fit evaluation, an inclusive approach was used involving a consideration of fit indices and the theoretical consistency and admissibility of parameter estimates. In particular, as the χ^2 can be oversensitive to minor model misspecifications given even moderate-sized samples and contains a restrictive hypothesis test (i.e., exact fit), three approximate fit indices were considered: root mean square error of approximation (RMSEA) of $\leqslant$ .050 for close fit (Chen et al., 2008) and the Comparative fit index (CFI) and Tucker-Lewis index (TLI) of $\geqslant$ .900 and .950 for acceptable and excellent fit, respectively (Hu & Bentler, 1999). Because these indices are sensitive to sample size, factor loading sizes, and number of factors and indicators, all were considered in assessment of model fit. For the comparative tests of the competing models, the chi-squared difference test was used, however in line with recommendations made by Finch (2020), a change in RMSEA of .015 was also considered. In simulation, Finch (2020) shows that while CFI and TLI difference statistics have a tendency to over factor in the context of EFA, the RMSEA difference criteria of .015 works as well as the parallel analysis method for determining the number of factors in many situations. Fit indices for all four models are provided in Table 10.

Table 10

Study 1R EFA Models and Fit Indices

Model	*df*	χ^2	Δdf	$\Delta\chi^2$	RMSEA	CFI	TLI	ΔRMSEA
1-Factor	189	1011.214*		-	.106* (.100, .112)	.766	.740	-
2-Factor	169	506.075*	20	505.138*	.072* (.065, .079)	.904	.881	-.034
3-Factor	150	278.853*	19	227.223*	.047 (.038, .058)	.963	.949	-.025
4-Factor	132	222.233*	18	56.620*	.042 (.032, .051)	.974	.959	-.005

Note. RMSEA = root mean square error of approximation, 90% confidence interval in parenthesis; CFI = comparative fit index; TLI = Tucker-Lewis Index;
*$p < .001$

The test of the three-factor model resulted in an excellent fit to the sample data, $\chi^2_{(150)} = 278.853$, $p < .001$, RMSEA = .047 (90% CI .038 , .058), CFI = .963, TLI =.949, and notably both a statistically significant improvement in fit relative to the two-factor model, $\chi^2_{(19)} = 227.233$, $p < .001$, and a RMSEA difference > .015. The four-factor model demonstrated excellent model fit, however the model failed the RMSEA difference test against the .015 criteria and examination of the factor loadings revealed no distinguishable pattern to provide evidence for a fourth factor permissible by theory. The three-factor model was therefore retained. Estimates from the three-factor model are shown in Table 11.

Table 11

3-Factor EFA Rotated Loadings, Communalities, Composite Reliabilities and Correlations

Factor - Item #	Factor 1 Intention	Factor 2 Attention	Factor 3 Attitude	h^2
Intention - 1	**.442***	.060	.092	.277
Intention - 4	**.585***	-.026	-.019	.317
Intention - 7	**.467***	.147*	.188*	.454
Intention - 10	**.536***	-.091	.023	.251
Intention - 16	**.548***	.217*	-.020	.468
Intention - 22	**.516***	.053	.172*	.415
Intention - 28	**.645***	.009	.009	.429
ω	.799			
Attention - 5	.107	**.705***	-.045	.565
Attention - 11	.039	**.732***	.066	.617
Attention - 14	-.008	**.662***	.135*	.524
Attention - 17	.013	**.850***	-.007	.731
Attention - 20	-.046	**.550***	.256*	.449
Attention - 23	.280*	**.308***	-.069	.239
Attention - 31	.213*	**.614***	.040	.598
ω		.857		
Attitude - 6	.150*	.001	**.629***	.502
Attitude - 9	-.107	.014	**.572***	.290
Attitude - 15	.086	.294*	**.510***	.546
Attitude - 18	-.013	.169*	**.757***	.694
Attitude - 21	**.341***	-.164*	**.510***	.424
Attitude - 27	.121	.001	**.644***	.499
Attitude - 32	**.350***	-.002	**.579***	.636
ω			.835	
Factor Correlations				
Factor 1	1	--	--	--
Factor 2	.560*	1	--	--
Factor 3	.443*	.419*	1	--

Note. Substantial loadings indicated in boldface. ω = omega coefficient of model-based composite reliability; h^2= communality estimates calculated as 1 – residual variance for each observed variable
*p <. 05

Factor loadings within subscales for the retained items ranged from .308 to .850. The first factor was characterized by fair to good loadings from items 1, 4, 7, 10, 16, 22, and 28. The second factor was characterized by good to excellent loadings from items 5, 11, 14, 17, 20, and 31. The third factor was characterized by good to excellent loadings by items 6, 9, 15, 18, 21, 27, and 32. Item 23 displayed a weak loading (.308) on its intended factor, factor 2, and also a similar size loading on factor 1 (.280). This may be due to the item content (*When I study, I am aware of the things that distract me as they happen)* closely relating to other study-related first-factor items. At this stage the item was retained to ensure content coverage and to further explore the item in subsequent samples. Within the component matrix, the majority of cross-loadings were nontrivial with two exceptions. Items 21 and 32 loaded marginally on the first factor. Their first-factor loadings, however, were considerably higher.

The pattern of loadings suggests that the first factor reflects Intention, the second-factor reflects Attention, and the third factor reflects Attitude. Communality estimates were calculated as 1 minus the residual variance for each observed variable. Estimates of communalities show that about 24% to 73% of the variation in the observed variables is accounted for by the factors. Factor correlations were interpreted along Cohen's (1988) conventions as weak (.10); moderate (.30); or strong (.50). There were statistically significant strong positive correlations between the factors theorized to represent intention and attention, $r = .56$, $p < .05$, and intention and attitude, $r = .54$ $p < .05$, and a statistically significant moderate positive correlation between attention and attitude, $r = .42$, $p < .05$.

Cronbach's alpha coefficients were calculated for each factor and ranged between .79 and .88 indicating adequate reliability (Nunnally & Bernstein, 1994). The total scale alpha with the retained items was .92.

Study 1R Results Summary

The main purpose of the EFA studies were to reduce the scale to a practical number of items, determine the number of factors underlying the data, as well as investigate the conceptual integrity of these factors and of the items themselves. Using a combination of examining factor loadings, cross-loadings, descriptive statistics, and examining item content in relation to the hypothesized construct dimensions, items were eliminated one by one and combined with subsequent EFA analyses in an iterative process from 32 to 21, with 7 items retained per factor. The results of the study provide preliminary support for both the internal consistency of the factors and whole scale as well as the hypothetical factor structure. Subsequent studies will further examine factor structure and internal consistency of the 21-item scale as well as convergent and divergent validity.

Study 2 Results

The data were screened for multivariate assumptions. Skewness values ranged from -.77 to .57 and kurtosis values ranged from -1.06 to .34, indicating reasonable normality (Tabachnick & Fidell, 2007). Corrected item-total correlation values ranged from .36 to .68. Initial analysis revealed that the overall scale demonstrated good internal consistency, $\alpha = .90$. Subscale reliability estimates were also good, $\alpha = .80 – .85$.

Tests of Dimensionality

The correlated three-factor model provided an adequate fit to the data, RMSEA = .053 (90 % CI .049, .058), CFI = .918, TLI = .907, while its standard ESEM counterpart provided an excellent fit to the data, RMSEA = .045 (90% CI .039, .050), CFI = .953, TLI = .935, and offered a significant improvement in fit, ΔCFI = +.035, ΔTLI = +.028, ΔRMSEA = -.008. Factor correlations were larger in the CFA solution versus the ESEM solution. In the ESEM solution

correlations between Attention and Intention (CFA r = .626, ESEM r = .533), Attention and Attitude (CFA r = .618, ESEM r = .547), and Intention and Attitude (CFA r = .506, ESEM r = .447) were reduced. Examination of the standardized parameter estimates revealed substantial and significant loadings for most targeted indicators, with the exception of Item 23 (*When I study, I am aware of the things that distract me as they happen*) which loaded poorly on its intended factor in both the CFA and ESEM solutions, λ = .390 and .200 respectively. Cross-loadings in the ESEM solution were mostly non-significant and both positive and negative in direction ranging from -.126 to .274. The largest cross loading of .274 belonged to Item 23. This cross-loading was both significant and larger than its targeted primary factor loading of .20. Item 23 had previously been flagged in the EFA for its weak loadings. On this justification, the item was deleted and the analyses were rerun with the 20 retained items. Fit indices for the five competing measurement models with the retained 20 items are provided in Table 12. Model comparisons are provided in Table 13.

Table 12

Model Fit Indices for Five Measurement Models of the m-SRLS

Model	*df*	χ^2	χ^2/df	RMSEA	CFI	TLI	AIC	BIC	SABIC	SRMR
CFA-1	170	1587.988*	9.341	.103** (.099 ,.108)	.709	.674	52257.172	52536.883	52346.353	.088
CFA-3	167	514.252*	3.079	.052 (.047,.057)	.929	.919	50963.642	51257.339	51057.282	.047
BI-CFA	150	400.860*	2.672	.046 (.041, .052)	.948	.935	50856.186	51229.135	50975.095	.036
ESEM-3	133	323.279*	2.431	.043 (.037, .059)	.961	.944	50806.956	51259.156	50951.132	.026
BI-ESEM	116	270.167*	2.329	.041 (.035, .048)	.968	.948	50742.348	51273.800	50911.793	.021

Note. CFA= confirmatory factor analysis, ESEM = exploratory structural equation modeling; RMSEA = root mean square error of approximation, 90% confidence interval in parenthesis; CFI = comparative fit index; TLI = Tucker-Lewis index; AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; SABIC = sample size-adjusted BIC; SRMR = standardized root mean square residual
*$p < .001$, **$p < .05$,

Table 13

Model Comparisons for the m-SRLS

Model Comparison	ΔRMSEA	ΔCFI	ΔTLI	ΔAIC	ΔBIC	ΔSABIC	ΔSRMR
CFA-3 vs CFA-1	-.052	+.220	+.245	-1293.530	-1279.544	-1289.071	-.041
ESEM-3 vs CFA-3	-.009	+.032	+.025	-156.686	+1.817	-106.150	-.021
BI-ESEM vs ESEM-3	-.002	+.007	+.004	-64.608	+14.644	-39.363	-.005

Note. CFA= confirmatory factor analysis, ESEM = exploratory structural equation modeling; RMSEA = root mean square error of approximation, 90% confidence interval in parenthesis; CFI = comparative fit index; TLI = Tucker-Lewis index; AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; SABIC = sample size-adjusted BIC; SRMR = standardized root mean square residual

Again, the correlated three-factor model provided an adequate fit to the data, RMSEA = .052 (90% CI .047, .057), CFI = .929, TLI = .919, while its standard ESEM counterpart provided an excellent fit to the data, RMSEA = .043 (90% CI .037, .059), CFI = .961, TLI = .944, and offered a significant improvement in fit, ΔCFI = +.032, ΔTLI = +.025, ΔRMSEA = -.009. In the ESEM solution, correlations between Attention and Intention (CFA *r* = .63, ESEM *r* = .53), Attention and Attitude (CFA *r* = .62, ESEM *r* = .55), and Intention and Attitude (CFA *r* = .51, ESEM *r* = .45) were reduced. While the bifactor CFA solution provided a good fit to the data, RMSEA = .046 (90% CI .041, .052), CFI = .948, TLI = .935, the reduced magnitude of factor correlations and small cross-loadings present in the ESEM standardized solution suggested the ESEM solution provided a better fit. The bifactor ESEM solution also provided an excellent fit to the data, RMSEA = .041 (90% CI .035, .048), CFI = .968, TLI = .948. Compared to the first-order ESEM solution, however, a marginal improvement of fit was evident ΔCFI = +.007, ΔTLI = +.004, ΔRMSEA = -.002. The cross-loading patterns between the bifactor ESEM and first-order ESEM are similar. The bifactor ESEM produces a weak to moderately defined G-factor, with about half of the factor loadings >.400 and reasonably well-defined S-factors, with targeted factor loadings ranging from .302 to .661. In this circumstance, given the similarity of fit, similar cross-loading pattern, and moderate G-factor definition, the more parsimonious first-order ESEM solution is retained (Morin, 2023).

Standardized parameter estimates and composite reliability estimates (ω calculated as the sum of the loadings squared, divided by the sum of the loadings squared plus the sum of the error variances) for the competing models are provided in Table 14. In addition, a visual representation of the first-order ESEM is provided in Figure 4.

Table 14

Standardized Factor Loadings and Composite Reliability Estimates for Four Measurement Models of the m-SRLS

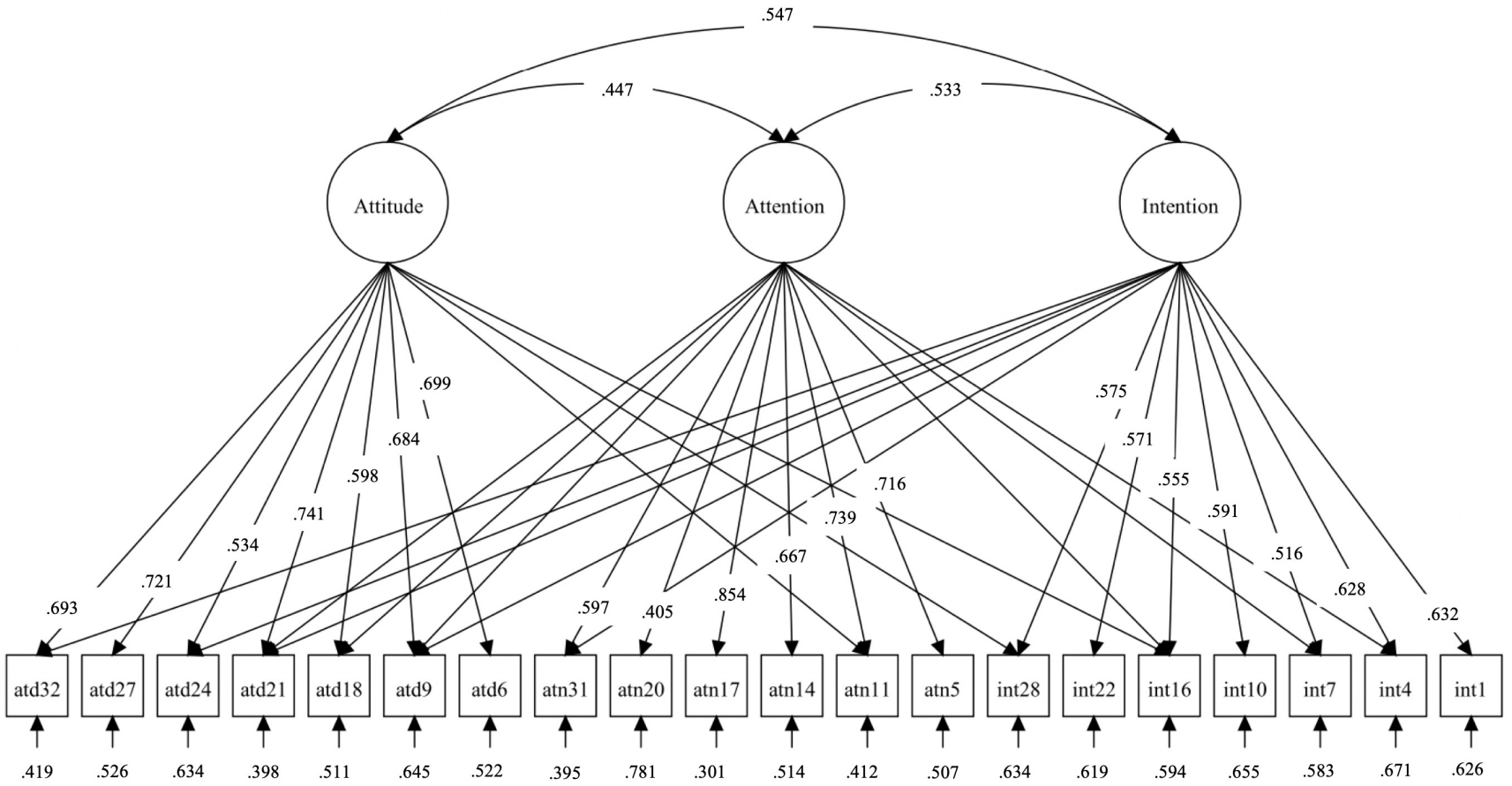
Factor – Item #	CFA-3	BI-CFA-3		ESEM-3			BI-ESEM			
	λ	S-λ	G-λ	λ	λ	λ	S-λ	S-λ	S-λ	G-λ
Intention - 1	**.599***	**.485***	**.391***	**.632***	.012	-.068	**.466***	.011	-.058	**.390***
Intention - 4	**.529***	**.515***	**.302***	**.628***	-.127***	.008	**.482***	-.047	.021	**.310***
Intention - 7	**.662***	**.310***	**.576***	**.516***	.183*	.024	**.306***	.010	-.076	**.585***
Intention - 10	**.568***	**.432***	**.396***	**.591***	-.084	.082	**.416***	-.066	.035	**.403***
Intention - 16	**.636***	**.383***	**.494***	**.555***	.207*	-.108**	**.496***	.230**	-.015	**.394***
Intention - 22	**.606***	**.293***	**.529***	**.571***	.021	.070	**.355****	-.078	-.031	**.517***
Intention - 28	**.599***	**.420***	**.438***	**.575***	-.021	.082***	**.446***	.024	.072	**.407***
ω	.78	.65		.79			.67			
Attention - 5	**.694***	**.470***	**.536***	-.004	**.716***	-.022	.031	**.494***	.019	**.511***
Attention - 11	**.762***	**.451***	**.618***	-.027	**.739***	.073***	-.042	**.432***	.024	**.632***
Attention - 14	**.700***	**.383***	**.585***	.029	**.667***	.026	.012	**.400***	.004	**.570***
Attention - 17	**.817***	**.483***	**.671***	-.058	**.854***	.022	-.061	**.503**	-.007	**.663***
Attention - 20	**.474***	**.257****	**.393***	.042	**.405***	.064	.121**	**.380***	.136**	**.306***
Attention - 31	**.770***	**.210***	**.774***	.243*	**.597***	.038	.127	**.302****	-.035	**.710***
ω	.82	.64			.84			.69		
Attitude - 6	**.678***	**.575***	**.404***	.043	-.052	**.699***	.142**	.129	**.661***	**.364***
Attitude - 9	**.542***	**.573***	**.226***	-.128**	-.099***	**.684***	-.022	.056	**.594***	**.234***
Attitude - 15	**.701***	**.441***	**.529***	-.040	.188*	**.598***	-.120	.019	**.338****	**.613***
Attitude - 18	**.770***	**.562***	**.516***	-.114*	.140*	**.741***	-.117	.065	**.497***	**.570***
Attitude - 21	**.607***	**.378***	**.476***	.101***	.031	**.534***	.073	.036	**.386***	**.458***
Attitude - 27	**.671***	**.531***	**.421***	.018	-.079	**.721***	-.067	-.131**	**.448***	**.517***
Attitude - 32	**.678***	**.488***	**.574***	.160*	-.026	**.693***	.017	-.132**	**.406***	**.658***
ω	.81	.78	.87			.86			.76	.88

Note. Targeted loadings indicated in boldface. CFA = confirmatory factor analysis; ESEM = exploratory structural equation modeling; G = global factor estimated in a bifactor model; S = specific factor estimated in a bifactor model; λ = standardized factor loadings; ω = omega coefficient of model-based composite reliability

*p< .001, **p<.01, ***p < .05

Figure 4

Completely Standardized (STDYX) First-Order ESEM Path Diagram of the m-SRLS



Note. Non-significant cross-loading paths not shown to reduce clutter. All standardized target loadings, residual variances, and factor correlations presented.

Study 2 Results Summary

Results of Study 2 provide support for Hypothesis 1. One item possessed an insufficient loading pattern. The item (*When I study, I am aware of the things that distract me as they happen*) was intended to load on the Attention latent factor, but demonstrated a significant and larger cross loading on the Intention latent factor. This is attributed to the semantic association of the item with other Intention items related to studying. However, this was unexpected given its close content association with another item in the Attention subscale (*If I get distracted while studying, I can easily shift my focus back*). The unexpected loading pattern could also be attributed to item stem wording effects. It is nevertheless problematic and was dropped from further analyses. The first-order ESEM model provided a superior fit to its CFA counterpart. The goodness-of-fit of the bifactor ESEM was also excellent, however did not differ significantly from the first-order ESEM. The first-order ESEM model was retained as the more parsimonious solution. Patterns of loadings amongst the 20 retained items were consistent with expectations, factor correlations were reduced compared with the CFA solution, cross-loadings were nontrivial, and subscales demonstrated adequate reliability.

Study 3 Results

The data were screened for multivariate assumptions. Item skewness values for the m-SRLS ranged from -.84 to .66 and kurtosis values ranged from -1.03 to .60, indicating reasonable normality (Tabachnick & Fidell, 2007). Corrected item-total correlation values for the m-SRLS ranged from .34 to .66 and the overall scale demonstrated good internal consistency, $\alpha = .90$. Subscale reliability and composite reliability estimates also indicated adequate reliability, $\alpha = .79 – .88$, $\omega = .77 – .87$. Item skewness and kurtosis values for the for the additional scales

ranged from -.66 to 1.21 and -1.27 to .61 respectively. Scale reliabilities were also adequate, α = .82 – .90.

Convergent and Divergent Validity

Scale descriptives, reliabilities, and correlations are reported in Table 15.

Table 15

Descriptives, Alphas and Pearson Correlations Among Study Measures

Scale	1	2	3	4	5	6	7
1. m-SRLS	.90						
2. FFMQ	.67	.90					
3. MSLQ-TA	-.39*	-.43*	.84				
4. MSLQ-MSR	.62*	.43*	-.06	.82			
5. DERS-18	-.56**	-.69*	.49*	-.23*	.91		
6. MWQ	-.51*	-.57*	.39*	-.32*	.50*	.89	
7. BSCS	.53*	.52*	-.27*	.41*	-.49*	-.59*	.87
M	4.34	3.05	4.38	4.32	2.59	3.82	2.99
SD	.87	.50	1.45	.93	.75	1.13	.73
Skew	-.07	.17	-.27	.04	.23	-.29	.08
Kurt	.16	.71	-.67	-.02	-.38	-.19	-.31

Note. Cronbach's alpha is reported along the diagonal; m-SRLS = Mindful Self-Regulated Learning Scale; FFMQ = Five Facet Mindfulness Questionnaire; MSLQ-TA = Motivated Strategies for Learning Questionnaire Test-Anxiety subscale; MSLQ-MSR = Motivated Strategies for Learning Questionnaire Metacognitive Self-Regulation subscale; DERS-18 = Difficulties in Emotional Regulation Scale Short Form; MWQ = Mind Wandering Questionnaire; BSCS = Brief Self-Control Scale; *M* = average item score
N = 788
*p < .01

Support for convergent validity was observed in significant and strong positive correlations between mindful self-regulated learning and mindfulness (FFMQ *r* = .67), metacognitive self-regulation (MSLQ-MSR *r* = .62), and self-control (BSCS *r* = .53). HTMT values between the m-SRLS and the FFMQ (HTMT = .74), MSLQ-MSR (HTMT = .74) and BSCS (HTMT = .60) were less than .85 indicating support for sufficient divergent validity.

Support for divergent validity was also observed in significant and moderate to strong negative correlations between mindful self-regulated learning and test anxiety (MSLQ-TA r = -.39), difficulties in emotional regulation (DERS-18 r = -. 56), and mind wandering (MWQ r = -.51). Similar expected patterns of correlations were observed among subscales and are provided in Table 16.

Table 16

Pearson Correlations Between the m-SRLS, m-SRLS Subscales and Study Measures

Scale	m-SRLS Total Score	m-SRLS Intention	m-SRLS Attention	m-SRLS Attitude
FFMQ				
Total Score	.67*	.42*	.56*	.61*
Observe	.23*	.36*	.07*	.15*
Describe	.47*	.33*	.43*	.38*
Acting with Awareness	.51*	.23*	.60*	.38*
Non-Judgement	.36*	.10*	.29*	.44*
Non-Reactivity	.51*	.32*	.34*	.55*
MSLQ				
Test-Anxiety	-.39*	-.11*	-.35*	-.42*
Metacognitive Self-Regulation	.62*	.65*	.50*	.37*
DERS-18				
Total Score	-.56*	-.30*	-.47*	-.55*
Awareness	-.42*	-.39*	-.28*	-.35*
Clarity	-.37*	-.24*	-.33*	-.31*
Goals	-.45*	-.19*	-.42*	-.45*
Impulse	-.32*	-.18*	-.31*	-.27*
Nonacceptance	-.32*	-.06	-.27*	-.41*
Strategies	-.45*	-.25*	-.35*	-.47*
MWQ				
Total Score	-.55*	-.22*	-.63*	-.35*
BSCS				
Total Score	.53*	.35*	.55*	.38*

Note. m-SRLS = Mindful Self-Regulated Learning Scale; FFMQ = Five Facet Mindfulness Questionnaire; MSLQ = Motivated Strategies for Learning Questionnaire; DERS-18 = Difficulties in Emotional Regulation Scale Short Form; MWQ = Mind Wandering Questionnaire; BSCS = Brief Self-Control Scale; N = 788

*p<.01

Tests of Dimensionality

In line with Study 2, a correlated three-factor model provided an adequate fit to the data, RMSEA= .054 (90% CI .049 - .059), CFI = .925, TLI = .914, while its standard ESEM counterpart provided an excellent fit to the data, RMSEA= .047 (90% CI .041 - .052), CFI = .956, TLI = .937, and offered a significant improvement in fit, ΔCFI = +.031, ΔTLI = +.022, ΔRMSEA = -.007. In the ESEM solution, correlations between Attention and Intention (CFA *r* = .60, ESEM *r* = .50), Attention and Attitude (CFA *r* = .57, ESEM *r* = .51), and Intention and Attitude (CFA *r* = .55, ESEM *r* = .47) were reduced. Standardized parameter estimates of the ESEM model revealed substantial and significant targeted loadings that ranged from .494 to .813. Cross-loadings were mostly non-significant and both positive and negative in direction ranging from -.225 to .267. The bifactor ESEM solution was also tested. It provided an excellent fit to the data, RMSEA = .046 (90% CI .040 -.053), CFI = .962, TLI = .938. Compared to the first-order ESEM solution, however, no substantial improvement of fit was evident, ΔCFI = +.006, ΔTLI = +.001, ΔRMSEA = -.001. The first-order ESEM model was retained as the more parsimonious solution.

Multiple Group Measurement Invariance

Multiple group measurement invariance tests of the first-order ESEM model were performed along the taxonomy laid out by Marsh et al. (2009). Systematic invariance tests were first done across the Study 2 (*n* = 790) and Study 3 (*n* = 788) samples. Results are summarized in Table 17. All thirteen models (M1-S – M13-S) supported good model fit, CFI and TLI $\geqslant$ 958 , RMSEA $\leqslant$ .045. Differences in CFI/TLI and RMSEA values between the nested models were $\leqslant$ .01 and < .015. The results support complete invariance across the factor loadings, latent variance-covariances, item intercepts, item uniquenesses, and latent means for each sample.

Thus, the samples were pooled ($N = 1578$) to assess meaningful subgroup differences. Subjects were grouped by biological sex (male $n = 555$, female $n = 1023$).

Table 17

Tests of Multiple Group Measurement Invariance for the First-Order ESEM Across Samples

Model	Constraints	χ^2/df	RMSEA	CFI	TLI	ΔRMSEA	ΔCFI	ΔTLI	Comparison Model
M1-S (configural)	-	686.430/266	.045(.041, .049)	.958	.941	-	-	-	-
M2-S (weak)	FL	731.271/317	.041(.037, .045)	.959	.951	-.004	+.001	+.01	M1-S
M3-S	FL, Uniq	738.525/337	.039(.035, .043)	.960	.955	-.002	+.001	+.004	M1-S, M2-S
M4-S	FL, FVCV	739.398.323	.040(.036, .044)	.959	.954	-.001	0	+.003	M1-S, M2-S
M5-S (strong)	FL, Inter	746.105/334	.040(.036, .043)	.959	.954	-.001	0	+.003	M1-S, M2-S
M6-S	FL, Uniq, FVCV	743.448/343	.038(.035, .042)	.960	.956	-.002	+.001	+.002	M1-S – M4-S
M7-S (strict)	FL, Uniq, Inter	752.029/354	.038(.034, .042)	.960	.958	-.002	+.001	+.004	M-1-S, M2-S, M3-S, M5-S
M8-S	FL, FVCV, Inter	751.062/340	.039(.035, .043)	.959	.955	-.001	0	+.001	M1-S, M2-S, M4-S, M5-S
M9-S	FL, FVCV, Inter, Uniq	757.907/360	.037(.034, .041)	.961	.958	-.002	+.002	+.003	M1-S – M8-S
M10-S (latent mean)	FL, Inter, FMn	750.909/337	.039(.036, .043)	.959	.954	-.001	0	0	M1-S, M2-S, M5-S
M11-S (manifest mean)	FL, Uniq, Inter, FMn	757.753/357	.038(.034, .041)	.960	.958	-.001	+.001	+.004	M1-S, M3-S, M5-S, M7-S, M10-S
M12-S	FL, FVCV, Inter, FMn	755.904/343	.039(.035, .043)	.959	.955	0	0	+.001	M1-S, M2-S, M4-S – M6-S, M10-S
M13 -S (complete)	FL, FVCV, Inter, Uniq, FMn	762.722/363	.037(.034, .041)	.960	.959	-.002	+.001	+.004	M1-S – M12-S

Note. χ^2/df = chi square/degrees of freedom ratio; RMSEA = root mean square error approximation and 90% confidence interval in parentheses; CFI = comparative fit index; TLI = Tucker-Lewis Index; FL = factor loadings; FVCV = factor variance-covariances; Inter = item intercepts; Uniq = item uniqenesses; FMn = factor means

Results for invariance tests across biological sex are provided in Table 18. The configural model (M1-B) provides support for configural invariance, RMSEA = .047 (90% CI .043 -.051), CFI = .954, TLI = .934. As invariance constraints were added, changes in CFI/TLI and RMSEA values across subsequent models were $\leqslant$ .01 and $\leqslant$ .015. Of particular interest are TLI and RMSEA values which incorporate control for parsimony (Marsh et al., 2020). Weak invariance across males and female was supported through comparison of models M1-B and M2-B, ΔTLI = +.008, ΔRMSEA = -.003, ΔCFI = +.001, indicating that the unstandardized factor loadings are the same across the groups. Strong invariance was supported through the comparison of models M2-B and M5-B, ΔTLI = +.001, ΔRMSEA = -.002, ΔCFI = -.002, indicating that item intercepts across groups as well as factor loadings were the invariant indicating the absence of DIF and justification for latent mean differences. Strict invariance was supported by comparing models M5-B and M7-B, ΔTLI = +.003, ΔRMSEA = -.001, ΔCFI = -.002, indicating that measurement error across groups does not differ. This supports meaningful manifest mean comparisons. Latent variance-covariance invariance was supported by comparing models M2-B with M4-B, ΔTLI = 0, ΔRMSEA = 0, ΔCFI = -.001, indicating that the conceptual domain across males and females is constant. Latent mean invariance was supported through the comparisons of M5-B and M10-B, M7-B and M11-B, M8-B and M12-B, and M9-B and M13-B, ΔTLI $\leqslant$ .003, ΔRMSEA $\leqslant$ .001, ΔCFI $\leqslant$ .001. Taken together the results produce strong support for full invariance across males and females.

Table 18

Tests of Multiple Group Measurement Invariance for the First-Order ESEM Across Biological Sex

Model	Constraints	χ^2/df	RMSEA	CFI	TLI	ΔRMSEA	ΔCFI	ΔTLI	Comparison Model
M1-B (configural)	-	729.491/266	.047(.043, .051)	.954	.934	-	-	-	-
M2-B (weak)	FL	805.617/317	.044(.040, .048)	.952	.942	-.003	+.001	+.008	M1-B
M3-B	FL, Uniq	835.969/337	.043(.040, .047)	.951	.944	-.001	-.001	+.002	M1-B, M2-B
M4-B	FL, FVCV	818.955/323	.044(.040, .048)	.951	.942	0	-.001	0	M1-B, M2-B
M5-B (strong)	FL, Inter	836.455/334	.044(.040, .047)	.950	.943	0	-.002	+.001	M1-B, M2-B
M6-B	FL, Uniq, FVCV	848.693/343	.043(.040, .047)	.950	.945	-.001	-.001	+.001	M1-B – M4-B
M7-B (strict)	FL, Uniq, Inter	866.406/354	.043(.039, .046)	.949	.946	-.001	-.001	+.003	M1-B, M2-B, M3-B, M5-B
M8-B	FL, FVCV, Inter	849.616/340	.044(.040, .047)	.950	.944	0	0	+.001	M1-B, M2-B, M4-B, M5-B
M9-B	FL, FVCV, Inter, Uniq	878.996/360	.043(.039, .046)	.949	.946	-.001	-.001	+.002	M1-B – M8-B
M10-B (latent mean)	FL, Inter, FMn	875.471/337	.045(.041, .049)	.947	.940	+.001	-.003	-.003	M1-B, M2-B, M5-B
M11-B (manifest mean)	FL, Uniq, Inter, FMn	906.538/357	.044(.041, .048)	.946	.942	-.001	-.001	+.002	M1-B, M3-B, M5-B, M7-B, M10-B
M12-B	FL, FVCV, Inter, FMn	888.119/343	.045(.041, .049)	.946	.940	0	-.001	0	M1-B, M2-B, M4-B –M6-B, M10-B
M13 -B (complete)	FL, FVCV, Inter, Uniq, FMn	917.654/363	.044(.040, .048)	.945	.943	-.001	+.001	+.003	M1-B – M12-B

Note. χ^2/df = chi square/degrees of freedom ratio; RMSEA = root mean square error approximation and 90% confidence interval in parentheses; CFI = comparative fit index; TLI = Tucker-Lewis Index; FL = factor loadings; FVCV = factor variance-covariances; Inter = item intercepts; Uniq = item uniqenesses; FMn = factor means

MIMIC Model Invariance

Three MIMIC models were specified for both age and mindfulness. Fit indices are provided in Table 19. The null effect, saturated, and invariant intercept MIMIC models for age (MM1-A – MM3-A) provided excellent fits to the data, CFI ⩾ .951, TLI ⩾ .931, RMSEA ⩽ .046. The comparison of models MM1-A and MM2-A, models MM1-A and MM2-A, and models MM2-A and MM3-A do not result in substantial changes in model fit, ΔCFI/TLI ⩽.001, ΔRMSEA ⩽ .015. This suggests that age does not have an effect as a predictor on the item intercepts or latent variables.

The null effect (MM1-M) model for mindfulness experience (MM1-M) resulted in just adequate model fit, CFI = .940, TLI = .918, RMSEA = .051. Some effects of the predictor variable could be expected. The saturated model (MM2-M) resulted in excellent model fit, CFI = .957, TLI = .932, RMSEA = .046 and a substantial improvement in fit over the null effect model, ΔCFI = +.017, ΔTLI = +.014, ΔRMSEA = -.005. This suggests that mindfulness experience influences item responses. The invariant intercept model (MM3-M) also provided a substantial improvement of fit in comparison with the null effect model (MM1-M), ΔCFI = +.014, ΔTLI = +.017, ΔRMSEA = -.006 and similar fit when compared with the saturated model (MM2-M), ΔCFI = -.003, ΔTLI = +.003, ΔRMSEA = -.001. Results of the comparison of the saturated and invariant models suggest that the influence of mindfulness experience on the item responses can be fully explained by the association of mindfulness experience and the latent factors.

Table 19

MIMIC Models for Age and Mindfulness Experience

MIMIC Model	χ^2/df	RMSEA	CFI	TLI	ΔRMSEA	ΔCFI	ΔTLI	Comparison
Age								
MM1-A	661.511*/153	.046(.042, .050)	.951	.933	-	-	-	-
MM2-A	584.726*/133	.046(.043, .050)	.957	.931	0	+.006	+.002	MM1-A
MM3-A	623.557*/150	.045(.041, .048)	.954	.936	-.001	-.003	+.005	MM2-A
Mindfulness Experience								
MM1-M	775.725*/153	.051(.047, .054)	.940	.918	-	-	-	-
MM2-M	583.219*/133	.046(.043, .050)	.957	.932	-.005	+.017	+.014	MM1-M
MM3-M	630.266*/150	.045(.041, .049)	.954	.935	-.001	-.003	+.003	MM3-M

Note. MM = Mimic Model; χ^2/df= chi square/degrees of freedom ratio; RMSEA = root mean square error approximation and 90% confidence interval in parentheses; CFI = comparative fit index; TLI = Tucker-Lewis Index.
* $p < .001$

Study 3 Results Summary

Study 3 provide support for Hypotheses 2 and 3. Convergent and divergent validity were assessed through examining scale and subscale correlations amongst theoretically similar and dissimilar constructs and HTMT ratios. In line with hypotheses, m-SRLS was positively associated with mindfulness (FFMQ), metacognitive self-regulation (MSLQ-MSR) and self-control (BSCS). It was negatively associated with test anxiety (MSLQ-TA), difficulties in emotional regulation (DERS-18) and mind wandering (MWQ). HTMT ratios between the m-SRLS and the FFMW, MSLQ-MSR, and BSCS supported sufficient discrimination between the scales. In line with Study 2 results, the first-order ESEM model provided a superior fit to its CFA counterpart. A bifactor ESEM solution also provided an excellent fit to the data, however did not offer significant improvement in fit over the first-order ESEM solution. Multiple group measurement invariance tests revealed that the measurement model was consistent between samples. Full invariance was observed between males and females in the pooled sample. Age did not influence the latent construct, however self-reported mindfulness experience did.

Study 4 Results

The data were screened for multivariate assumptions. Skewness values for the m-SRLS at Time 1 and Time 2 ranged from .18 to .23 and kurtosis values ranged from -.55 to -.40, indicating reasonable normality (Tabachnick & Fidell, 2007). The overall scale demonstrated good internal consistency at both time points, α = .87 and .89 respectively. Subscales also demonstrated good internal consistency across time points with subscale alphas ranging from .80 to .85 and composite omegas ranging from .73 to .87 .Total scores for the m-SRLS were calculated for each time point by taking the sum of all of the items (after reverse scoring one) and dividing by the total number of items. Subscale scores for each time point were calculated as

the average subscale item score. Single-measurement, absolute agreement, two-way random effects models were used to calculate ICCs and their 95% confidence intervals for the total scale and subscale scores. The total scale demonstrated good to excellent test-retest reliability, ICC = .89 (95% CI .85, .92), such that 89% of the variation in Time 1 and Time 2 scores was attributable to the true score variance. The Intention, ICC = .83 (95% CI .76, .88) Attention, ICC = .85 (95% CI .79, .89), and Attitude, ICC = .85 (95% CI .79, .89), subscales also demonstrated good test-retest reliability.

Study 4 Results Summary

Results of Study 4 provide support for Hypothesis 4. The m-SRLS and its subscales demonstrate good to excellent test-retest reliability over a one-week time period. Continued support for the internal consistency of the total scale and subscales was also observed.

Chapter V: Discussion

Together the current studies provide initial evidence of scale dimensionality, validity, and reliability of the Mindful Self-Regulated Learning Scale (m-SRLS) for use in higher education. The m-SRLS is a context specific measurement tool that can be used in a wide variety of applications in education such as assessing its relationship to educational outcomes or the effectiveness of secularized mindfulness training programs. Following a comprehensive review of literature, five pilot studies were implemented to develop a construct definition and scale items. Mindful self-regulated learning was defined as the adaptive and active self-monitoring of one's thoughts, feelings, and behaviors, characterized by a quality of re-perception and acceptance, in the conscious service of the learning process. Both deductive and inductive methods were used to develop items and explore the construct amongst the target population of students (N = 166) and experts in the field (N = 10).

Item development was informed by a bottom-up investigation, a response to the absence of this kind of approach in the development of other mindfulness scales (Krägeloh et al., 2019). The goal was to situate the construct in the educational context through the language of students. Students provided their own perceptions of mindfulness in education in semi-structured interviews and these responses were used to draft statements about mindfulness that were presented to other students to assess their generality. Next, experts in the field were asked to provide their feedback on the items and this was used to help refine items over two rounds of ratings and comments. In particular, experts helped guide the elimination of compound statements and the inclusion of active/present-moment verbiage as reflected in the construct definition. The refined items were presented to another sample of students who were provided the final opportunity to assess the items in cognitive think alouds. Repeated efforts to minimize

any item problems between each round were made until no further revisions were suggested (Willis, 2005). Through this process items were eliminated that participants felt they misunderstood, were unclear, were irrelevant, were over-reliant on mindfulness specific terminology or idiomatic terminology, or were deemed redundant to another more preferred item. This rigorous approach to item development provided confidence that content validity was achieved in line with best practices (Boateng et al., 2018). The resulting 32 initial items were used in subsequent studies to investigate the following research questions:

1. What is the factor structure underlying the m-SRLS scale? (Tests of Dimensionality)
2. Does the m-SRLS relate in the anticipated ways to measures that should or should not be related? (Convergent/Divergent Validity)
3. Does the m-SRLS perform the same across different groups at different times? (Measurement Invariance)
4. Does the m-SRLS perform the same across the same group at different times? (Scale Reliability)

Key Findings

Exploratory factor analyses were conducted with two independent samples to reduce the number of items and explore the initial factor structure of the data. Patterns of rotated loadings and item descriptives in Study 1 revealed eleven misbehaving items. Six of these items belonged to the Attention subscale. Rather than eliminate all of these items, a revision approach was adopted to ensure the interpretability of the scale and to achieve a more parsimonious structure (Devellis & Thorpe, 2021). Scrutinization of item content revealed that the pattern of misbehaving items may be explained by the absence of present-moment verbiage and/or educational context in these items. This may have been missed in pre-testing because expert and

target population reviewers were provided subscale definitions and thus could have inferred these aspects of the subscale were present in the items only in their association with the subscale definition. It was decided that a slight revision of the items take place. A repetition of the EFA in a second, larger, independent sample was thus necessary before moving forward with tests of dimensionality. Study 1R was conducted with the revised items and resulted in an expected pattern of loadings and three well-defined factors. To ensure scale parsimony, function, and internal consistency final item reduction decisions resulted in 21 retained items and initial evidence of a hypothetical three-factor structure.

The dimensionality of the scale was fully tested in Study 2 across five competing measurement models. Examination of pattern loadings revealed one item with a poor targeted factor loading and a large and significant cross loading. This item had exhibited similar patterns in the previous EFA studies and was deleted at this point on the grounds that the content was sufficiently covered by another item in the subscale. In line with expectations, a first-order ESEM model provided the best fit to the data, a significant improvement of fit over its CFA counterpart, and a reduction in factor correlations. This is owed to the flexibility of the ESEM model in incorporating cross-loadings (Morin, 2023). Allowing cross-loadings to be constrained as close to 0 as possible, rather than constrained to equal 0, protects against inflated factor correlations and offers more accurate measurement quality with respect to construct relevant multidimensionality. In addition, an ESEM bifactor model was explored, but the model did not support a substantial improvement in fit. The first-order ESEM model was retained for its parsimony. In the retained model, mindful self-regulated learning is composed of three related factors: Intention, Attention, and Attitude. These factors were well-defined, had strong and

significant loadings from targeted items, and small, but present, cross loadings. The final 20-item version of the m-SRLS scale can be found at the end of this discussion.

Study 3 provided evidence for convergent and divergent validity. As hypothesized, the m-SRLS was positively associated with mindfulness, self-control, and metacognitive self-regulation. It was negatively associated with test anxiety, difficulties in emotional regulation, and mind wandering. Discriminant validity was further explored with heterotrait-monotrait (HTMT) ratios. The HTMT ratios observed between the m-SRLS and positively associated constructs (the FFMQ, BSCS, and subscale of the MSLQ) were under a .85 threshold. This suggests that the m-SRLS measures something related, but distinct from these other scales. Tests of dimensionality were also replicated in the Study 3 sample. Complete measurement invariance was observed between independent Study 2 and Study 3 samples suggesting the instrument measured mindful self-regulated learning in the same way in both samples. Further tests of multiple group invariance with pooled samples of Study 2 and Study 3 provided evidence that the instrument also measured mindful self-regulated learning in the same way for males and females. In addition, multiple indicator multiple causes (MIMIC) models provided evidence that age did not have an influence as a predictor on the item intercepts or latent variables. In contrast, mindfulness experience (self-reported on a scale of 0 – 10) influenced item responses and this influence was fully explained by the association of mindfulness experience and the latent factors of the construct. The observed influence of mindfulness experience on mindful self-regulated learning suggests that the scale is able to discriminate between experienced and non-experienced practitioners, though this should be explored further in future work. Interest is understanding whether the presence or absence of mindfulness experience leads to semantic incongruence or

changes in sensitivity of self-report response is an issue of criterion validity that has been associated with other mindfulness scales (Grossman, 2008; 2011).

Study 4 showed that the scale total and subscale scores demonstrated sufficient consistency across two time-points (1-week apart) indicating test-retest reliability. Across all studies the scale demonstrated good overall internal consistency and subscale reliability.

Limitations & Future Work

With all social science research, certain assumptions are made (Wright, 2023). For example, it is assumed that responses provided are reflective of construct rather than some alternative source of variance. It is also assumed that the instrument used to measure the construct is valid, reliable, and fair. While the above studies support the validity and reliability of the m-SRLS, scale development is a complex iterative process that is ongoing for the life of the instrument. Further studies addressing the consistency of the measure across time, differentiation between groups, assessment of DIF, and the predictive validity of the measure should follow from here (DeVellis & Thorpe, 2021). There is interest in the use of mindfulness in education to address issues of diversity, equity, and inclusion and any instrument used to evaluate programs with respect to these issues must be tested for its fairness and relevance amongst all groups (Andreu et al., 2021; Jagers et al., 2019; Simmons, 2023). On fairness, the current scale was developed amongst a diverse student body, however work is needed to confirm whether mindful self-regulated learning is understood the same way across underserved and/or historically marginalized populations of students.

On group differentiation, the scale should be examined for cultural differences and tested in other countries and/or languages before used in populations outside of the US. The present studies used a combination of sampling students from a university research pool and Prolific.co.

Reliance on larger samples from Prolific.co may be considered a limitation of this work, however multiple studies support the satisfactory quality of this data in social science research (Chandler et al., 2019; Peer et al., 2017; Peer et al., 2022). The unique subject pool management features, including its rejection guidelines, attention checks, and robust pre-screening options that minimize opportunistic study sign up, make Prolific.co a tenable source of subjects (Palan & Schitter, 2018). With respect to data quality concerns, studies conducted in this paper followed additional apriori criteria for response rejection including CAPTCHA scoring, response variance, and response time considerations. Population characteristics of the university samples versus the Prolific.co samples were slightly different with respect to age, year of undergraduate study, and ethnicity. Overall the Prolific.co samples were slightly older, less Hispanic, and in the later years of undergraduate study versus the university samples. Care should be taken to investigate the scale in further populations of students and conduct invariance investigations across characteristics such as ethnicity, race, gender identity, disability status, school characteristics, and so forth.

While tests of measurement invariance performed in this study can indicate non-DIF between groups, this is not the same as detecting DIF. Where there is interest in comparing groups, there is interest in tests of DIF. Future studies should further examine the presence of uniform and non-uniform DIF across a variety of different groups. The goal is to establish whether there are unequal probabilities of responding to any given item between groups. Bulut and Suh (2017) offer an examination of different approaches to evaluating the presence of DIF in multidimensional scales. Multidimensional Rasch models such as the multidimensional random coefficients multinomial logit model may also be pursued (Adams et al., 1997).

A key disadvantage of the intra-class correlation coefficients used to examine test-retest reliability here is that they do not take advantage of the latent construct scores, but are rather applied to observed scores which do not contain measurement error nor account for correlated uniquenesses unlike ESEM models (Morin et al., 2013). Had a larger sample been recruited, tests of longitudinal measurement invariance would have been the preferred avenue to explore the temporal stability of the m-SRLS. The present test-retest study had inadequate power to detect meaningful differences (Wong & Wong, 2020). The same logic and taxonomy of testing used in multiple group invariance testing can be applied in longitudinal invariance testing, with the additional inclusion of correlated uniquenesses (Marsh et al., 2009; Morin et al., 2013). If the instrument is validated in adolescent populations, this work may also be extended into examinations of developmental trajectories of mindful self-regulated learning as a latent trait.

The current studies provided preliminary evidence that mindfulness experience is a predictor of scores on the m-SRLS, however further studies establishing the predictive validity of the scale must be pursued. A natural next step is to examine the relationship of the latent construct to its intended utility – effects on academic achievement. Does mindful self-regulated learning predict self-regulatory behaviors or learning strategies? Does it predict academic achievement? If so, through which mechanisms? The ESEM measurement model established in the current studies can be incorporated into traditional SEM path models to pursue these questions while achieving a more realistic depiction of the construct without an inflation of factor correlations that may otherwise lead to bias in predictions (Mai et al., 2018; Morin, 2023). It is hoped that in this way the scale can be used to investigate and build upon existing theories that support the mindfulness-achievement path. Following, the scale may be used in intervention or evaluation studies to measure change in mindful self-regulated learning in relationship to

participation in mindfulness programs or curricula including frequency and duration of practice to better understand the relationship of program components and the construct.

Scholarly Significance & Suggestions for Use

Over the past decades, interest in the utility of mindfulness in education has continued to increase. As mainstream popularity of secular mindfulness has grown, so has widespread acceptance for its purported benefits (Creswell, 2017; Weare, 2019). Enthusiastic calls for its use in education continue grow louder (Aktan & Demirbağ Kaplan, 2023; Montgomery, 2023) and are contrasted with critical concerns for program fidelity and integrity stemming from inconsistencies in the definition of mindfulness (Jennings, 2023; Roeser et al., 2022; Schussler et al., 2021). These concerns have led to calls for consistency and clarity in the implementation of mindfulness practices in education and a distinct need to address measurement inconsistencies that may close the knowledge-to-practice gap (Emerson et al., 2020; Jenner, 2023; Rosser et al., 2022). The call for contextualized definitions of mindfulness in education parallel measurement concerns with existing mindfulness self-report scales (Grossman et al., 2008; Van Dam et al., 2018). The purpose of this study was to address the shortcomings of the use of these existing measures in evaluating change in mindfulness for students and to provide a new evaluative tool for field use in both theory development and program evaluation. The current instrument was designed to assess mindfulness in education along a theory of change in which the utility of mindfulness programs in education relates to mindful self-regulated learning (Roeser et al., 2022). In this way, mindfulness in education is conceptualized as an enhanced form of self-regulation (Shaprio & Schwartz, 2000, Tang et al., 2015, Zhou et al., 2023).

While reliability and validity can be an issue in any retrospective self-report method, attempts were made in the development of the m-SRLS to contextualize the instrument for use in

education over and above existing self-report mindfulness scales. This was accomplished through in depth consideration of both existing theory and student perceptions of the construct. Thus the m-SRLS addresses context-specificity in both the construct definition and the scale items to address change in mindfulness as it relates to educational outcomes across three dimensions: Intention, Attention, and Attitude (Shapiro et al., 2006). Situating mindfulness within this particular theoretical framework may allow for deeper exploration of mindfulness training programs in education as tools for academic success. Given the initial evidence of scale validity and reliability provided here, the m-SRLS may begin to be used in a wide variety of study designs in higher education to investigate various relationships between the construct and academic outcomes.

It has been with intention and is of substantial research interest that investigations of the scale's utility, validity, and reliability be extended to adolescent populations. With this next step, the scale's use could be extended to school-based mindfulness program (SBMP) evaluation and help support large scale investigations into program implementation and advancement of the science of mindfulness in schools that has been called for in the field (Roeser et al., 2022; Schonert-Reichl, 2023). The current scale can be used by researchers to meaningfully assess self-reported mindful self-regulated learning in college students, investigate the mechanisms that lead to increases in mindful self-regulated learning, and used to determine whether mindfulness interventions, apps, or course curricula designed to promote the use of mindfulness in higher education populations are effective. The hope is that the m-SRLS serves as an easy-to-implement measurement instrument to move the field forwards both as an evaluative tool and as a means to develop and support theory into the utility of mindfulness in education with greater context-specificity and less reliance on trait mindfulness scales developed in other fields.

The final scale and scoring information is provided below.

Mindful Self-Regulated Learning Scale (m-SRLS)

Below are a set of statements about some general learning experiences in school.

Using the 1-7 scale provided, please rate each of the following statements with the number that best describes your own opinion of what has been most true of your recent experience in school.

1. I try something different or new when my study strategies are not working.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

2. It is easy to maintain my focus on class lectures or instructional materials.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

3. I accept myself when I don't immediately understand something.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

4. I make an effort to engage with what I learn by making connections to my own life.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

5. If I get distracted while studying, I can easily shift my focus back.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

6. I am quick to judge myself when I do not get something right the first time. (**R**)

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

7. When I notice I am avoiding my school work, I try to change my attitude towards it.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

8. If I lose my concentration while reading, I can easily bring my attention back.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

9. In moments I feel stressed about school, I can let that feeling go.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

10. I re-evaluate my own judgements about my learning often.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

11. During class lectures, it is easy to re-focus when my thoughts wander.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

12. When I get overwhelmed with school, I allow those feelings to pass without judging them.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

13. When I recognize I don't understand something, I take actions to study it mode.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

14. When I am taking a test, it is easy to manage distracting thoughts.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

15. I accept negative feelings I experience about school as they arise.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

16. I actively appreciate the process of learning even when it is challenging.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

17. I observe my feelings about my grades without judgement.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

18. When I am struggling in school, I revisit the reasons why I am there to help me stay motivated.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

19. I re-direct my thoughts when I get sidetracked in class.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

20. I monitor my reactions to school stressors with kindness.

1	2	3	4	5	6	7
Very untrue of me	Untrue of me	Somewhat untrue of me	Neutral	Somewhat true of me	True of me	Very true of me

Scoring Information

(Note: **R** indicates the item should be reverse scored)

Total Score = Sum of all items once reversed / 20

Subscale Scoring = Sum of the subscale items / total number of items in the subscale

Attention = 2 + 5 + 8 + 11 + 14 +19 / 6

Intention = 1 + 4 + 7 + 10 + 13 + 16 + 18 / 7

Attitude = 3 + 6**R** + 9 + 12 + 15 + 17 + 20/ 7

Appendix A

Semi-Structured Interview Protocol

Participant perceptions of mindfulness in the educational context will be explored through tape-recorded interviews. Individual participants respond to a set of statements designed to address three primary research questions: 1) How do university students define and experience mindfulness? 2) What are the perceived benefits of mindfulness practice? and 3) What are the perceived benefits of mindfulness practice specifically in the context of education? Questions will include non-free form talk opportunities. Example statements aligned with primary research questions are found in Table A1.

Table A1

Semi-Structured Interview Guide

Researcher Questions	Interview Questions
How do university students define and experience mindfulness?	What first comes to mind when you think of the word mindfulness? Do you have personal experience with mindfulness? If so, what is it? What does mindfulness practice look like? Or what do you imagine it to look like? Based off your experiences, how would you define mindfulness?
What are the perceived benefits of mindfulness practice?	Describe any benefits of mindfulness practice you have experienced. Or, describe any benefits of mindfulness that you believe to be true. Do you believe mindfulness could influence your academic performance? How?
What are the perceived benefits of mindfulness practice specifically in the context of education?	What are the specific academic tasks in your classes that you would expect to see improvements in from practicing mindfulness? (tests, quizzes, assignments, papers). Please describe them in as much detail as you can. Are there any academic behaviors that you would expect to see increase or become easier from practicing mindfulness? (studying, note-taking, asking questions in class, etc.) Please describe them in as much detail as you can.

	Are there any other emotional benefits to practicing mindfulness that might also influence your academics? Please describe them in as much detail as you can. Are there any other important benefits or disadvantages to practicing mindfulness that come to your mind? Please describe them in as much detail as you can. Overall, if you had to choose the top three areas in your education experience that you think mindfulness would influence most, what would those be? I have no further questions. Is there anything else you would like to bring up, or ask about, before we finish the interview?

Appendix B

Item Changes Resulting from Cognitive Interviews with Students for the Mindful Self-Regulated Learning Scale (m-SRLS)

Words or items that have been eliminated due to misunderstanding, lack of clarity, lack of relevance, and over-reliance on mindfulness specific terminology or idiomatic terminology are indicated with a cross-through line (i.e. ~~word~~). Words that have been added in addition to, or changed, within items are italicized. Items are grouped by hypothesized scale dimension for reader ease. The definition of mindful self-regulated learning and the survey prompt is also provided to provide item context. In addition, reverse coded items are denoted with **R**.

Mindful self-regulated learning is defined here as:

the adaptive and active self-monitoring of one's thoughts, feelings, and behaviors, characterized by quality of re-perception and acceptance, in the conscious service of the learning process.

Items are measured on a 7-point Likert scale that ranges from 1- *very untrue of me* to 7- *very true of me.*

Survey prompt:

Below are a set of statements about some general learning experiences in school. Using the 1-7 scale provided, please rate each of the following statements with the number that best describes your own opinion of what has been most true of your recent experience in school.

(1) Very untrue of me (2) Untrue of me (3) Somewhat untrue of me (4) Neutral (5) Somewhat true of me (6) True of me (7) Very true of me

Intention (purposeful orientation to learning that is flexible and dynamic)

1. I try something different or new when my study strategies are not working.
2. I make an effort to engage with what I learn by making connections to my own life.
3. When I notice I am avoiding my school work, I try to change my attitude towards it.
4. I re-evaluate my own judgments about my learning often.
5. When I get an answer wrong, I remind myself of my ability to learn.
6. When I recognize I don't understand something, I take actions to study it more.
7. I set flexible goals for myself in my classes that I change when necessary.
8. When I am struggling in ~~class~~ *school*, I ~~periodically~~ revisit the reasons why I am *there* ~~in school~~ to help me stay ~~focused~~ *motivated*.
9. ~~I often find myself on auto-pilot in class.~~ **R**
10. I change my perspective when my expectations for a class are not met.
11. I *actively* appreciate the process of learning ~~something new~~ even when it is challenging.

~~12. I purposefully keep an open mind to things I do not agree with in class.~~

~~13. I check in with myself regularly about why I am in school.~~

Attention (attention that is characterized by focus on the present-moment experience)

14. I recognize when my thoughts interfere with my ability to learn.
15. It is easy to maintain my focus on class lectures or instructional materials.
~~16. If I lose concentration during class, I remind myself why I am there to help me stay present.~~
17. I ~~purposefully~~ re-~~set~~ *orient* my attention when I find myself off-task.
18. I shift my focus back when I find myself procrastinating.
19. *If I lose my concentration while reading*, I ~~recognize when I lose focus in class and~~ can bring my attention back.
20. During class lectures, it is easy to ~~bring my attention back to the teacher~~ *re-focus* when my thoughts wander.
~~21. I take time to notice how I feel when I am in class.~~
22. I can slow down my thoughts when they are racing.
~~23.~~ I am aware of ~~my distractions~~ *things that distract me* when I ~~am~~ study~~ing.~~
24. I worry about future assignments and tests when I should be focusing on something else. **R**
25. I notice my reactions to things I am learning.
~~26.~~ I ~~tend to~~ re-direct my thoughts *when I* get side-tracked ~~by my thoughts~~ in class. ~~**R**~~

Attitude (an open, non-judgmental and accepting attitude)

27. When I feel critical about my academic performance, I take a step back to look at it in a different way.
28. I accept myself when I don't immediately understand something.
29. I am quick to judge myself when I do not get something right the first time. **R**
30. If I start to get nervous about an exam, I can easily pause and re-set.
31. I remain calm when I come across a hard question on a test.
~~32. My emotions get in the way of my ability to learn.~~ **R**
33. In moments I feel stressed about school, I can let that feeling go.
34. When I get overwhelmed with school, I allow those feelings to pass without judging them.
35. I ~~can distance myself from~~ *accept* negative feelings I experience about school ~~when~~ *as* they arise.
36. I observe my feelings about my grades without judgement.
37. I am open to help from others ~~when~~ *if* I have trouble understanding ~~the~~ class material.
~~38. I take a deep breath to relax when I start to feel under pressure.~~
~~39.~~ *I monitor my reactions to school stressors with kindness.* I ~~make an effort to be kind to myself when school gets stressful.~~

Appendix C

Mindful Self-Regulated Learning Scale (m-SRLS) Version 1

Survey prompt:
Below are a set of statements about some general learning experiences in school. Using the 1-7 scale provided, please rate each of the following statements with the number that best describes your own opinion of what has been most true of your recent experience in school.

(2) Very untrue of me (2) Untrue of me (3) Somewhat untrue of me (4) Neutral (5) Somewhat true of me (6) True of me (7) Very true of me

1. I try something different or new when my study strategies are not working.
2. I recognize when my thoughts interfere with my ability to learn.
3. When I feel critical about my academic performance, I take a step back to look at it in a different way
4. I make an effort to engage with what I learn by making connections to my own life.
5. It is easy to maintain my focus on class lectures or instructional materials.
6. I accept myself when I don't immediately understand something.
7. When I notice I am avoiding my school work, I try to change my attitude towards it.
8. I re-orient my attention when I find myself off-task.
9. I am quick to judge myself when I do not get something right the first time. **R**
10. I re-evaluate my own judgments about my learning often.
11. I shift my focus back when I find myself procrastinating.
12. If I start to get nervous about an exam, I can easily pause and re-set.
13. When I get an answer wrong, I remind myself of my ability to learn.
14. If I lose my concentration while reading, I can bring my attention back.
15. I remain calm when I come across a hard question on a test.
16. When I recognize I don't understand something, I take actions to study it more.
17. During class lectures, it is easy to re-focus when my thoughts wander.
18. In moments I feel stressed about school, I can let that feeling go.
19. I set flexible goals for myself in my classes that I change when necessary.
20. I can slow down my thoughts when they are racing.
21. When I get overwhelmed with school, I allow those feelings to pass without judging them.
22. When I am struggling in school, I revisit the reasons why I am there to help me stay motivated.
23. I am aware of things that distract me when I study.
24. I accept negative feelings I experience about school as they arise.
25. I change my perspective when my expectations for a class are not met.
26. I worry about future assignments and tests when I should be focusing on something else. **R**
27. I observe my feelings about my grades without judgement.
28. I actively appreciate the process of learning even when it is challenging.
29. I notice my reactions to things I am learning.
30. I am open to help from others if I have trouble understanding class material.
31. I re-direct my thoughts when I get side-tracked in class.
32. I monitor my reactions to school stressors with kindness.

Appendix D

Mindful Self-Regulated Learning Scale (m-SRLS): Version 2

Survey prompt:
Below are a set of statements about some general learning experiences in school. Using the 1-7 scale provided, please rate each of the following statements with the number that best describes your own opinion of what has been most true of your recent experience in school.

(3) Very untrue of me (2) Untrue of me (3) Somewhat untrue of me (4) Neutral (5) Somewhat true of me (6) True of me (7) Very true of me

1. I try something different or new when my study strategies are not working.
2. *I recognize when my thoughts interfere with my ability to understand something in class.*
3. When I feel critical about my academic performance, I take a step back to look at it in a different way
4. I make an effort to engage with what I learn by making connections to my own life.
5. It is easy to maintain my focus on class lectures or instructional materials.
6. I accept myself when I don't immediately understand something.
7. When I notice I am avoiding my school work, I try to change my attitude towards it.
8. *I re-orient my attention when I find myself off-task from class assignments.*
9. I am quick to judge myself when I do not get something right the first time. **R**
10. I re-evaluate my own judgments about my learning often.
11. *If I get distracted while studying, I can easily shift my focus back.*
12. If I start to get nervous about an exam, I can easily pause and re-set.
13. When I get an answer wrong, I remind myself of my ability to learn.
14. If I lose my concentration while reading, I can bring my attention back.
15. I remain calm when I come across a hard question on a test.
16. When I recognize I don't understand something, I take actions to study it more.
17. During class lectures, it is easy to re-focus when my thoughts wander.
18. In moments I feel stressed about school, I can let that feeling go.
19. I set flexible goals for myself in my classes that I change when necessary.
20. *When I am taking a test, it is easy to manage distracting thoughts.*
21. When I get overwhelmed with school, I allow those feelings to pass without judging them.
22. When I am struggling in school, I revisit the reasons why I am there to help me stay motivated.
23. *When I study, I am aware of the things that distract me as they happen*.
24. I accept negative feelings I experience about school as they arise.
25. I change my perspective when my expectations for a class are not met.
26. I worry about future assignments and tests when I should be focusing on something else. **R**
27. I observe my feelings about my grades without judgement.
28. I actively appreciate the process of learning even when it is challenging.
29. *While I am in class, I notice my immediate reactions to things I am learning.*
30. I am open to help from others if I have trouble understanding class material.
31. I re-direct my thoughts when I get side-tracked in class.
32. I monitor my reactions to school stressors with kindness.

Appendix E

Mindful Self-Regulated Learning Scale (m-SRLS): Version 3

Survey prompt:
Below are a set of statements about some general learning experiences in school. Using the 1-7 scale provided, please rate each of the following statements with the number that best describes your own opinion of what has been most true of your recent experience in school.

(4) Very untrue of me (2) Untrue of me (3) Somewhat untrue of me (4) Neutral (5) Somewhat true of me (6) True of me (7) Very true of me

1. I try something different or new when my study strategies are not working.
5. It is easy to maintain my focus on class lectures or instructional materials.
6. I accept myself when I don't immediately understand something.
4. I make an effort to engage with what I learn by making connections to my own life.
11. If I get distracted while studying, I can easily shift my focus back.
9. I am quick to judge myself when I do not get something right the first time. **R**
7. When I notice I am avoiding my school work, I try to change my attitude towards it.
14. If I lose my concentration while reading, I can easily bring my attention back.
18. In moments I feel stressed about school, I can let that feeling go.
10. I re-evaluate my own judgements about my learning often.
17. During class lectures, it is easy to re-focus when my thoughts wander.
21. When I get overwhelmed with school, I allow those feelings to pass without judging them.
16. When I recognize I don't understand something, I take actions to study it mode.
20. When I am taking a test, it is easy to manage distracting thoughts.
24. I accept negative feelings I experience about school as they arise.
28. I actively appreciate the process of learning even when it is challenging.
23. When I study, I am aware of the things that distract me as they happen.
27. I observe my feelings about my grades without judgement.
22. When I am struggling in school, I revisit the reasons why I am there to help me stay motivated.
31. I re-direct my thoughts when I get sidetracked in class.
32. I monitor my reactions to school stressors with kindness.

Appendix F

Five Facet Mindfulness Questionnaire (FFMQ)

1. When I'm walking, I deliberately notice the sensations of my body moving.
2. I'm good at finding words to describe my feelings.
3. I criticize myself for having irrational or inappropriate emotions.
4. I perceive my feelings and emotions without having to react to them.
5. When I do things, my mind wanders off and I'm easily distracted.
6. When I take a shower or bath, I stay alert to the sensations of water on my body.
7. I can easily put my beliefs, opinions, and expectations into words.
8. I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.
9. I watch my feelings without getting lost in them.
10. I tell myself I shouldn't be feeling the way I'm feeling.
11. I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.
12. It's hard for me to find the words to describe what I'm thinking.
13. I am easily distracted.
14. I believe some of my thoughts are abnormal or bad and I shouldn't think that way.
15. I pay attention to sensations, such as the wind in my hair or sun on my face.
16. I have trouble thinking of the right words to express how I feel about things
17. I make judgments about whether my thoughts are good or bad.
18. I find it difficult to stay focused on what's happening in the present.
19. When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.
20. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.
21. In difficult situations, I can pause without immediately reacting.
22. When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words.
23. It seems I am "running on automatic" without much awareness of what I'm doing.
24. When I have distressing thoughts or images, I feel calm soon after.
25. I tell myself that I shouldn't be thinking the way I'm thinking.
26. I notice the smells and aromas of things.
27. Even when I'm feeling terribly upset, I can find a way to put it into words.
28. I rush through activities without being really attentive to them.
29. When I have distressing thoughts or images I am able just to notice them without reacting.
30. I think some of my emotions are bad or inappropriate and I shouldn't feel them.
31. I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.
32. My natural tendency is to put my experiences into words.
33. When I have distressing thoughts or images, I just notice them and let them go.
34. I do jobs or tasks automatically without being aware of what I'm doing.
35. When I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about.
36. I pay attention to how my emotions affect my thoughts and behavior.
37. I can usually describe how I feel at the moment in considerable detail.

38. I find myself doing things without paying attention.
39. I disapprove of myself when I have irrational ideas.

Appendix G

Motivated Strategies for Learning Questionnaire (MSLQ)

Affective Component: Test Anxiety

3. When I take a test I think about how poorly I am doing compared with other students.
8. When I take a test I think about items on other parts of the test I can't answer.
14. When I take tests I think of the consequences of failing.
19. I have an uneasy, upset feeling when I take an exam.
28. I feel my heart beating fast when I take an exam.

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33. During class time I often miss important points because I'm thinking of other things. (REVERSED)
36. When reading for this course, I make up questions to help focus my reading.
41. When I become confused about something I'm reading for this class, I go back and try to figure it out.
44. If course materials are difficult to understand, I change the way I read the material.
54. Before I study new course material thoroughly, I often skim it to see how it is organized.
55. I ask myself questions to make sure I understand the material I have been studying in this class.
56. I try to change the way I study in order to fit the course requirements and instructor's teaching style.
57. I often find that I have been reading for class but don't know what it was all about. (REVERSED)
61. I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.
76. When studying for this course I try to determine which concepts I don't understand well.
78. When I study for this class, I set goals for myself in order to direct my activities in each study period.
79. If I get confused taking notes in class, I make sure I sort it out afterwards.

Appendix H

Difficulties in Emotion Regulation Scale Short Form (DERS-18)

2. I pay attention to how I feel. (A) (r)
6. I am attentive to my feelings. (A) (r)
10. When I am upset, I acknowledge my emotions. (A) (r)
4. I have no idea how I am feeling. (C)
5. I have difficulty making sense out of my feelings. (C)
9. I am confused about how I feel. (C) .
13. When I am upset, I have difficulty getting work done. (G)
18. When I am upset, I have difficulty focusing on other things. (G)
26. When I am upset, I have difficulty concentrating. (G)
14. When I am upset, I become out of control. (I)
27. When I am upset, I have difficulty controlling my behaviors. (I)
32. When I am upset, I lose control over my behaviors. (I)
12. When I am upset, I become embarrassed for feeling that way. (N) .
21. When I am upset, I feel ashamed with myself for feeling that way. (N)
25. When I am upset, I feel guilty for feeling that way. (N)
15. When I am upset, I believe that I will remain that way for a long time. (S)
16. When I am upset, I believe that I'll end up feeling very depressed. (S)
31. When I am upset, I believe that wallowing in it is all I can do. (S)

Appendix I

Mind Wandering Questionnaire

1. I have difficulty maintain focus on simple or repetitive work.
2. While reading, I find I haven't been thinking about the text and therefore must read it again.
3. I do things without paying full attention.
4. I find myself listening with one ear, thinking about something else at the same time.
5. I mind-wander during lectures of presentations.

Appendix J

Brief Self-Control Scale (BSCS)

1. I am good at resisting temptation.
2. I have a hard time breaking bad habits. (r)
3. I am lazy. (r)
4. I say inappropriate things. (r)
5. I do certain things that are bad for me, if they are fun. (r)
6. I refuse things that are bad for me.
7. I wish I had more self-discipline. (r)
8. People would say that I have iron self-discipline.
9. Pleasure and fun sometimes keep me from getting work done. (r)
10. I have trouble concentrating. (r)
11. I am able to work effectively toward long-term goals.
12. Sometimes I can't stop myself from doing something, even if I know it is wrong. (r)
13. I often act without thinking through all the alternatives. (r)

Appendix K

Study 1 Comparison Tables

Table A2

Study 1 Comparison Table for Attention Items

Item #	Item	FL	CL	Mean	*SD*	Skew	Kurt
2	**I recognize when my thoughts interfere with my ability to learn.**	.05	Yes*	5.74	1.02	-.87	1.10
5	It is easy to maintain my focus on class lectures or instructional materials.	.69*	No	4.10	1.57	-.08	-.81
8	**I re-orient my attention when I find myself off-task.**	.30*	Yes*	4.95	1.16	-.43	.07
11	**I shift my focus back when I find myself procrastinating.**	.35*	Yes*	4.44	1.49	-.24	-.67
14	If I lose my concentration while reading, I can bring my attention back.	.49*	No	4.44	1.49	-.46	-.42
17	During class lectures, it is easy to re-focus when my thoughts wander.	.87*	No	4.39	1.45	-.28	-.54
20	**I can slow down my thoughts when they are racing.**	.01	Yes*	3.93	1.45	.09	-.55
23	**I am aware of things that distract me when I study.**	-.09	No*	5.64	1.19	-1.05	1.55
29	**I notice my reactions to things I am learning.**	.21*	No*	5.15	1.19	-.62	.70
31	I re-direct my thoughts when I get side-tracked in class.	.68*	No	4.77	1.20	-.32	-.23

Note. Items selected for revision are in boldface. FL = Factor Loading; CL = Cross loading >.32.
*$p < .05$

Table A3

Study 1 Comparison Table for Intention Items

Item #	Item	FL	CL	Mean	*SD*	Skew	Kurt
1	I try something different or new when my study strategies are not working.	.64*	No	4.84	1.30	-.63	.21
4	I make an effort to engage with what I learn by making connections to my own life.	.40*	No	5.21	1.37	-.78	.56
7	When I notice I am avoiding my school work, I try to change my attitude towards it.	.45*	No	4.76	1.44	-.44	-.53
10	I re-evaluate my own judgments about my learning often.	.42*	No	4.72	1.31	-.14	-.36
13	When I get an answer wrong, I remind myself of my ability to learn.	.31*	Yes*	4.17	1.48	-.28	-.51
16	When I recognize I don't understand something, I take actions to study it more.	.39*	No*	5.02	1.28	-.56	-.13
19	I set flexible goals for myself in my classes that I change when necessary.	.46*	No	4.72	1.34	-.54	.17
22	When I am struggling in school, I revisit the reasons why I am there to help me stay motivated.	.38*	Yes*	5.07	1.53	-.64	-.07
25	I change my perspective when my expectations for a class are not met.	.32	No*	4.55	1.26	-.16	-.52
28	I actively appreciate the process of learning even when it is challenging.	.39*	No*	4.95	1.35	-.52	.11

Note. FL = Factor loading on primary factor; CL = Cross loading >.32 on one or more non-primary factors.
*$p < .05$

Table A4

Study 1 Comparison Table for Attitude Items

Item #	Item	FL	CL	Mean	*SD*	Skew	Kurt
3	When I feel critical about my academic performance, I take a step back to look at it in a different way	.08	Yes*	4.55	1.46	-.30	-.59
6	I accept myself when I don't immediately understand something.	.45*	No	4.20	1.61	-.02	-.89
9	I am quick to judge myself when I do not get something right the first time.	.28*	No*	2.61	1.47	.98	.47
12	If I start to get nervous about an exam, I can easily pause and re-set.	.60*	No	3.62	1.61	.23	-.76
15	I remain calm when I come across a hard question on a test.	.49*	No	4.34	1.52	-.33	-.70
18	In moments I feel stressed about school, I can let that feeling go.	.66*	No	3.46	1.65	.37	-.71
21	When I get overwhelmed with school, I allow those feelings to pass without judging them.	.80*	No	3.63	1.53	.13	-.84
24	I accept negative feelings I experience about school as they arise.	.30*	No	4.68	1.33	-.60	.49
27	I observe my feelings about my grades without judgement.	.51*	No	3.43	1.50	.38	-.42
30	I am open to help from others if I have trouble understanding class material.	.12	No	5.41	1.52	-1.01	.38
32	I monitor my reactions to school stressors with kindness.	.44*	No	4.28	1.52	-.06	-.55

Note. FL = Factor loading on primary factor; CL = Cross loading >.32 on one or more non-primary factors.
*$p < .05$

Appendix L

Study 1R Comparison Tables

Table A5

Study 1R Comparison Table for Attention Items

Item #	Item	FL	CL	Mean	*SD*	Skew	Kurt
2	**I recognize when my thoughts interfere with my ability to understand something in class.**	**-.12**	**Yes***	**5.53**	**1.05**	**-.76**	**.58**
5	It is easy to maintain my focus on class lectures or instructional materials.	.72*	No	3.95	1.65	-.05	-1.01
8	**I re-orient my attention when I find myself off-task from class assignments.**	**.21***	**Yes***	**5.01**	**1.37**	**-.54**	**-.23**
11	If I get distracted while studying, I can easily shift my focus back.	.74*	No	3.80	1.58	.03	-.76
14	If I lose my concentration while reading, I can bring my attention back.	.68*	No*	4.58	1.54	-.47	-.55
17	During class lectures, it is easy to re-focus when my thoughts wander.	.84*	No	4.16	1.57	-.24	-.74
20	When I am taking a test, it is easy to manage distracting thoughts.	.58*	No*	4.45	1.57	-.39	-.70
23	When I study, I am aware of the things that distract me as they happen.	.27*	Yes*	4.99	1.28	-.84	.65
29	**While I am in class, I notice my immediate reactions to things I am learning.**	**.12**	**Yes***	**1.25**	**-.58**	**.12**	**.38**
31	I re-direct my thoughts when I get side-tracked in class.	.63*	No*	1.35	-.49	.12	-.18

Note. Items selected for deletion in boldface. FL = Factor loading on primary factor; CL = Cross loading >.32 on one or more non-primary factors.
*$p < .05$

Table A6

Study 1R Comparison Table for Intention Items

Item #	Item	FL	CL	Mean	*SD*	Skew	Kurt
1	I try something different or new when my study strategies are not working.	.46*	No	4.98	1.29	-.65	.02
4	I make an effort to engage with what I learn by making connections to my own life.	.52*	No	5.18	1.36	-.76	.32
7	When I notice I am avoiding my school work, I try to change my attitude towards it.	.47*	No*	4.53	1.48	-.38	-.61
10	I re-evaluate my own judgments about my learning often.	.59*	No*	4.57	1.27	-.28	-.21
13	**When I get an answer wrong, I remind myself of my ability to learn.**	**.40***	**Yes***	**4.33**	**1.56**	**-.19**	**-.90**
16	When I recognize I don't understand something, I take actions to study it more.	.52*	No*	5.15	1.27	-.73	.46
19	**I set flexible goals for myself in my classes that I change when necessary.**	**.36***	**Yes***	**4.71**	**1.33**	**-.52**	**-.04**
22	When I am struggling in school, I revisit the reasons why I am there to help me stay motivated.	.49*	No*	4.82	1.56	-.58	-.34
25	**I change my perspective when my expectations for a class are not met.**	**.39***	**Yes***	**4.45**	**1.29**	**-.34**	**-.26**
28	I actively appreciate the process of learning even when it is challenging.	.60*	No	4.91	1.48	-.64	-.16

Note. Items selected for deletion in boldface. FL = Factor loading on primary factor; CL = Cross loading >.32 on one or more non-primary factors.
*$p < .05$

Table A7

Study 1R Comparison Table for Attitude Items

Item #	Item	FL	CL	Mean	*SD*	Skew	Kurt
3	**When I feel critical about my academic performance, I take a step back to look at it in a different way**	**.25***	**Yes***	**4.63**	**1.39**	**-.30**	**-.56**
6	I accept myself when I don't immediately understand something.	.62*	No	4.17	1.60	-.10	-.86
9	I am quick to judge myself when I do not get something right the first time.	.63*	No*	2.87	1.52	.60	-.40
12	**If I start to get nervous about an exam, I can easily pause and re-set.**	**.37***	**Yes***	**3.91**	**1.63**	**-.05**	**-.93**
15	**I remain calm when I come across a hard question on a test.**	**.31***	**Yes***	**4.58**	**1.51**	**-.40**	**-.59**
18	In moments I feel stressed about school, I can let that feeling go.	.53*	No*	3.74	1.64	.05	-1.01
21	When I get overwhelmed with school, I allow those feelings to pass without judging them.	.74*	No*	3.94	1.60	-.05	-.89
24	I accept negative feelings I experience about school as they arise.	.53*	No*	4.54	1.35	-.55	.04
27	I observe my feelings about my grades without judgement.	.69*	No	3.54	1.67	.24	-.92
30	**I am open to help from others if I have trouble understanding class material.**	**.11**	**Yes***	**5.22**	**1.49**	**-.97**	**.55**
32	I monitor my reactions to school stressors with kindness.	.62*	No*	4.14	1.53	-.19	-.52

Note. Items selected for deletion in boldface. FL = Factor loading on primary factor; CL = Cross loading >.32 on one or more non-primary factors.
*$p < .05$

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Zwick, W. R., & Velicer, W. F. (1986). Comparison of five rules for determining the number of components to retain. *Psychological Bulletin, 99*(3), 432–442. https://doi.org/10.1037/0033-2909.99.3.432

Curriculum Vitae

Sarah M. Wolff
Graduate Research Assistant & Part Time Instructor
President's UNLV Foundation Doctorial Research Fellow

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EDUCATION

2019-2023 **Ph.D** – Educational Psychology
Assessment and Quantitative Analysis
University of Nevada, Las Vegas, Nevada

Graduate Certificate – Program Evaluation

Graduate Certificate – Online Teaching & Instruction

Graduate Certificate – Teaching

2017-2019 **M.S**. – Educational Psychology
University of Nevada, Las Vegas, Nevada
Thesis Track May 2019

2014 **B.F.A**. – Fine Art Photography
San Jose State University, San Jose, California
President's Scholar

2012 De Anza College, Cupertino, CA general undergraduate studies

PROFESSIONAL EXPERIENCE

2022-2023 **Research Assistant**: University of Nevada, Las Vegas

An LOA part-time active and ongoing research and publication support role for the current endowed chair of educational psychology and higher education, Dr. Daniel Wright. Supporting role on research lab development and research projects partially funded by the Dunn Family Foundation.

2019-2022 **Graduate Research Assistant**: University of Nevada, Las Vegas

A part-time active and ongoing research and publication support role for the current endowed chair of educational psychology and higher education, Dr.

Daniel Wright. Supporting role on research lab development and research projects partially funded by the Dunn Family Foundation.

2021-2022 **Part Time Instructor (PTI)**: University of Nevada, Las Vegas

A part-time teaching position teaching for the College of Education. Classes taught: Second Year Seminar COE 202. First Year Seminar COE 103.

2021 **Program Evaluation:** University of Nevada, Las Vegas

An LOA position to assist the Nevada Department of Education in the evaluations of the Zoom, Victory, and SB139 programs in Clark County School District. Responsible for data management, survey development, evaluation report, and various supporting tasks.

2020 **Program & Evaluation Specialist**: Pablove Foundation, Los Angeles, CA

A two-fold, part-time, telecommute, non-exempt position involving components of program evaluation and the role of online master teaching artist for students living with cancer. Responsibilities of evaluation role include coordination of evaluation process, questionnaire design, dissemination, data analysis, and reporting. Responsibilities of program teaching role includes effectively leading 6-week cohorts of online instruction, mentoring volunteers, and facilitating successful Shutterbugs program implementation through a "creative, interactive, student-centered" process for children living with cancer ages 6-18.

2019-present **Research Advisory Board Member**: Pablove Foundation, Los Angeles, CA

A part-time advisory board member position for the Pablove Foundation assisting the acceleration, adoption and integration of the Shutterbugs Program as standard of practice for arts in medicine for kids and teens with cancer. This technical support role is to provide feedback, actionable advice, and practical support for improvement efforts to define qualitative and quantitative performance parameters, and to develop scalable programming for maximum impact and funding opportunities.

2019-2020 **Behavioral Health Specialist**: Mingo Health Solutions, Las Vegas

An independent contractor position involving program development and training implementation, both in person and online, of the mandated Nevada 16-hour Medicaid Provider training for Quality Mental Health Associates. Responsibilities include the education of theory, principles, and practicalities of providing BST/PSR services.

2017-2019 **Graduate Research Assistant**: University of Nevada, Las Vegas

A part-time active and ongoing research and publication support role in the Office of Research and Sponsored Projects, assisting with growth of scholarship within the College of Education. Responsibilities include literature searches, grant editing, grant opportunity research, and research scholarship support.

2017-2019 **Teaching Artist in Residence**: Project Imagine; Summerlin Hospital, Las Vegas

Once a week, onsite hospital artist in residence facilitating bedside arts activities for pediatric patients.

2015-2017 **MindFULLness Program Developer**: Palo Alto Union School District, CA

Six-week pilot mindfulness curriculum for the elementary classroom aimed to develop and encourage mindful visualization and body awareness to enhance social, emotional, and cognitive learning. Pilot sites: Ohlone Elementary School, Barron Park Elementary School, Duveneck Elementary School.

2015-2017 **Spectra Art Program Specialist**: Palo Alto Union School District, Palo Alto, CA

K-3 art curriculum developer and teacher at Ohlone Elementary School, modeling and developing cross-disciplinary lessons that engage students in creative expression, artistic perception, cultural and historical contextualization, and aesthetic valuing.

2015-2017 **Art Program Specialist**: Lucile Packard Children's Hospital School, PAUSD

Onsite hospital school art teacher for critically and chronically ill children of ranging ages, abilities, and physical/cognitive impairments.

2014-2017 **Local Teaching Artist**: Pablove Foundation, Los Angeles, CA

Bi-annual teacher of the Pablove Shutterbugs Photography Program San Francisco Bay Area chapter, catering a 5-week photography curriculum to pediatric cancer patients (6-21 yrs.).

2013-2016 **Children's Fine Art Program Instructor**: City of Palo Alto Arts Center, CA

Visual Thinking Strategies (VTS), museum-based art educator, for children ages 7-15. Seasonal art immersive experiences: Get Smart with Art, Digital Photography, Nature Photography

2011-2016 **Managing Coordinator & Photographer**: First Day Photo, Mountain View, CA

Team Manager of newborn photography staff at El Camino Hospital.

2012-2016 **Teaching Assistant**: San Jose State Dept. Art & Art History, San Jose, CA

University teaching assistant for Intermediate Photography: Beginning Black & White Film, Introduction to Studio Lighting, and Alternative Processes in Photography

2011-2012 **Teaching Assistant**: De Anza College Dept. Art & Art History, Cupertino, CA

Community College teaching assistant for Beginning Black & White Film

2008-2010 **Dance Teacher**: East West Music & Dance, Cupertino, CA

UNIVERSITY COURSES TAUGHT

Fall 2021 **First Year Seminar**, COE 103, University of Nevada Las Vegas
Prepares students with skills and knowledge to promote academic success, retention, and civic engagement. Major areas of focus include: inquiry and critical thinking, communication, global/multicultural awareness, intellectual and life-long learning, and citizenship and ethics. Anticipated outcomes are: connections with faculty and peers, college/community engagement, and improvement in academic skills.

Summer 2021 **Second Year Seminar**, COE 202, University of Nevada Las Vegas

Spring 2021 **Second Year Seminar**, COE 202, University of Nevada Las Vegas
This course builds on the First Year Seminar (FYS) to prepare students with skills and knowledge to promote academic success and retention. Major areas of focus include: inquiry and critical thinking skills, communication, global/multicultural awareness, intellectual and life-long learning perspectives, and citizenship and ethics. Anticipated outcomes are: connections with faculty and peers, overall college engagement, and improvement in academic skills.

GUEST LECTURES

Nov 2021 **To Qual, to Quant, or to Mix? A dilemma of knowing for the educational researcher**, Research Methods EPY 702, University of Nevada, Las Vegas

Oct 2021 **Analysis of Covariance, Theory & Application**, University of Nevada, Las Vegas, Inferential Statistics & Experimental Design, EPY 722

March 2020 **Mindfulness for Coping in the Global Pandemic: A 6-week lecture series**, CampRhino, Las Vegas, NV.

May 2019 **Mindfulness for Counseling Psychologists**, University of Nevada Las Vegas

July 2015 **Mindfulness in the K-5 Classroom,** Palo Alto Union School District.

Nov 2015 **"Off the Mat": Bringing Mindfulness Principles of Yoga into Daily Life,** Yoga Connects Festival Guest Speaker, United Kingdom

REFEREED BOOKS/CHAPTERS

Wright, D.B., & **Wolff, S.M.** (Under Contract Springer). *Introduction to Research Methods in R*. Springer. Due for release 2024.

Wright, D.B., & **Wells, S.M.** (2020) Creating Latent Variables. In Breakwell, G., Wright, D.B., & Barnett (Eds.), *Research Methods in Psychology 5th Edition*. London, England: Sage Publications.

Wright, D.B., & **Wells, S.M**. (2020). Creating Latent Variables: Computing Supplementary Material. In Breakwell, G., Wright, D.B., & Barnett (Eds.), *Research Methods in Psychology 5th Edition*. London, England: Sage Publications.

CURRENT RESEARCH & PUBLICATIONS

Wolff, S.M. (2023). Development and initial validation of the Mindful Self-Regulated Learning Scale (m-SRLS) [Manuscript in preparation]. Educational Psychology & Higher Education, University of Nevada Las Vegas.

Wolff, S.M., Hatcher, W., & Wright, D.B. (2023). The effects of distraction and mindful self-regulated learning on test accuracy and response time. [Manuscript in preparation]. Educational Psychology & Higher Education, University of Nevada Las Vegas. Pre-registered at https://doi.org/10.17605/OSF.IO/PJWKX.

Wolff, S.M., Wright, D.B., & Jennison, K. (2023). Gender bias in perceived success of statisticians: A sentiment analysis and [Manuscript in preparation]. Educational Psychology & Higher Education, University of Nevada Las Vegas.

Wright, D.B., & **Wolff, S.M.** (2023) Treating rapid responses as errant (TARRE) improves estimates of test performance for NAEP. [Manuscript under review]. Educational Psychology & Higher Education, University of Nevada Las Vegas.

Wright, D.B. & **Wolff, S.M.** (2023) Justifying responses affects the relationship between confidence and accuracy. [Manuscript under review]. Educational Psychology & Higher Education, University of Nevada Las Vegas.

Wolff, S.M., Lynam, K., Smith, H., & Piland, N.F. (2023) Impact of a virtual participatory arts program on pediatric patient quality of life. [Manuscript in preparation]. Educational Psychology & Higher Education, University of Nevada Las Vegas.

Wright, D.B. & **Wolff, S.M.** (2022) Metacomprehension responses are affected by feedback. *Journal of Cognitive Education and Psychology*, *21*(2), 182-196, http://dx.doi.org/10.1891/JCEP-2021-0010

Wright, D.B., **Wolff, S.M.**, Jaspal, R., Barnett, J., & Breakwell, G.M. (2022) The choice of response alternatives in COVID-19 social science surveys. *PLoS ONE*, *17*(11), 1-17, https://doi.org/10.1371/journal.pone.0263552

Lynam, K., Smith, H., **Wolff, S.M**., Piland, N.F. (2022) The pandemic as a stimulus for innovation in pediatric cancer care. *Health Management, Policy and Innovation, 7*(3), https://hmpi.org/2022/10/07/the-pandemic-as-a-stimulus-for-innovation-in-pediatric-cancer-care/?pdf=3817

Wells, S. M., Corkill, A. J. & Putney, L. G. (2021) Examining the utility of mindfulness training in the elementary school classroom [Manuscript submitted for publication (Journal of Research in Childhood Education)]. Educational Psychology & Higher Education, University of Nevada Las Vegas.

Wright, D.B., & **Wolff, S.M.** (2022) Replace options in formative assessment. [Manuscript in preparation]. Educational Psychology & Higher Education, University of Nevada Las Vegas.

Wright, D.B., **Wolff, S.M**., Hilpert J., & Arabi, M Wells, S.M. (2021) Matching modules and learning materials. [Manuscript submitted for publication (Journal of Learning Analytics)]. Educational Psychology & Higher Education, University of Nevada Las Vegas.

Wright, D.B., **Wolff, S.M**., Jennison, K., & Wheeler, K. (2021) Data-to-decision pipeline. [Manuscript in preparation]. Educational Psychology & Higher Education, University of Nevada Las Vegas.

Part, R., & **Wolff, S.M.** (2021) A software introduction to confirmatory factor analysis. [Manuscript in preparation]. Educational Psychology & Higher Education, University of Nevada Las Vegas.

PROFESSIONAL PAPERS & PRESENTATIONS

Wolff, S.M. (2023, April) *Development and initial validation of the Mindful Self-Regulated Learning Scale* [Roundtable Session]. AERA Annual Meeting Chicago, IL.

Wells, S. M., Corkill, A. J. & Putney, L. G. (2022, April) *Examining the utility of mindfulness training in the elementary school classroom* [Roundtable Session]. AERA Annual Meeting San Diego, CA.

Wells, S.M. & Wright, D.B. (2021, October) *Justifying responses improves calibration but harms diagnosticity*. Paper presented at Northern Rocky Mountain Education Research Association, Ketchum, ID.

Wells, S.M., Lynam, K., Lorenzano, R. Smith, H., & Piland N.F. (2021, October) *Impact of a virtual, participatory art program on quality of life for kids living with cancer*. Poster presented at the Association of Pediatric Hematology/Oncology Nurses, Virtual Conference Presentation.

Wells, S.M., (2020, February). *Mindfulness for the elementary classroom.* Paper presented at the UNLV Graduate Student Professional Association Research Forum, Las Vegas, NV.

Wells, S.M., & Wright D.B. (2020, February). *Metacomprehension responses are affected by feedback.* Poster presented at the Conference on Academic Research in Education. Las Vegas, NV.

Wells, S. M., (2019, May). *Evaluating the utility of a mindfulness-based intervention in the elementary classroom: A theorized path analysis*. Master's thesis presented at the University of Nevada, Las Vegas, NV.

Wells, S.M., & Thompson, H., & Mulvenon, S. (2019, April) *Understanding teacher perceptions: Socioeconomic labeling and its implications for student success*. Paper presented at the American Educational Research Association conference. Toronto, CA.

Wells, S.M., & Thompson, H. (2018, April) *An Examination of Labeling, Student Self-Victimization, and Academic Performance*. Paper presented at the Global Conference on Education & Research. Las Vegas, NV.

Wells, S.M., Hawkins, G., & Mulvenon, S. (2017, Oct). *Understanding the Economics and Quality of Life of a Career in K-12 Education*. Poster presented at UNLV College of Education and RAMP Poster Session, Las Vegas, NV.

CERTIFICATIONS

- **Graduate Teaching Certificate**, University of Nevada, Las Vegas

- **Graduate Certificate in Online Teaching and Training,** University of Nevada, Las Vegas

- **Graduate Certificate in Program Evaluation,** University of Nevada, Las Vegas

- **Online Teaching Essentials-GA**, University of Nevada, Las Vegas
- **16hr Medicaid Provider Training for Quality Mental Health Associates**, Mingo Health Solutions, Nevada

- **200hr E-RYT Yoga Teacher Certification**, Ayur-Eco Ashram, Mysore India

AWARDS AND SCHOLARSHIPS

- **Graduate Professional & Student Research Forum 2023**. GPSA awarded funding for conference travel and research presentation.

- **Division D AERA Graduate Student Conference Registration Award 2023**.

- **UNLV Graduate College Medallion 2023.** Awarded to exceptionally involved and high-achieving students for participation in Graduate College sponsored programs, events, and professional development opportunities.

- **President's UNLV Foundation Graduate Research Fellowship 2022-2023 $25,000**. Awarded for outstanding contribution to scholarship, excellence in research, academic accomplishments and dissertation topic.

- **College of Education Dissertation Completion Grant Summer 2022 $750.** Competitive grant funding awarded in support of dissertation research.

- **Summer Doctoral Fellowship Summer 2022 $7,000.** Awarded to outstanding doctoral students who have demonstrated excellence in their fields of study and who will reduce their time to degree through summer support.

- **Edward Pierson Memorial Scholarship Spring 2021**. Awarded for outstanding Graduate GPA and commitment to public education and teaching in areas of critical need in Clark County, NV.

- **Monti Carlin Tettamanti Scholarship Endowed Fund Spring 2021**. Awarded for outstanding Graduate GPA and teaching.

- **Dorothy A. Dawson Scholarship Spring 2021**. Awarded for outstanding Graduate GPA and inspiring teaching.

- **Dorothy A. Dawson Scholarship Fall 2021**. Awarded for outstanding Graduate GPA and inspiring teaching.

- **UNLV Access Grant 2019-2020.** Awarded for outstanding Graduate GPA.

- **Graduate Professional & Student Research Forum 2020**. GPSA awarded funding for conference travel and research presentation.

- **UNLV Access Grant 2018-2019.** Awarded for outstanding Graduate GPA.

- **Graduate Professional & Student Research Forum Spring 2019**. GPSA awarded funding for masters thesis research.

PROFESSIONAL ORGANIZATIONS

- American Educational Research Association (AERA)
- National Council on Measurement in Education (NCME)
- Association of North America Higher Education International (ANAHEI)
- American Psychological Association of Graduate Students (APAGS)
- Scholarly Consortium for Innovative Psychology in Education (SCIEPIE)
- Yoga Alliance