Culture and Self-Regulated Learning: Exploring Cultural Influences on Chinese International and Canadian Domestic Undergraduate Students' Engagement in Self-Regulated Learning

by

Meng Qi (Annie) Wu

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

Supervisory Committee

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Abstract

Culture, as an advanced form of social life, is internalized within each individual as an essential component of learning, socializing, and developing (Baumeister, 2011; Greenfield et al., 2003). Self-regulated learning (SRL), as demonstrated in the literature, is essential for students' academic success, where self-regulated learners strategically and metacognitively plan, monitor, and adapt their learning processes to achieve their goals in learning (Winne & Hadwin, 1998; Winne, 1995; Zimmerman, 2002). Because SRL theories significantly emphasize the importance of social contexts, culture is likely to influence how individuals develop and gain SRL competency. Nevertheless, there is a paucity of cross-cultural studies of SRL research; thus, this study aimed to examine and compare Chinese international and Canadian domestic students' self-reported engagement in SRL processes and their academic performance. To achieve this purpose, we adopted an emic approach by evaluating Winne and Hadwin's (1998) model of SRL and systematically comparing it with Chinese conceptualization of learning (e.g., Confucianism). Then, we used an advanced statistical method to investigate the measurement invariance of the Regulation of Learning Questionnaire (RLQ) designed to capture SRL as dynamic processes unfolding over time for Chinese and Canadian groups. Our findings supported configural and metric invariances across Chinese and Canadian cultural groups. Based on the evidence of partial scalar invariance, we also identified single items that contributed to scalar non-invariance. This study demonstrated the significance of examining the measurement invariance across cultures, which warrants comparability in cross-cultural comparisons, and contributed greatly to the current literature on the relation between culture and SRL.

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Dedication

To my husband Sunny, my son Aiden, and my dear parents, especially my mother.

Thank you for your unconditional love and support so that I can chase my dream.

Chapter 1 Introduction

With decades of research, self-regulated learning (SRL) researchers have demonstrated that SRL is essential for students' academic success (Hadwin & Winne, 2012; Pintrich, 1999; Winne, 2015; Zimmerman, 2000, 2002). Because self-regulated learners strategically and metacognitively plan, monitor, and adapt their learning processes to achieve their goals in learning (Winne & Hadwin, 1998, 2008; Winne, 2015; Zimmerman, 2002), they are likely to succeed academically and view their futures optimistically (Zimmerman, 2002). In addition, the development of self-regulatory competence is strongly influenced by socialization; that is, students' SRL capability develops initially from social sources of academic skill and then transforming into individual sources (Schunk & Zimmerman, 1997), which is aligned with Vygotsky's (1978) sociocultural theory. Similarly, grounded in social cognitive theory of self-regulation (Zimmerman, 1989), contemporary models acknowledge the reciprocal role social context plays in SRL (Schunk & Zimmerman, 1997; Winne & Hadwin, 1998; Zimmerman, 1989). The significance of social contexts emphasized in SRL theories suggests that SRL is a socially situated concept. Built upon this perspective, culture is likely to play an essential role in shaping how individuals develop and gain SRL competency, given that culture provides a platform for people to engage in cultural learning and acquire information from social interactions (Heine & Ruby, 2010).

Moreover, with rapid growth of globalization, pursuing higher education in another country has become popular for students from all over the world. Particularly, this migration from Eastern countries to Western countries for education has subsequently increased cultural diversity in Western institutions. Canada had over 800,000 international students with valid study permits in Canada at all levels of study in 2019, which ranks Canada third in the world's

top destinations for learning (Immigration, Refugees and Citizenship Canada [IRCC], 2020). Among all international students, Chinese international students accounted for the largest share of postsecondary students enrolled in Canadian universities in 2019 (Canadian Bureau for International Education [CBIE], 2020). International students in Canada not only bring the cultural diversity to strengthen the quality of educational experiences (CBIE, 2018) but also contribute significantly to Canada's economy (IRCC, 2020). Therefore, this continuously growing cultural diversity in Canadian postsecondary institutions highlights the importance of understanding how learners with diverse cultural background engage in their learning to achieve academic success in Canada.

While studying in a foreign country, international students, compared with domestic students, may experience intensified academic stress and challenges due to many factors that arise from adapting to different cultures, including language anxiety and barriers, educational stressors, financial difficulties, perceived cultural differences, and discrimination (Berry, 2005; Houshmand et al., 2014; Poyrazli & Isaiah, 2018; for a review, see Smith & Khawaja, 2011). For instance, Asian international undergraduate students reported experiences of racial microaggressions (e.g., excluded and avoided, rendered invisible, and disregarded international values) in classrooms and social settings on campus, which influenced their academic engagement (Houshmand et al., 2014). In particular, Chinese families strive to push their children successfully up through the ladder of education into secure, high-paying jobs (Rosen, 2004; Sue & Okazaki, 1990). Therefore, family pressure and high expectations of academic success become another major factor that may influence Chinese international students' academic performance.

Given the stressors mentioned above, Chinese international students may encounter multiple and simultaneous regulatory demands during their adaptation in a foreign country. According to Baumeister and Heatherton (1996), fatigue and overexertion resulting from many simultaneous demands will deplete the person's strength and self-control. Being psychologically stressed and exhausted in response to acculturative stressors and academic challenges, Chinese international students may not be able to effectively and strategically adapt learning processes, which might in turn impede their academic performances. Research has demonstrated the presence of maladaptive coping strategies used by international students, particularly Asian students, with the respect to predicted psychological distress and depression (see Smith & Khawaja, 2011). Considering that international students' main purpose is to achieve academic success and attain a degree oversea (Poyrazli & Isaiah, 2018), it becomes critical to understand how Chinese international students negotiate and leverage their own learning situations to effectively resolve academic challenges, gradually achieve a higher level of engagement, successfully become self-regulated learners, and eventually optimize their learning experiences in a foreign country.

Based on McInerney and King's (2017) review study of culture and self-regulation in educational contexts, self-regulation was found to be essential for students' academic engagement and achievement cross-culturally. Nevertheless, cross-cultural research studies about SRL, particularly with respect to Chinese (international) students, are rare in the extant literature. In other words, how Chinese learners engage in SRL processes may not be adequately understood. Also, the predominant models of SRL used in cross-cultural studies were based on Western theoretical frameworks (McInerney, 2011; McInerney & King, 2017). Such a presumption of viewing Western SRL models as universal across cultures in research poses

challenges in understanding cross-cultural similarities and differences of SRL. This view was evidenced in the paradox of Chinese learners. In the past, a widespread view has portrayed Chinese students as engaging less in SRL and placing more emphasis on passive and rote learning (e.g., memorization and repetition; Pratt et al., 1999). There is ample evidence to confirm, though, that Asian students tend to achieve well compared with students from other developed countries and continue to do well when they come to the West (Kember, 2000; Li, 2012; Marton et al., 1996). The misinterpretation of Chinese learners may result from an inaccurate understanding of Confucian values, where collectivism and conformity are commonly emphasized in the research literature about Chinese learners (Kennedy, 2002). These values often led to a conclusion that Chinese students engage in rote learning as being obedient to teachers, family members, or people in authority during the learning process. However, Confucius not only emphasized the significance of social relationships in learning but also acknowledged the individuality in learning to achieve self-perfection (Lee, 1996; Kennedy, 2002). Essentially, the perfection of the self illustrates that "the purpose of learning is to cultivate oneself as an intelligent, creative, independent, autonomous being" (Cheng, 2000, p. 441). A deficit view of Chinese learning in the extant literature, especially with the Confucian values rooted in Chinese culture for thousands of years, may preclude us from uncovering the underlying differences of SRL between Chinese and Western cultures, thereby limiting our understanding of how Chinese international students engage in SRL in Canada.

Taking the aforementioned limitations into consideration in this study, I adopt a bottom-up emic approach to gain insights of cross-cultural differences and similarities in SRL between Chinese and Western cultures. To elaborate, I evaluate Winne and Hadwin's (1998) model of SRL and systematically compare it with Chinese conceptualization of learning – Confucius'

learning philosophy. This emic approach allows me to build a case that SRL is a universal concept through a critical examination of the literature, rather than directly assuming the universality of SRL across cultures. Next, I take an etic approach by utilizing Winne and Hadwin's (1998) model to examine whether Chinese international and Canadian domestic university students engage in SRL processes in the same way. Therefore, incorporating both emic and etic approaches in this study, as highly recommended by McInerney and King (2017), enables us to recognize the universality of essential components of SRL and acknowledge culturally specific phenomena that may not be captured by Western SRL models. Correspondingly, it can help to understand the sociocultural theoretical account of SRL processes of two cultural groups of Chinese international and Canadian domestic undergraduate students.

Chapter 2 Literature Review

Self-regulation is essential for the development of life-long learning skills to succeed in educational and employment settings where important skills are demanded (Sitzmann & Ely, 2011; Zimmerman, 2000, 2002). This chapter begins with a general theoretical framework of SRL and then moves on to evaluate how culture influences SRL by looking into cross-cultural differences and similarities between Winne and Hadwin's (1998) model of SRL and Chinese conceptualization of learning in the literature. Next, current challenges of measuring SRL in relation to culture are identified. Finally, I end this chapter with research purpose and questions that will be examined in this study.

Self-Regulated Learning

Our capability to self-regulate, a core aspect of human adaptive behaviour and essential element of self (Baumeister, 2011; Martin, 2007), enabled our ancestors to survive, flourish, and reproduce (Zimmerman, 2000). SRL originated from the work of Albert Bandura's (1986) *Social Foundations of Thought and Action* and became an important concept in academic settings (Dinsmore et al., 2008). According to Zimmerman (2002), self-regulation of learning is not a mental ability or academic learning skill; instead, it refers to "a self-directive process by which learners transform their mental abilities into academic skill" (p. 65). In other words, SRL should be considered as a proactive process rather than a covert or passive event (Zimmerman, 2002). Similarly, Winne (2015) defines that learning is a process where learners actively engage in transforming information into knowledge. Essentially, successfully adapting to academic environments requires regulated processes of strategically planning, monitoring, evaluating, and adapting to individual learning goals and situations (Schunk & Zimmerman, 1997; Zimmerman, 1989; Zimmerman & Schunk, 2001). These regulatory processes in learning help learners to

build strong metacognitive knowledge, including selecting effective strategies to manage their time and structure their environment (Pintrich, 2000); therefore, learners can effectively make decisions about how to manage their learning processes (Winne, 2015).

Given the nature of human beings as consistently regulating one another's fundamental physiological processes through social communication, sociality serves as a survival strategy that optimizes humans' ability to secure resources to enable growth, protection, and reproduction (Atzil et al., 2018). Also, from a biological perspective, our genes give us a brain that can align its wiring with its physical and social environments (Barrett, 2017), which allows us to effectively adapt to changing environments. Correspondingly, the social nature of human beings suggests that SRL, an important determinant of successful learning, is social in nature and origin.

That being said, we are architects of our own learning experiences by participating in social interaction to develop the self-regulatory competency, which has been illustrated in theories and models of SRL. Bandura's social cognitive theory (1986), the theoretical foundation of SRL, illustrates that personal, behavioural, and environmental factors co-determine human experiences and functioning. Also, Vygotsky (1978) viewed a person as socially constructed through interactions with others, and his sociocultural theory suggested that each cultural context provides culturally specific cognitive tools (e.g., methods of thinking, problem-solving, and regulation) for children to learn from other competent adults. Similarly, many contemporary models of SRL acknowledge the reciprocal role that social context plays in SRL (Hadwin et al., 2017; Schunk & Zimmerman, 1997; Winne & Hadwin, 1998; Zimmerman, 1989). For example, the social influence on SRL can be observed in Zimmerman's (1989) cyclical phases model, in which learners evaluate their performance by comparing it with another person's performance. As Martin (2007) addressed, it is critical to understand how people express themselves, engage

in strategic planning, and pursue various goals through communal relations with others. Therefore, through social modeling, social guidance, and social interaction, the development of self-regulation in learning can be fostered. This leads to an important question of how learners with culturally different learning experience develop their SRL competency and engage in SRL processes.

Culture and Self-Regulation of Learning

According to Baumeister (2011), culture is defined as "an advanced form of social life based on shared understandings and the use of meaning for processing information collectively" (p. 6). That is, culture is internalized within each individual as an essential component of learning, socialization, and development (Greenfield et al., 2003). This repeated and continuous engagement in specific cultural contexts or practices may lead to certain characteristic patterns of psychological responses that will be eventually automized (Markus & Kitayama, 2010); such a cultural learning process is ubiquitous and constant across one's life-long journey (Li & Yamamoto, 2019). More importantly, internalized cultural beliefs, values, and characteristics seem to be successfully transmitted from generation to generation (Gardiner & Kosmitzki, 2018). Therefore, culture significantly influences every aspect of our life, but its effects on us have become unobtrusive, just like air that we breathe.

Furthermore, this cultural learning process gives rise to pronounced cultural variance, and many psychological phenomena are significantly different across cultures (Heine & Ruby, 2010). Empirical evidence from multiple disciplines has demonstrated that people from distinct cultures (e.g., individualistic and collectivistic cultures) exhibit significant differences in patterns of neural activities of the brain (Chiao et al., 2009; Han & Ma, 2015; Kitayama & Park, 2010), self-concepts of cognition, motivation, and emotion (for a review, see Markus & Kitayama, 1991,

2010), learning models and approaches (Li, 2003a, 2012; Tweed & Lehman, 2002; Marton et al., 1996; Kember, 2000), and learning pathways of development (Greenfield et al., 2003). Nevertheless, as Norenzayan, Schaller, and Heine (2006) stated, "at some level, members of the human species share universal conceptual and motivational mechanism that interact with cultural contexts in important ways" (p. 351). Therefore, cultural variation exists as people think, feel, and behave in different ways that are shared and emphasized with their own cultural members; however, it is equally important, though challenging, to recognize certain psychological processes that might be fundamentally universal across cultures.

Because of the socially situated nature of SRL, culture is likely to influence the development of SRL (Helmke & Tuyet, 1999; Li et al., 2018; McInerney & King, 2017; Purdie & Hattie, 1996; Shi et al., 2013). To reiterate, our capability of self-regulation in learning is continually developing through social interaction within various sociocultural environments and their social members. Thus, the way that we regulate our learning might be conceptualized or operationalized differently in respect to different sociocultural contexts. Nevertheless, the cultural influence on the theoretical account of SRL is still underexamined (McInerney & King, 2017; Shi et al., 2013), which addresses a need to further investigate the relation between culture and SRL.

As Henrich, Heine, and Norenzayan (2010) argued, most of the psychological research has utilized WEIRD (Western, educated, industrial, rich, and democratic) population, representing 12% of the world's population. Findings from these research studies can hardly be generalized to the rest of world population, though researchers often implicitly drew assumption of the universality from WEIRD samples. This issue is also evidenced in educational psychology, pertaining to research in SRL. According to McInerney and King (2017), most of

the cross-cultural research studies continuously utilized SRL theoretical models and measurements developed and validated in the West with WEIRD samples; there was a limited non-Western theory or model of SRL to guide cross-cultural research in SRL. More critically, researchers tended to assume the theoretical components of SRL as universal across cultures (McInerney & King, 2017). Subsequently, the lack of precision in the theoretical definition of SRL constructs may in turn lead to a lack of explicitness in the operational characteristics of indicators in SRL measurement. Therefore, conclusions or findings from cross-cultural studies that are lack of theoretical precision and operational explicitness could be ambiguous and problematic.

As a result, rather than directly applying a Western model of SRL to examine Chinese students, we take a bottom-up approach (i.e., an emic approach) by thoroughly reviewing and systematically comparing cross-cultural similarities and differences in both Western and Chinese literature of the conceptualization of SRL. This approach has three important implications: (a) it allows us to recognize that a culturally specific phenomena of SRL may exist in Chinese learning context but may not be effectively captured by Western models or theories of SRL; (b) it helps us to disentangle cross-cultural differences to build a case that some essential components of SRL is indeed universal; and (c) it supports us to justify the reason of adopting a SRL model established in the West to examine Chinese students in this study.

Winne and Hadwin's Model of Self-Regulated Learning

As an active area of research for decades, several models of SRL have been proposed with a consolidated theoretical background and empirical support (Boekaerts, 1996; Efklides, 2011; see Panadero, 2017 for a review; Pintrich, 2000; Winne & Hadwin, 1998; Zimmerman, 2000). All theoretical SRL models recognize SRL as a cyclical process composing various

phases (e.g., planning, monitoring, and adapting) and subprocesses (Panadero, 2017) but identify different key factors in SRL processes, such as metacognition, motivation, and emotion (see Winne, 2015, for a review). For example, Pintrich's model of SRL (2000) emphasizes the role of motivation throughout all our phases, particularly with the respect to learner's achievement goal orientation.

Among many theoretical SRL models, Winne and Hadwin's (1998) model of SRL strongly emphasizes metacognition as the predominant process for learners to metacognitively monitor and take control of their learning processes to ensure a quality of learning (Hadwin & Winne, 2012). As Winne and Perry (2000) noted, "metacognitive monitoring is the gateway to self-regulating one's learning" (p. 540). In Winne and Hadwin's model, four loosely sequenced and recursively linked phases are characterized. In the first phase, learners generate a *task perception/understanding* about features of academic tasks by evaluating personal characteristics, such as self-efficacy, domain knowledge, and other relevant knowledge of self, as well as external environments. In phase two, *goal setting and planning*, learners select goals for the task and construct plans to accomplish the established goals. Particularly, goals serve as standards for learners to monitor their regulation in learning (Winne, 2015). Phase three, *task enactment*, is where learners engage tactics and strategies to achieve goals created in previous phases. In phase four, *metacognitive adaptation*, learners make purposeful changes to approach their future learning; particularly, this adaptation can involve either a large-scale or small-scale adaptation (Winne & Hadwin, 1998, 2008). Because of the nature of SRL as a recursive cycle, learners may revisit phases in any order (Winne, 2015). As Hadwin and Winne (2012) pointed out, learners produce high-quality learning through consistently developing metacognitive

knowledge about their learning tasks, reflecting with past learning experiences, and recognizing maladaptive learning patterns, as well as subsequently making adaptation to their future learning.

In addition, each phase of Winne and Hadwin's (1998) model of SRL can be described by five facets, including condition, operations, products, standards, and evaluation, (i.e., COPES model; Winne, 1997). *Conditions* are characteristics that learners bring to the task and features in the environment or task may potentially affect operations and standards. Conditions comprise external conditions (e.g., task, time, instructional cues, and sociocultural context) and internal conditions (e.g., cognition, motivation, and beliefs). *Operations* are basic cognitive processes, tactics, and learning strategies that students use when encountered with a learning task or situation. Particularly, five basic cognitive operations, referred to SMART processes that learners utilize to acquire knowledge and regulate their learning, are searching, monitoring, assembling, rehearsing, and translating (Winne, 2010). For instance, rehearsing involves mentally repeating information, and translating allows learners to transform the representation of given information (definitions retrieved from Winne, 2017). *Products* are the information created by operations, and *evaluations* are judgements about products that are either generated internally by students or often validated by external sources. Lastly, *standards* refer to criteria against which products are monitored (Panadero, 2017; definitions retrieved from Winne, 2017). More importantly, Winne's (1997) COPES model acknowledges the socially situated nature of SRL; as Hadwin et al. (2017) noted, the COPES architecture emphasizes that "choices and outcomes in each phase are inextricably intertwined with dynamic internal, social, and environmental conditions as affordances and constraints for regulation" (p. 89).

Chinese Conceptualization of Self-Regulated Learning

For understanding Chinese international students' SRL in this study, solely focusing on Western scholars' perspectives of SRL may result in a stereotyped view of Chinese learners as explained in the introduction. Hence, it is important to introduce Chinese philosophy and other scholars' perspective of SRL in Chinese learning context in this study to present a holistic picture of what SRL means for Chinese learners.

Confucius (551 - 479 B. C. E.), portrayed as a teacher, advisor, philosopher, reformer, and prophet, has been a profound influence on Chinese teaching and learning for over two thousand years. His philosophy in learning has flourished in the present day and will continue. However, despite the pervasive current popularity of Confucianism in Chinese psychology, Liu (2014) argued that the current focus on Confucianism is a shallow, limiting its emphasis to concepts such as family values, diligence, and education. Lee (1996) also raised a similar issue that Confucian values of collectivism and conformity that were frequently emphasized in the literature are only a part of Confucianism. As Li (2003b) argued in her article titled "The Core of Confucian Learning", the Confucian model was inaccurately described by Tweed and Lehman (2002), which could inevitably lead to a misunderstanding and perpetuation of stereotypes of how Chinese learners regulate their learning (for detailed explanation, see Li, 2003b; Tweed & Lehman, 2002). Therefore, it becomes important to present a complete picture of what Confucius's notion of learning.

To illustrate Confucianism in detail, Confucius's notion of learning is not concerned with truth inquiry as defined in Western epistemology, nor is it concerned with the acquisition of particular skills (e.g., analytical thinking skills and evaluation of knowledge). Instead, Confucius's long-lasting influence resides in his core teaching of self-perfection – the moral

striving (Li, 2003a). Accordingly, learning is a never-ending lifelong process, through which human beings develop the specific virtues of sincerity, diligence, endurance of hardship, perseverance, concentration, respect for teachers, and humility (Lee, 1996; Li, 2003a; Tu, 1979). Self-perfection is not obtainable, but one should make commitments to seeking self-perfection and to fully developing one's potentiality (Lee, 1996). Therefore, Confucius believed that everyone could seek self-perfection through learning, and learning by itself is an end (Li, 2003b). Also, Confucius emphasized that learning to self-perfect is filled with all sorts of obstacles and challenges. Regardless of how much a person achieves, one should continuously make efforts because learning never ends (Li, 2002, 2003b). From Confucius's perspective, learning requires effortful regulations to develop learning virtues to perfect oneself morally, intellectually, and mentally.

Moreover, in pursue of self-perfection through learning, Confucius acknowledged a sense of integrity and a sense of shame by recognizing one's wrongdoings or challenges and simultaneously amending oneself (Li, 2003b). For example, Confucius stated, "If you know a thing, say that you know; and if you don't, admit that you don't, that is knowledge" (as quoted in Li, 2003b, p. 147), which is also an ancient form of metacognitive awareness of learning. Similarly, the respectful learning in Chinese education does not mean passivity or obedience. It stems from the concept of humility, and beliefs about humility allow learners to be open and ready to learn from anyone (Tu, 1979). Listening attentively to understand others and then questioning require an internal reflection and ensure a better learning result (Li, 2003b). In sum, not only does Confucius's philosophy of learning illustrate a pathway for all human beings to achieve life-long moral striving or self-perfection but also elucidate a theoretical account of SRL in Chinese context.

Most importantly, according to Confucius (1979), social relationships are significantly important for Chinese learners during this learning process to seek self-perfection (Li, 2013). Some research showed that family closeness was significantly and positively related to Chinese students' SRL (Huang & Prochner, 2004). To achieve a moral striving and develop virtues to become self-perfected through learning, it is wise to honour inherent social relationships including (a) parent-child relationships, (b) sibling relationships, (c) husband-wife relationships, (d) basic economic relationships (employer-employee), and (e) friendships. That is, one begins the learning process as a beneficiary from others' dedicated guidance within those described relationships, and then will become a benefactor to others' learning and self-cultivation (Li, 2003a, 2003b, 2012).

It is critical to examine Confucianism thoroughly as one essential component of Chinese conceptualization of learning. Equally importantly, what cognitive operations are used by Chinese learners, especially pertaining to the stereotyped views on memorization strategies in Chinese learning contexts, should be reconsidered. For instance, Watkins (1996) examined how Hong Kong secondary school students learned and concluded a learning process model consisted of three to four stages. In stage one, students' initial attention was to focus on reproducing everything by memorizing. In the second stage, students' intention was about memorizing key points. In the third stage, students intended to understand the learning content first by reproduction. In the last stage, students were to both understand and achieve by combining understanding and memorizing strategies. In the same vein, Pratt et al. (1999) suggested that Chinese students believed that learning was a gradual process that required tremendous dedication and methodical steps. The authors proposed that learning perceived by Chinese involved a sequential four-stage process: (a) memorizing, (b) understanding, (c) applying, and

(d) questioning or modifying. These studies demonstrate that various cognitive operations, though with a strong emphasis on memorization, are effectively used by Chinese learners to transform information into knowledge.

Overall, Confucius's notion of learning in fact underlines the importance of SRL in individual's learning process to cultivate learning virtues to achieve self-perfection. Reiterating Zimmerman's (2002) definition of SRL, which is "a self-directive process by which learners transform their mental abilities into academic skill" (p. 65), I attempt to define SRL related to Confucianism as a proactive, long-lasting, and individualistic process whereby learners transform their learning virtues into academic skills with supports from social relationships. More importantly, taking a closer look at how Chinese learners utilize memorization strategies in learning, I recognize that memorization is effectively used in combination with other cognitive operations to achieve deep understanding of learning content. These cognitive operations frequently used by Chinese learners seem to be closely aligned with Winne's (2010) SMART cognitive operations that are fundamental in SRL. After a critical examination of conceptual understandings of SRL in Winne and Hadwin's model of SRL and Confucius's learning philosophy, it is also important to view the current empirical research studies that investigate the relation between culture and SRL.

Empirical Research on Culture and Self-Regulated Learning

Despite the rapid growth of SRL research in education psychology, to date, only a limited number of cross-cultural studies of SRL have been identified, and most of the studies that have examined the relation between culture and SRL used mono-cultural samples (McInerney & King, 2017). These limitations influence our insights about cross-cultural differences and

similarities in SRL, which yet suggest the importance of this study as it contributes to an adequate understanding of how culture may play its part in SRL.

In my search, I found four two-culture studies related to SRL. Wang and other colleagues (2013) investigated the relation between the self-efficacy and SRL strategies for English language learners of German and Chinese college students. Based on Zimmerman (2000) and Pintrich (2000)'s SRL theories, the authors implemented a survey that targeted English self-regulated learning strategies comprised 12 categories (for details, see Wang et al., 2013). Differences of the SRL sub-scales were found between German and Chinese students, indicating that there might be cultural differences in SRL strategies salient to each cultural group. However, Wang et al. did not examine whether the latent structure of the SRL was invariant between Chinese and German students but then proceeded using various MANOVA to examine differences between the two groups. This study, as addressed by McInerney and King (2017), clearly adopted an etic approach that neglected possible differences in the SRL construct. In another study examining Asian, Latino, and White students' study strategies used in organic chemistry in relation to course outcomes, Lopez et al. (2013) identified four commonly used reviewing strategies across groups: organizing and transforming, reviewing previous problems, reviewing notes, and reviewing text for culturally diverse students. In addition, findings showed that Latino students applied these strategies more frequently than Asian and White students.

Similarly, a cross-cultural study that examined learning conceptions and approaches demonstrated Chinese students reflected more conceptions of learning that emphasized understanding, personal change, and development of social competence than Flemish students (Zhu et al., 2008). At last, Shi et al. (2013) examined the sociocultural impacts on SRL for Chinese international students and Canadian domestic students in a multicultural collaborative

learning context. Their results showed that compared with Chinese international students, Canadian domestic students demonstrated more individually-oriented SRL actions (e.g., emphasizing individualistic actions and maintaining one's own individual goals) relative to socially-oriented SRL actions (e.g., emphasizing others' interest and benefits and meeting the needs of others or the group) for several types of SRL actions including motivation, monitoring, elaboration, clarification, and environment structuring. Although the studies presented thus far provide evidence that culture indeed strongly influences how learners engage in their learning, these studies using an etic approach remain narrow that made a presumption that SRL was universal across cultures.

In addition, a meta-analysis investigating fifty-nine SRL studies (covering 23,497 Chinese students published in Chinese journals from 1998 to 2016) attempted to understand the relation between SRL and academic achievement of elementary and secondary students in China (Li et al., 2018). SRL examined in this study was based on Zimmerman's (2008) cyclical model. The results indicated that the overall effect size of SRL on academic achievement for Chinese students was small and gradually has decreased from 1998 to 2016. For Chinese students, self-efficacy, task strategies, and self-evaluation appeared to be frequently used SRL strategies. Further, the authors found that Chinese students tended to emphasize performance and self-evaluation phases in learning. These findings are in line with Chinese learners' emphasis on making dedicated efforts to achieve self-perfection by reflecting on and monitoring one's own learning process. However, this study relied heavily on an etic approach of applying Zimmerman's SRL model to Chinese students and failed to recognize that culturally specific learning approaches may not be stressed in Zimmerman's model. This limitation could explain

why the effect size of SRL on academic achievement for Chinese students was small, which was not mentioned in this study.

Finally, a relevant research study that is worth being mentioned in this study is Li's (2003a) *U.S. and Chinese Cultural Beliefs about Learning.* Although Li (2003a) did not examine SRL but rather learning concepts cross-culturally, she demonstrated that distinct conceptualizations of learning between Eastern culture and Western culture guide the thinking, affect, behaviour, and motivation in people's learning, thus possibly contributing to differences in operation of and engagement in SRL. Examining European American and Chinese conceptions of learning with learning-related terms, Li (2003a) found cultural differences of beliefs about learning between U.S. and Chinese college students. Based on her findings, European Americans emphasize (a) knowing the world, (b) certainty of knowledge, (c) mental processes, and (d) critical thinking in learning. In contrast, Chinese emphasize (a) perfecting self, (b) taking the world upon oneself, (c) learning virtues, and (d) action is better than words (Li, 2002 & 2003a,). The long-lasting influence of Confucius's learning philosophy is again evidenced in this study. Interestingly, Li (2003a) stated that there was little overlap between European American and Chinese students' cultural beliefs, specifically with the respect to learners' internal characteristics including cognitive skill, intelligence, thinking, communicating, active engagement, and motivation. Her findings may indicate that beliefs about learning are fundamentally different across cultures, which may subsequently affect learners' perceptions of and engagement in SRL.

In view of all studies that have been mentioned so far, one may suppose that people from Asian and Western cultural contexts do exhibit significant differences in SRL. Yet, these studies

are limited in theorizing and measuring SRL, which may in turn lead to ambiguous and problematic interpretations.

Summary

After a thorough review, I realize that the Chinese notion of learning is theoretically well-aligned with many components of Winne and Hadwin's (1998) model of SRL, underlining SRL as a life-long, proactive, and metacognitive process that is socially situated. To clarify in conceptualization, SRL is a self-directed, proactive process that requires some type of transformation from mental abilities into academic skills (Zimmerman, 2002; Winne, 2017). Likewise, SRL in Chinese cultures, related to Confucius' self-perfection, means learners proactively engage in learning by transforming their learning virtues into academic skills.

Particularly, as in Winne and Hadwin's (1998) model and Confucian values of learning, metacognition is strongly emphasized as an important determinant of achieving high-quality learning experiences. In other words, a high-quality learning requires learners to reflect on past learning experiences, recognize wrongdoings in learning (or maladaptive learning patterns), and subsequently amend ones' learning to adapt their future learning, which is essential in SRL. Moreover, reviewing cognitive operations in learning that has been emphasized by Winne (2010), Watkins (1996), and Pratt et al. (1999), the process of "coming to know" that transforms information into knowledge operates similarly in Western and Chinese cultures, where various cognitive processes, such as searching, monitoring, assembling, rehearsing, and translating, work together in symphony. This notion confirms what Winne (2017) stressed: SMART cognitive operations are basic to human cognitive system.

I argue that the conceptual understandings of some essential components of SRL between Western and Chinese cultures seem to converge. However, the observed cross-cultural

differences in the extant SRL literature could be explained by the lack of theoretical precision and operational explicitness of SRL constructs, which may lead to ambiguous and problematic conclusions or findings of cross-cultural studies. Therefore, it is critical to establish the equivalence of a measurement used in a cross-cultural study.

Challenges of Measuring Self-Regulated Learning

Past research has examined SRL actions through the design of self-report instruments (Winne, 2010, 2015), and commonly used questionnaires include the Learning and Study Strategies Inventory (LASSI; Weinstein et al., 1987) and the Motivated Strategies for Learning Questionnaire (MSLQ, Pintrich et al., 1993). However, Winne and Perry (2000) argued that these self-reported SRL instruments treated SRL actions as an aptitude or a relatively enduring attribute of an individual that predict future behaviours. This approach contradicts with the essence of SRL as a set of dynamic processes/events (Butler & Cartier, 2017; McCardle & Hadwin, 2015) unfolding over time in contexts (Hadwin et al., 2017), and also limits the understanding of how learners intentionally, strategically, and adaptively respond to challenges and situations in learning (McCardle & Hadwin, 2015).

An alternative approach is to assess SRL as an event (Winne & Perry, 2000). Zimmerman (2008) addressed that event measures assessing the sequential dependency of responses can produce causal inferences about changes in SRL in real time and authentic contexts. For example, an event approach of assessment is a phase model of SRL, separating students' efforts of engagement in SRL into phases (e.g., before, during, and after attempts to learn; Zimmerman, 2000). Other event measures of SRL include trace logs of learners' SRL processes (Winne, 2010), think-aloud method (Azevedo et al., 2010), and structured diary measures (Zimmerman, 2000). For instance, a think-aloud method asks learners to report about their thoughts and

cognitive processes while performing a task. Although implementing the think-aloud method to assess SRL permits a high degree of reliability, it is a very labor-intensive methodology (Zimmerman, 2008). Using trace logs promotes the success for students monitoring their achievement. Nevertheless, students reported difficulty in tracking their use of self-regulated strategies (Zimmerman, 2008), which indicates a limitation in enhancing students' monitoring, evaluating, and adapting in SRL.

Using self-report inventories may constrain individual's accurate responses to items (Markus & Kitayama, 2010) due to retrieval failure in memory (Bjork et al., 2013). Given that the essential characteristic of SRL is that leaners actively engage in monitoring and evaluating their own learning processes (Winne & Hadwin, 1998, 2008), learners' interpretations derived from self-report questionnaires provide important data for learners to develop a metacognitive awareness of their own SRL processes (Butler, 2002; McCardle & Hadwin, 2015). As McCardle and Hadwin stated, understanding SRL is equivalent in understanding learners' own interpretations of how to engage in task understanding, planning, goals, monitoring, and adapting in learning.

More importantly, Byrne (2004) addressed that substantive research of multiple-group comparisons tended to assume the instrument of measurement shared the same underlying theoretical structure and operated in the same way. These studies with multiple groups rarely test the used measurement statistically. Without testing invariance of used measurement across groups, comparisons are lack of measurement comparability, and conclusions or findings are ambiguous and problematic (Boer et al., 2018; Davidov, 2008). In addition, Tong and other colleagues (2019) investigated the psychometric properties of an adapted Chinese version of Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1993) by sampling 611

Chinese undergraduate students in China. Three types of statistical analyses were performed, including reliability analysis, exploratory factor analysis (EFA), and confirmatory factor analysis (CFA), using SPSS with AMOS. The original MSLQ with 81 items was subsequently revised, and only 52 items were obtained for the proposed MSLQ for Chinese adult learners. Specifically, the authors summarized three modified constructs in SRL models including: (a) the reason of learners' engagement in an academic task, (b) learners' beliefs in accomplishing a given task, and (c) learners' strategy to control for learning resources (Tong et al., 2019). The results of this study confirmed that cross-cultural adaptation and modification of a well-established SRL instrument were necessary when addressing the applicability of SRL models developed in Western cultural contexts to Eastern cultural contexts. Despite cross-cultural adaptation, factors formed from EFA for the revised MSLQ for Chinese adult learners corresponded to the original factors of the MSLQ. This result indicated that certain elements of SRL might be universal across cultures. As a result, it is critical to investigate the way of how SRL is operationalized in different cultures by examining the measurement invariance of the RLQ statistically (i.e., number of factors, item measurements, and the underlying factorial structure).

Measurement Consideration

The Regulation of Learning Questionnaire (RLQ; Hadwin, 2009), based on Winne and Hadwin's (1998) SRL model, is designed to capture the dynamic SRL processes as it unfolds over time in context (McCardle & Hadwin, 2015). In particular, the RLQ allows learners to respond to items about each phase SRL (i.e., task understanding, goal setting and planning, monitoring, evaluating, and adapting) as they pertain to a recent and specific study event. Learners report contextual details of the course, task, and the challenges they have encountered in that study event. More importantly, the RLQ addresses the importance of learners'

metacognitive awareness in SRL processes because it supports learners to develop adequate perceptions of their own intentions and actions to engage in SRL processes. Hence, this study will use the RLQ to examine SRL processes as this questionnaire aligns with the conceptualization of SRL.

Furthermore, most of the cross-cultural studies used SRL instruments and models largely based on the work of Zimmerman (2000) and Pintrinch (1999). No existing empirical studies have attempted to validate Winne and Hadwin's SRL model for diverse cultural groups other than WEIRD population sample. As illustrated previously, both Confucius's notion of learning and Winne and Hadwin's (1998) SRL theoretical framework place a great emphasis on learners' metacognitive awareness; that is, self-regulated learners actively manage their own learning through monitoring and evaluating and the use of (meta)cognitive strategies (Panadero, 2017). Therefore, it would be theoretically and conceptually appropriate to use Winne and Hadwin's SRL model as the framework to examine Chinese international students' SRL for this study. Adopting an imposed etic approach may provide considerably values as researchers can find similarities (McInerney, 2011; McInerney & King, 2017).

Purpose and Research Questions

McInerney and King (2017) advocated that future SRL research should use (a) multicultural groups to gain insights into the cross-cultural similarities and differences in SRL and (b) more sophisticated statistical analyses to examine whether key constructs of SRL share the same meaning across various cultural groups. This study addresses the call for understanding the sociocultural theoretical account of SRL processes by examining two cultural groups of Chinese international students and Canadian domestic students. That is a critical step to build an

adequate understanding of how to help Chinese international students become self-regulated learners, thereby succeeding in academic settings and beyond in Canada.

Given that there is a need to investigate the influence of culture on SRL, the purpose of this study was therefore to examine and compare Chinese international and Canadian domestic undergraduate students' engagement in SRL processes and academic performance in a Canadian university. Specifically, I aimed to (a) evaluate the measurement invariance of SRL constructs represented by the Regulation of Learning Questionnaire (RLQ; Hadwin, 2009; McCardle & Hadwin, 2015) between Chinese and Canadian students across three time points, and (b) examine Chinese and Canadian students' self-reported engagement in SRL processes across time. As such, this study investigated the following research questions:

1. Is the RLQ valid and reliable to examine the engagement in SRL processes for Chinese international and Canadian domestic students across three time points?
2. Are the latent constructs of SRL captured by the RLQ invariant across two groups of Chinese international students and Canadian domestic students across three time points?
3. How does engagement in SRL processes relate to academic performance for Chinese international and Canadian domestic students over three time points during a semester?

Chapter 3 Methods

This chapter explains the research design and outlines the research methods used in this research study.

Research Context

The research context was a first-year undergraduate educational psychology course – *Learning Strategies for University Success*, at a Canadian university. Students enrolled in this course came from various faculties and disciplines (e.g., Social Sciences, Humanities, Sciences, Business, Fine Arts, Engineering, and Education) and demonstrated a full range of incoming academic performance levels (e.g., GPA). Based on Winne and Hadwin's (1998, 2008) model, SRL was used as a framework for learning about monitoring, evaluating, and optimizing academic learning, behaviour, motivation and emotion, and well-being. Students not only learned the SRL theory from weekly lectures but also actively applied the SRL theory to their other discipline-specific courses through weekly labs. Overall, as a living research community, this course allowed students to actively engage in various graded and non-graded assignments that helped them to collect and interpret their learning data, increase their metacognitive awareness of their learning processes and, subsequently, achieve academic success.

Participants

Participants came from a convenience sample of 676 consenting undergraduate students enrolled in a first-year undergraduate elective course. Among these participants, a subsample of participants was purposively chosen for this research study.

Criteria for inclusion. The selected participants (N = 586; 334 female, 245 male, and 7 not identified) in this study represented a combination of four independent data sets selected from four semesters of course offerings in two consecutive academic years: Fall 2013 (n = 166),

Spring 2014 (*n* = 108), Fall 2014 (*n* = 162), and Spring 2015 (*n* = 150). Ages ranged from 17 through 44 years, and average age was available for 579 participants and consistent with a traditional undergraduate student sample (*M* = 19.12, *SD* = 2.13). 65.7% of participants were in their first year of university. Participants in this study came from various faculties, including Business, Education, Engineering, Humanities, Science, and Social Science; in particular, the largest group were 130 (22.2%) were from Business, and 233 (39.8%) from Social Science.

Of these participants, Chinese international students (i.e., Chinese; *n* = 150; 95 female, 52 males, and 3 not identified) of this study were defined as those who (a) held Chinese citizenships, (b) held study permits, and (c) self-reported that English was not their first languages. Given that the learning beliefs of Chinese learners are profoundly influenced by cultural value systems or cultural models (D'Andrade, 1995; Li, 2003a; Quinn & Holland, 1987) and cannot be easily affected by a short acculturation period (for detailed explanation, see Cheung, Chudek, & Heine, 2011), I decided to include Chinese international students who attended Canadian high schools (*n* = 5). Ages of Chinese students ranged from 17 through 30 years, and the average age of the 147 participants were 19.93 (*SD* = 1.99). The Canadian domestic students' (i.e., Canadians; *n* = 436; 239 female, 193 males, and 4 not identified) inclusion criteria were of those who (a) held Canadian citizenships, (b) self-reported that English was their first languages, and (c) attended Canadian high schools. Ages ranged from 17 to 44 years, with an average age of 18.84 (*SD* = 2.10).

Instruments

Regulation of Learning Questionnaire. The Regulation of Learning Questionnaire (RLQ; Hadwin, 2009) was based on Winne and Hadwin's (1998) model of SRL and designed to be sensitive to time, context, and metacognitive process. This questionnaire assessed

participants' perceptions of actions and strategies specific to key processes and phases associated with SRL.

The RLQ comprised three sections (see Appendix A). In the first section, rather than reporting on what they do generally, learners were instructed to think about a recent challenge that they had faced specifically in their academic learning. Students were asked to (a) provide the name of the course for which they had been studying, (b) describe the task, and (c) describe the challenge they faced with an open-ended text-field.

The second section, students were given an instruction as following "Whenever you study, you balance lots of different goals and intentions to tailor studying to this task and your own needs as a learner. Rate the extent to which you intended to engage each of the following in your study session. *I wanted to…*" Learners responded to five items (i.e., thoroughly understand the task, set good quality goals, monitor my progress, evaluate my progress, and adapt my learning) on a 4-point Likert scale (1 = *not at all,* 2 = *not really,* 3 = *sort of,* and 4 = *yes*). For example, a higher score on monitoring my progress indicated that a learner reported to intend to engage more in monitoring process during a specified study session.

Students were instructed with "Think about the study session when you encountered the challenge you indicated above. Rate the extent to which you actually did each of the following from 1 (not at all) to 4 (yes). Before I got started, I…." The revised RLQ (Hadwin & McCardle, 2020; for detailed items, see Table 1) comprises 29 items targeting 7 sub-scales: (a) Task Understanding (TU; 5 items), (b) Task Value (TV; 3 items), (c) Goal Management (GM; 7 items), (d) Time Management (TM; 3 items), (e) Motivation Appraisal (MA; 2 items), (f) Monitoring (MON; 3 items), and (g) Adaptation (AD; 6 items). Learners responded to items on a 4-point Likert scale (1 = *not at all,* 2 = *not really,* 3 = *sort of,* and 4 = *yes*). For instance, a higher

score on TU indicates that the learner reports engaging more in task understanding during the study session. For the purposes of this study, only the third section of RLQ will be used for the data analysis.

Participants completed the RLQ online as a lab activity first in week 2 (Time 1), in week 6 (Time 2), and week 11 (Time 3) of the semester. Completion of the RLQ was required for a participation mark, but responses were not graded. Immediate feedback was provided for students in the form of a profile of a priori sub-scale scores. Three time points were chosen to reflect students' self-reported SRL processes at the beginning, middle, and end of the semester.

Table 1
The Revised Regulation of Learning Questionnaire

Scale	Item	Label
Task Value (TV)	thought about why I am being asked to know this stuff	TU2
	reflected on why this task is important	TU7
	made a judgment about the usefulness or value of the content	EV14
Task Understanding (TU)	asked myself if I knew what was important	MON1
	made sure I understood terminology used in task instructions	TU4
	thought about the professor's standards for the task	TU5
	considered what knowledge or big ideas I should learn or demonstrate	TU6
	thought about what documents/resources I should use for this task (files, notes, readings)	TU8
Time Management (TM)	checked to see if I was staying on time	EV6
	chose goals that could be completed within a 1-2-hour work session	GO13
	created a timeline or schedule	GO14
Motivation Appraisal (MA)	assessed my feelings for the task	EV8
	evaluated the effort I was putting in	EV9
Goal Management (GM)	set goals for my work	GO9
	identified specific content, ideas, or terms in my goals	GO10
	decided on goals that focused on learning, understanding, or remembering	GO11
	set goals that would be useful for checking on my own progress	GO12
	considered whether my goals were appropriate for the task	EV7
	assessed my goal attainment	EV16
	evaluated my progress toward my goal	EV12
Monitoring (MON)	asked myself if I was understanding the task	MON2
	asked myself if I was remembering	MON3
	asked myself if I was understanding the material	MON4
Adaptation (AD)	changed my understanding of what the task was	AD17
	modified my plans for the task	AD19
	switched to a different strategy or approach	AD20
	changed my feelings about the task	AD21
	altered the level of effort I was putting in	AD22
	modified my beliefs about how well I would do on this task	AD23

Academic performance. To measure academic performance, participants' final grades in ED-D 101 and their semester GPAs on a nine-point scale were obtained. Because ED-D 101 teaches students in self-regulated learning, final grades are considered to reflect self-regulatory knowledge, whereas GPA is considered to reflect participants' university performance.

Procedure

The university's Human Research Ethics Board approved all procedures as part of the SSHRC funded project called "PAR-21: Promoting Adaptive Regulation for the 21st Century" at

the University of Victoria. This study was not expected to pose any significant risks to participants. All students who enrolled in this undergraduate elective course automatically enrolled in this research. Students were provided with a consent letter (see Appendix B) that described the general purpose of the research study at the beginning of the semester and additionally, were given multiple opportunities to withdraw from the research. Students who chose not to participate in this study would sign the letter. Those students' names and corresponding data were removed prior to analysis to ensure confidentiality. Students' participation in this study granted permission for investigators to access their coursework and university records for research purposes.

Instructional Value of the Study

Completion of the RLQ gave students the opportunity to self-assess and identify their own studying strengths and weaknesses. Consciously reporting their own perceived engagement in different SRL processes during studying activities enable students to recognize their learning processes, which in turn enhances students' metacognitive awareness of their own learning, and consequently promoting positive adaptation for their future learning. Therefore, I acknowledged that any self-report about learning, particularly when it is coupled with feedback summaries for learners, serves as a form of metacognitive intervention because it prompts students to think about their engagement in these processes. This is considered as both a limitation and a strength of this study and revisited in the discussion.

Data Analysis

Because the RLQ was used to evaluate students' self-reported engagement in SRL process at the beginning, middle, and end of the semester, responses from three time points were chosen to examine SRL as a dynamic changing construct and validate the RLQ for Chinese and

Canadian students across time. In addition, given that the data was collected from four independent samples (semesters), I tested the extent to which mean scores on the RLQ scale differed across four semesters using a one-way analysis of variance (ANOVA).

Using structural equation modelling (SEM) within the framework of a confirmatory factor analytic (CFA) model is essential to test for measurement and structural invariance in culture-comparative research (Byrne & van de Vijver, 2010). In particular, the measurement invariance testing answers the question of whether the measurement instrument and the measured theoretical construct are operating in the same way across different cultural groups, which ensures the measurement comparability and meaningful interpretations of findings. Therefore, this research study adopted a two-step modelling approach of the multiple-group confirmatory factor analysis (MG-CFA), followed with latent mean difference analysis and correlational analysis.

In sum, this study firstly evaluated whether the RLQ exhibited the same structural characteristic and internal validity between Chinese international and Canadian domestic university students across three time points. This assumption was a prerequisite for the subsequent analysis of external validity, which ensures statistical comparability in a cross-cultural study. Secondly, external predictive validity was tested by examining the correlation between students' self-reported engagement in SRL processes and academic performance for Chinese international and Canadian domestic students across three time points.

Normality and Reliability Check

First, descriptive statistics, normality check, and internal consistency (e.g., mean and standard deviations, values of skewness and kurtosis, and Cronbach's alpha) were conducted to provide information of the RLQ items for Chinese and Canadian groups across three time points.

As DeCarlo (1997) addressed, kurtosis severely affects tests of variances and covariances; correspondingly, given that SEM is based on analysis of covariance structures, the univariate normality check is necessary. I used the cut-off values of skewness and kurtosis ranging from -1.50 to 1.50 considered to approximate a normal distribution (Blanca et al., 2013; Muthén & Kaplan, 1985). However, regardless of whether the distribution of observed variables is univariate normal, the multivariate distribution needs to be checked prior to SEM analyses (Byrnes, 2016). Multivariate normality was examined using Mardia's (1970) normalized estimate of multivariate kurtosis, and estimates values higher than 5.00 were indicative of multivariate non-normality of the sample data.

The information of reliability allows researchers to evaluate (a) the stability of measures administered at different time to the same individuals and (b) the internal consistency of the extent to which sets of items measure the same construct (Kimberlin & Winterstein, 2008). Cronbach's alpha is the most widely used method for estimating internal consistency. Because Cronbach's alpha is a lower-bound estimate, the actual reliability may be slightly higher (Osburn, 2000). Although an acceptable reliability coefficient is considered to be .70 or above (Taber, 2016), a lower reliability at .60 was acceptable in this study.

Confirmatory Factor Analysis (CFA)

I firstly conducted single-group CFAs in Chinese and Canadian groups to evaluate the hypothesized structure of the RLQ across three time points over a semester. The full information maximum likelihood estimation procedure was used as the optimal method for the multivariate data sets where missing data occurs (Leong et al., 2018; Miller, 2011). Evidence of model goodness-of-fit was based on triangulated findings from multiple indices (Bentler, 1990; Hu & Bentler, 1999; Ponterotte et al., 2003; Steiger, 1990), including chi-square/DF (CMIN/DF),

comparative fit index (CFI), the standardized root mean square residual (SRMR), together with its 90% confidence interval (CI) accompanying the root mean square error of approximation (RMSEA). However, due to the commonly recognized restrictiveness of the chi-square statistic and its sensitivity to sample size, I used the following recommendations when assessing model fit: (a) CFI values equal to or higher than 0.90, (b) SRMR lower than or equal to 0.08, and (c) RMSEA lower than or equal to 0.06 (Hu & Bentler, 1999).

Multiple-Group Confirmatory Factor Analysis (MGCFA)

In testing for measurement invariance at this stage, the primary focus is to determine whether the items operate in the same way, and the interpretation of the item content is equivalent across Chinese and Canadian groups. I proceed with multiple-group CFAs for testing measurement invariance between Chinese and Canadian student groups across three time points. Based on Vandenberg and Lance (2000) and Bryne (2013), hierarchical steps in testing measurement invariance were illustrated as following:

Step 1. The initial analysis of invariance was to test configural invariance. The number of factors and the pattern of factor loadings are equivalent across groups, and no equality constraints are specified. Determination of invariance at this step was based on indices of goodness-of-fit to the data. When configural invariance is supported, it indicates that the same latent construct could be indicated by the same manifest observations across groups (Vandenberg & Lance, 2000). In contrast, if configural invariance cannot be established, the likelihood of constructs being qualitatively different is very high, and correspondingly, those constructs cannot and should not be compared (Boer et al., 2018). However, the configural invariance does not mean that the relation of the latent constructs with manifest observations were equivalent across groups, and therefore, subsequent analyses were performed.

Step 2. The metric invariance model with factor loadings constrained to be equal across two groups was tested against the configural model. As such, each item except for the one constrained to 1.00 for purposes of statistical identification was estimated for the first group, and then this value was constrained equal across the comparison group. When metric invariance is confirmed, it indicates that the same latent construct is represented by the same manifest observations in an equivalent manner across groups. That is, I could conclude that the psychological meanings of the measured latent constructs are equivalent across groups (Vandenberg & Lance, 2000). With the metric invariance, correlations of latent factors can be compared across cultures (Boer et al., 2018).

Step 3. This step of invariance examination was to examine scalar invariance by comparing the means of the latent construct. I imposed constraints on both factor loadings and item intercepts to be equal across groups against the metric invariance model. When scalar invariance is supported, it indicates that different groups could exhibit the same mean level of the same latent construct (Vandenberg & Lance, 2000). Establishing scalar invariance warrants valid and meaningful comparisons of mean scores across cultures (e.g., using *t* tests, multivariate ANOVAs, SEM with mean structures; Boer et al., 2018; van de Vijver & Leung, 1997). If the full scalar invariance could not be established, the partial scalar invariance was examined by freely estimating the intercept of the variant items (Byrne et al., 1989). Considering the common and widespread finding of intercept non-invariance, testing for intercept invariance across groups is necessary and critical as to explore and locate sources of noninvariant items (Byrne et al., 1989; Cheung & Lau, 2012) in a cross-cultural study.

According to Leong et al. (2018), using the difference in CFI values might be more appropriate to obtain evidence of noninvariance, rather than chi-square (χ^2) difference value. To

evaluate the invariance between different consecutive models, I examined the difference in CFI values to determine whether the decrease in fit between the latter model and the previous model was substantial, and a $\Delta CFI \leq 0.01$ was indicative of invariance (see Chen, 2007; Cheung & Rensvold, 2002).

Latent Mean Differences

Once the partial scalar invariance was satisfied, I proceed in testing the extent to which there is a statistically significant mean difference between Canadians and Chinese with respect to the latent factor of the RLQ. Byrne (2016) stressed that because the latent factor means have no definite origin when the intercepts of the observed variables are constrained equal, the latent factor means for one group must be fixed to zero. In other words, the test for whether latent factor means for one group differ from those of another can be conducted; however, origins of the measurements and the means of latent variables cannot be statistically identified simultaneously. Correspondingly, one group operates as a reference group (the latent means constrained to zero) against the other group (the latent means freely estimated). Therefore, latent factor means are interpreted in a relative sense. Statistical significance associated with differences between latent means for the reference group and those that are freely estimated for the other group is determined by the z-statistics (critical ratio in AMOS). The cut-off point of critical ratio (CR) > 1.96 or < -1.96 (Byrne, 2016) as indicative of statistically significant latent mean differences.

Correlation

Correlations were conducted to examine and compare how Chinese international students and Canadian domestic students' engagement in SRL processes related their academic performance across three time points.

In summary, descriptive statistics, reliability, and correlation used SPSS Statistics (version 26.0). Confirmatory factor analysis (CFA), multiple-group confirmatory factor analysis (MG-CFA), and latent mean differences were conducted with SPSS AMOS (version 26.0) statistical package. The ANOVA analyses followed by the normality and reliability tests were firstly examined. Tests of measurement invariance were logically conducted in three stages comprising CFA and MGCFA analyses, followed with analyses of latent mean differences analysis across three time points. Correlations between students' self-reported engagement in SRL processes and their academic performance were conducted at last.

Chapter 4 Results

Findings are presented separately corresponding to each step stated in data analysis. With an initial one-way (ANOVA) analysis, the statistically significant differences were found between Spring 2014 and Spring 2015 at time 3 (see Table 2). Tukey post hoc tests indicated that mean scores of TU, TV, GM, TM, and MON from 2014 academic year, particularly the Spring 2015, were significantly lower than the academic year of 2013 (for detailed information, see Appendix C). That may result from random events that possibly influenced students' responses to the RLQ at the end of the Spring 2015 semester. Also, mean score differences for seven subscales at time 1 and time 2 across four independent semesters were not significant. Therefore, all four semester samples were combined for further statistical analyses.

Table 2
One-Way ANOVA at Time 3

Source	Outcome	df	F	*p*
Semester	TU	3	3.937	. 008
	TV	3	4.445	.004
	GM	3	7.416	.000
	TM	3	5.726	. 001
	MON	3	6.215	.000
	AD	3	2.918	.034
	MA	3	2.430	.064

Note. TU = Task Understanding, TV = Task Value, GM = Goal Management, TM = Time Management, MON = Monitoring, and AD = Adaptation, MA = Motivation Appraisal.

Testing for Normality and Reliability

Testing Multivariate and Univariate Normality

Descriptive statistics for each RLQ items including mean, standard deviations, skewness, and kurtosis for Canadians and Chinese students at each time point are presented in appendices D, E, and F. Most RLQ item responses demonstrated evidence of univariate normality based on skewness and kurtosis values for each group and across time. Only item TU8 (*thought about*

what documents/resources I should use for this task) was found to be negatively skewed (-1.64 and -1.96) and kurtotic (2.175 and 3.18) at time 2 and time 3, respectively. Data were also found to be multivariate non-normal for Canadians (13.70, 20.87, and 20.22 at time 1, time 2, and time 3 respectively) and Chinese (13.39, 10.47, and 9.68 at time 1, time 2, and time 3 respectively), according to Mardia's (1970) normalized estimate of multivariate kurtosis (> 5.00).

Testing Reliability

In the combined samples of Chinese and Canadians, Cronbach's α reliabilities were acceptable (Cronbach's αs >.60) for TV, GM, MON, and AD at three time points. TU, TM, and MA showed unacceptable reliabilities (Cronbach's αs < .60; see Table 3). According to Kline (2010), using psychometrically inadequate measures with many measurement errors (i.e., unreliability) can lead to inaccurate results in the analysis of a measurement model, which may further impede meaningful interpretations of cross-cultural similarities or differences findings. Therefore, subscales of TU, TM, and MA with unacceptable reliabilities were not used in further analyses.

Table 3
Reliability of Each Subscale of The RLQ across Time

	Time 1			Time 2			Time 3		
	Canadian	Chinese	All	Canadian	Chinese	All	Canadian	Chinese	All
TV	.62	.43	.60	.68	.41	.62	.65	.61	.65
TU	.41	.51	.43	.52	.52	.51	.60	.62	.60
TM	.54	.56	.56	.58	.65	.61	.48	.53	.50
MA	.44	.39	.43	.51	.49	.51	.52	.33	.47
GM	.79	.78	.80	.83	.80	.83	.83	.77	.82
MON	.68	.54	.66	.62	.59	.61	.64	.53	.62
AD	.71	.73	.73	.70	.74	.72	.77	.72	.77

Note. TV = Task Value, TU = Task Understanding, TM = Time Management, MA = Motivation Appraisal, GM = Goal Management, MON = Monitoring, and AD = Adaptation.

Particularly, Cronbach's alphas were found to be acceptable across time for Canadians, all above .62 for TV, GM, MON, and AD. However, in the Chinese sample, Cronbach's alphas were acceptable (Cronbach's αs > .70) only for GM and AD. As Table 3 showed, the reliabilities

of TV and MON were questionable ranging from .41 to .61 for Chinese across time. However, I decided to keep those two subscales for subsequent analyses, which may provide insights of sources of noninvariant items resulting in low reliabilities for Chinese. As a result, a hypothesized a four-factor-structure model for the RLQ (Figure 1) was obtained.

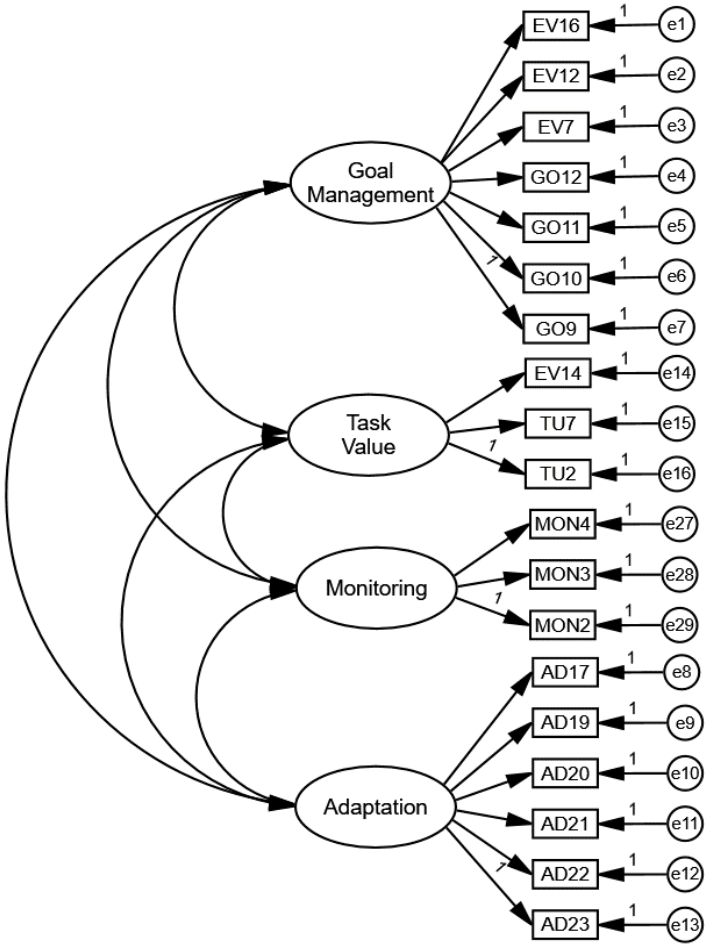

Figure 1. Hypothesized model of factorial structure of the Regulation of Learning Questionnaire for multiple group confirmatory factor analysis

Testing for Measurement Invariance

The full information maximum likelihood estimation procedure was used (AMOS 26.0 statistical program), which is considered as the optimal approach for multivariate data sets with missing data (Feitosa et al., 2017; Millar, 2011). Separate CFAs for the hypothesized four-factor-

structure of the RLQ across Chinese and Canadians at three time points were conducted. In the Canadian sample, initial testing of goodness-of-fit resulted in adequately acceptable fit (see Table 5). In the Chinese sample, goodness-of-fit for the four-factor-structure of the RLQ resulted in a modestly acceptable model fit (see Table 5). However, a somewhat poor model fit for Chinese was found at time 3: $\chi^2_{(146)} = 241.26$, CFI = .831, SRMR = .079, RMSEA = .067, 90% CI [.052, .082].

According to Byrne (2016), CFA post hoc procedures can be conducted to identify item parameters contributing to model misfit using modification indices (MIs) provided in Amos. MIs refer to the value of which approximates to the expected drop in overall univariate chi-square value if the parameter were to be freely estimated in a subsequent run (Byrne, 2016). Nevertheless, in the case of poor model fit for Chinese participants, examination of MIs revealed inconsistent error covariances across time, which may derive from method effects such as item format associated with subscales of the same measuring instrument (Byrne et al., 1989). Also, MIs of the mis-specified model for Chinese were relatively small. Unless the exceptionally large MIs are identified in a mis-specified model, it is not recommended to incorporate error covariances in the model (Byrne, 2016). Moreover, based on the goodness-of-fit indexes, modestly acceptable model fits were found for Chinese at time 1 and time 2. As Byrne (2016) emphasized, obtaining parsimony of the model is the utmost importance in testing multigroup invariance. As a result, I moved on to test the measurement invariance without modifying the hypothesized model for Chinese group.

With respect to latent factor correlations, most of the latent factors were significantly and positively correlated for both Canadians and Chinese at each time point (Table 4). However, at

time 1, AD was not significantly correlated with MON for either group nor was it significantly correlated with TV for Canadians at time 1 or for Chinese at time 3.

Table 4
Latent Factor Correlations for Canadians and Chinese across Time

	Canadians			Chinese		
	TV	GM	MON	TV	GM	MON
Time 1						
TV	–			–		
GM	.42**	–		.33*	–	
MON	.43**	.53**	–	.59**	.47**	–
AD	.13	.22**	.09	.65**	.39**	.21
Time 2						
TV	–			–		
GM	.47**	–		.85**	–	
MON	.40**	.60**	–	.97**	.85**	–
AD	.22**	.29**	.21**	.77**	.78**	.61**
Time 3						
TV	–			–		
GM	.46**	–		.56**	–	
MON	.38**	.55**	–	.44*	.83**	–
AD	.33**	.28**	.21**	.11	.48**	.36*

Note. TV = Task Value; GM = Goal Management; MON = Monitoring; AD = Adaptation.
** $p < .01$; * $p < .05$

Next, I tested the extent to which the hypothesized four-factor-structure of the RLQ was invariant across Chinese and Canadians. As explained in the data analysis, tests for measurement invariance across two groups were conducted in three hierarchical steps. First, I tested for configural invariance. Results supported the configural invariance across Chinese and Canadian groups at three time points as shown that the fit indices met the generally accepted fit criteria (see Table 5). Therefore, the configural invariance model was used as the baseline model against subsequent models. Moving on to step 2, I tested for the metric invariance (i.e., factor loadings) across two groups. Results revealed that loadings for all items of the four-factor-structure RLQ to be fully invariant across Canadians and Chinese (ΔCFI = .006, .003, and .004 at time 1, time 2, and time 3, respectively).

Table 5
Tests for Invariance of the RLQ: Goodness-of-Fit Statistics

Model	χ^2	df	CFI	SRMR	RMSEA	90% CI	Comparison	ΔCFI	Pass?
Time 1									
Canadian	269.332	146	.924	.051	.045	.036, .053	/	/	/
Chinese	214.568	146	.868	.071	.057	.039, .072	/	/	/
A. Configural	486.101	292	.909	.051	.034	.029, .039	/	/	/
B. Full Metric	514.132	307	.903	.051	.034	.029, .040	B versus A	.006	Yes
C. Full Scalar	606.624	326	.869	.051	.039	.034, .044	C versus B	.034	No
C-1. Partial Scalar[a]	538.996	314	.895	.051	.035	.030, .040	C-1 versus B	.008	Yes
Time 2									
Canadian	243.751	146	.944	.043	.040	.031, .049	/	/	/
Chinese	222.272	146	.881	.069	.060	.044, .076	/	/	/
A. Configural	466.023	292	.927	.043	.033	.027, .038	/	/	/
B. Full Metric	486.328	307	.924	.043	.032	.027, .038	B versus A	.003	Yes
C. Full Scalar	591.272	326	.888	.043	.038	.033, .043	C versus B	.039	No
C-1. Partial Scalar[b]	518.803	316	.915	.044	.034	.029, .039	C-1 versus B	.009	Yes
Time 3									
Canadian	257.438	146	.943	.050	.043	.034, .051	/	/	/
Chinese	241.263	146	.831	.079	.067	.052, .082	/	/	/
A. Configural	498.701	292	.918	.050	.035	.030, .041	/	/	/
B. Full Metric	522.681	307	.914	.051	.035	.030, .040	B versus A	.004	Yes
C. Full Scalar	654.643	326	.869	.051	.042	.038, .047	C versus B	.045	No
C-1. Partial Scalar[c]	551.643	317	.906	.051	.036	.031, .041	C-1 versus B	.008	Yes

Note. CFI = comparative fit index; 90% CI = 90% confidence interval; RMSEA = root mean square error of analysis; SRMR = standardized root mean square residual; Latent Mean = Latent Factor Mean Difference Analysis. All χ^2 tests were significant, $p < .001$. [a]In the partial scalar invariance model at time 1, intercepts of items GO10, AD21, AD22, EV14, MON4, MON2, and EV16 were constrained equal. [b]In the partial scalar invariance model at time 2, intercepts of items GO10, AD21, AD22, EV14, MON4, MON2, EV16, MON3, EV12, and GO11were constrained equal. [c]In the partial scalar invariance model at time 3, intercepts of items EV16, EV12, AD19, AD20, AD22, AD23, EV14, TU2, MON4, and MON2 were constrained equal.

My final test of measurement invariance examined the scalar invariance of item intercepts. However, full scalar invariance was not supported across time (see Table 5), and subsequently, partial scalar invariance was conducted. Nevertheless, there is a limited discussion of the specific criterion regarding the minimal number of invariant items required to establish partial scalar invariance, and standards of the establishing partial measurement invariance vary in the current literature (Byrne et al., 1989; Cheung & Lau, 2012; Putnick & Bornstein, 2016; Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000). For instance, Cheung and Lau (2012) argued that identifying the number of invariant items is more critical than the number of identified noninvariant items; then, authors recommended that a majority of items (more than

half) identified as invariant is acceptable. However, according to other researchers (see Byrne et al.,1989; Steenkamp & Baumgartner, 1998), a minimum of two items, including the reference indicator, must be invariant before researchers can make meaningful comparisons across groups. In sum, I argue that it is critical to investigate and understand the situations in which invariance fails; that is, identifying noninvariant items is necessary to fully understand the measurement invariance at the item-level in a cross-cultural study (Cheung & Lau, 2012; Feitosa et al., 2017). I decided to investigate measurement items individually as sources of scalar non-invariance. Additionally, I adopted Byrne et al.'s (1989) criterion that obtaining at least one invariant item in each factor is necessary to establish partial scalar invariance.

I constrained each item intercept to be equal across groups, and the rest of items are freely estimated, one at a time. High ΔCFIs with nonoverlapping RMSEA CIs were indicative of noninvariant items and considered to be varied. This strategy was used to examine partial scalar invariance at three time points separately. Detailed information of tracing noninvariant item intercepts and the establishment of partial scalar invariance are provided in Appendices G, H, and I. As a result, I identified 12 intercepts (63%) at time 1, 8 intercepts (42%) at time 2, and 9 intercepts (47%) at time 3 that differed across Chinese and Canadian groups (Table 6). Freeing intercept equality constraints for identified noninvariant items supported the partial scalar invariances across three time points (see Table 5).

Table 6
Noninvariant Item Intercepts for Partial Scalar Invariance Models at Time 1, Time 2, and Time 3

Scale	Item	Label	Time 1	Time 2	Time 3
TV	thought about why I am being asked to know this stuff	TU2	X		
	reflected on why this task is important	TU7	X	X	X
	made a judgment about the usefulness or value of the content	EV14			
GM	set goals for my work	GO9	X	X	X
	identified specific content, ideas, or terms in my goals	GO10			X
	decided on goals that focused on learning, understanding, or remembering	GO11	X	X	X
	set goals that would be useful for checking on my own progress	GO12	X		X
	considered whether my goals were appropriate for the task	EV7	X	X	X
	assessed my goal attainment	EV16			
	evaluated my progress toward my goal	EV12	X		
MON	asked myself if I was understanding the task	MON2			
	asked myself if I was remembering	MON3	X		X
	asked myself if I was understanding the material	MON4			
AD	changed my understanding of what the task was	AD17	X	X	X
	modified my plans for the task	AD19	X	X	
	switched to a different strategy or approach	AD20	X	X	
	changed my feelings about the task	AD21		X	X
	altered the level of effort I was putting in	AD22			
	modified my beliefs about how well I would do on this task	AD23	X		

Note. GM = Goal Management; AD = Adaptation; TV = Task Value; MON = Monitoring.

Testing for Latent Mean Differences

Although full scalar invariance was not supported, Byrne et al. (1989) argued that mean differences are still meaningful with the establishment of partial scalar invariance when at least one item is invariant in each factor. Based on my findings from testing measurement invariance, all four factors met Byrne's (1989) suggested criteria across time. Therefore, I tested the extent to which there were statistically significant mean differences between Chinese and Canadians with respect to four latent factors of the RLQ across three time points. For my case, the latent factor means of the RLQ for Chinese as a reference group were set to be zero, whereas the latent

factor means of the RLQ for Canadians as a comparison group were freely estimated. Statistical significance is determined on the basis of z-statistic (i.e., CR values), where significant positive values indicated higher levels of the latent factor than the reference group, significant negative values indicated lower levels of the latent factor than the reference group, and nonsignificant values indicated latent mean invariance between groups.

As shown in table 7, Canadian students demonstrated significantly lower latent means on all four factors than Chinese students at time 1. Canadian students had significantly lower latent mean on AD than Chinese students, and there was no significant difference of latent means on TV, GM, and MON between Chinese and Canadian students at time 2. Canadian students had significantly lower latent means on TV, GM, and AD than Chinese, and there was no significant difference of the latent mean on MON between Chinese and Canadian students at time 3.

Table 7
Factor Means of the RLQ for Chinese Compared with Canadians

Factor	Estimate	*SE*	CR	*p*
Time 1				
Task Value	-.313	.121	-2.591	.010
GM	-.216	.061	-3.533	.000
Monitoring	-.207	.058	-3.546	.000
Adaptation	-.162	.067	-2.401	.016
Time 2				
Task Value	.137	.085	1.613	.107
GM	-.130	.066	-1.974	.048
Monitoring	.068	.056	1.219	.223
Adaptation	-.239	.069	-3.467	.000
Time 3				
Task Value	-.229	.095	-2.412	.016
GM	-.247	.062	-3.959	.000
Monitoring	-.014	.045	-.314	.753
Adaptation	-.325	.065	-5.031	.000

Note. Factor mean estimates are for the Canadian group (the Chinese group served as a reference group with a factor mean constrained as a zero); *SE* = standard error; CR = critical ratio. All latent mean comparisons were conducted based on the partial scalar invariance.

Correlations between SRL and Academic Performance

To examine how engagement in SRL influenced academic performance for Canadians and Chinese across time, correlations between the latent constructs of SRL and academic performance (i.e., final course grade and semester GPA) were conducted (for detailed information, see Appendix J). For Canadians, results showed that goal management at time 2 and time 3 was associated with course grade (r = .11 and r = .12, p < .05, respectively) and significantly correlated with semester GPA (r = .14 and r = .16, p < .01, respectively); monitoring at time 2 was moderately associated with semester GPA for both Canadians (r = .12, p < .05). However, for Chinese, only monitoring at time 2 was associated with students' semester GPA (r = .19, p < .05).

Chapter 5 Discussion

Given the paucity of research examining the influence of culture on SRL, the purpose of this study was to examine and compare Chinese international and Canadian domestic undergraduate students' self-reported engagement in SRL processes and academic performance. Rather than measuring SRL as a relatively enduring attribute, this study employed the RLQ (Hadwin & McCardle, 2020) to measure SRL as a dynamic learning process that unfolds over time in context as an event. Specifically, I aimed to (a) evaluate the measurement invariance of SRL constructs represented by the RLQ between Chinese and Canadian students across three time points, and (b) examine Chinese and Canadian students' self-reported engagement in SRL processes across three time points. This chapter discusses (a) major findings for each research question, (b) limitations of this study and opportunities for future research, and (c) contributions to theory, research, and practice.

Reliability and Validity of the RLQ for Chinese International and Canadian Domestic Students across Time

Based on the initial analysis of reliability of the RLQ, three subscales of the RLQ (task understanding, time management, and motivation appraisal) showed unacceptable reliabilities for Chinese and Canadian students across three time points, which indicated that sets of items did not measure the same construct. For example, two items of motivation appraisal (EV8 – *assessed my feelings for the task* and EV9 – *evaluated the effort I was putting in*) may not adequately measure students' evaluations of motivation, where item EV8 may target on students' emotions toward the task, and item EV9 may assess student's effort regulation. Notably, although task understanding was not reliable across time, its reliabilities increased across three time points over a semester. According to Hadwin and Winne (2012), accurately understanding academic tasks

requires learners to assemble information from multiple sources explicitly, implicitly, and in social contexts, which is foundational for setting goals, making strategic plans, and metacognitively adapting to an academic task. However, the complexity of gaining an adequate task understanding poses challenges to university students. Therefore, it takes time for students to gradually develop an accurate understanding of any assigned academic task. This gradual process could explain the increased reliability of task understanding over time, where students recognized the importance of certain item questions later. Nevertheless, as Hadwin and Winne (2012) pointed out, there is a limited research in how task understanding plays its role in learning skills instruction. This limitation stresses a need to further investigate the effects of task understanding on students' development of SRL competency, which may benefit for students with challenges in assessing various features of academic tasks. In sum, considering that scores of the RLQ was given to students to interpret and recognize their engagement in SRL processes, and a high value of alpha is desirable when an instrument is used to assign a score to an individual (Cronbach, 1951), an evaluation of the reliability of these three subscales, task understanding, time management, and motivation appraisal, was necessary for future studies.

Also, based on my findings, reliabilities of task value and monitoring were not satisfactory for Chinese students. Particularly, Chinese international students may not fully understand certain items due to abstract meanings of English words translated into Chinese, such as "stuff" in the item TU2 in task value (*thought about why I am being asked to know this stuff*). Another possible explanation for the low reliability of task value and monitoring might be due to a limited number of items in each subscale. However, unsatisfactory reliability of these two subscales for Chinese students requires a further investigation, possibly with an exploratory factor analysis to see whether a resemblance in factor structure could be obtained.

Evaluating the validity of a four-factor-structure of the RLQ for Chinese and Canadian students separately across three time points, I found adequately acceptable model fits of a four-factor-structure of the RLQ for Canadian students. However, modestly acceptable model fits were found at time 1 and time 2 but a poor model fit at time 3 for Chinese students. The lack of goodness-of-fit for Chinese students indicated that the four-factor-structure of the RLQ may not be valid to examine Chinese students' engagement in SRL processes, which in turn suggested that a cross-cultural difference in SRL may exist. I postulated that a lack of validity of the RLQ for Chinese students may result from a lack of reliability in task value and monitoring, given that validity of a measurement requires reliability, but a measurement can be reliable without being valid (Kimberlin & Winterstein, 2008). These results corroborate the ideas of Tong et al. (2019), who suggested that translating, adapting, and validating of an SRL questionnaire established in Western cultural contexts are necessary to generate a valid and reliable instrument that accurately describes and measures SRL that fit in a specific cultural group.

Measurement Invariance of the RLQ across Chinese International and Canadian Domestic Students across Time

Testing of The Measurement Invariance

Findings supported the configural invariance across Chinese and Canadian students at three time points, indicating that similar latent constructs were present in two cultural groups. The success of establishing the configural invariance demonstrated that Chinese and Canadian students conceptualized SRL similarly, as reflected by four factors – task value, goal management, monitoring, and adaptation. Findings also supported the metric invariance across Chinese and Canadian students at three time points, which indicated that the four-factor-structure of the RLQ was invariant across the two groups. In other words, the psychological meaning of

the measured latent constructs – task value, goal management, monitoring, and adaptation – were attributed equivalently by Chinese and Canadian students.

Although the scalar invariance was not supported, I established the partial scalar invariance across three time points based on Byrne et al.'s (1989) criterion of obtaining at least one invariant item in each factor. Some researchers (e.g., Cheung & Lau, 2012; Steenkamp & Baumgartner, 1998) suggested that ideally more than half of items on a factor identified as invariant is acceptable. Nevertheless, no empirical evidence existed to support these guidelines (Putnick & Bornstein, 2016). Considering that a limited study explored the extent to which the SRL construct and its measurement was theoretically and operationally equivalent across cultural groups, this study was rather exploratory in nature. Therefore, I argued that investigating sources of measurement items that failed the measurement invariance of the RLQ was more important than adopting a strict guideline to establish the partial scalar invariance. Such an explorative approach allowed us to investigate cultural differences of the RLQ explicitly at the item-level.

Among 19 items of the four-factor-structure of the RLQ, I identified different numbers of noninvariant items across Chinese and Canadian students at each time. Also, I found that noninvariant items varied across time, which indicated that students' interpretations of the RLQ items could be influenced by the dynamic interplay between learners' characteristics, tasks, sociocultural contexts, and time. This finding was aligned with Winne's (1997) COPES model, where external (e.g., task, time, and context) and internal conditions (e.g., learners' cognition, motivation, and beliefs) may potentially affect how learners to engage in a learning task and evaluate their engagement in SRL processes. Nevertheless, almost half of the RLQ items were identified as noninvariant at each time point. This finding suggested that latent factors of task value, goal management, monitoring, and adaptation did not operate in the same way for Chinese

and Canadian students, albeit that the conceptual understandings of these latent factors were equivalent across the two groups. This result may also explain the lack of fit of the RLQ for Chinese students.

Upon closely examining the intercepts, I found five items to be consistently noninvariant across three time points: TU7 (*reflected on why this task is important*), GO9 (*set goals for my work*), GO11 (*decided on goals that focused on learning, understanding, or remembering*), EV7 (*considered whether my goals were appropriate for the task*), and AD17 (*changed my understanding of what the task was*). GO9, GO11, and EV7 all related to goal management, which suggested that these items as indicators of goal management could be different between Chinese and Canadian students. These items targeted on the explicitness of goals focusing on learning, understanding, remembering, or the task. As Li (2013) proposed, Chinese learners may not set their learning goals explicitly and measurably because they emphasize virtues in learning as a goal. In other words, regardless of whether Chinese learners achieve their goals set for a specific task, displaying virtues, such as sincerity, diligence, and endurance of hardship, may be a highly motivating goal in learning. Therefore, to Chinese learners, learning does not merely represent an academic pursuit but more importantly, serves as a moral and social striving that enables them to achieve self-perfection throughout the journey of learning (Li, 2006, 2013). For example, Li (2006) found that when Chinese adolescents were asked to describe their goals of learning with an open-ended question, five goals, including aspiration, cognitive development, social contribution, socioeconomic advancement, and moral growth were the most common. Another noninvariant item TU7 – *reflecting why this task is important* between Chinese and Canadian students may reflect the same virtuous goals. As for the noninvariant item AD17 (*changed my understanding of what the task was*), Chinese students may not adequately

understand this item because the word “change” could mean a discontinuity or separation from previous learning for Chinese. Chinese learners inherit a strong principle that learning is a cumulative process demanding consistent reflection and review of the old to gain new insight. Hence, for Chinese students, the word “change” placed in the context related to task understanding may not effectively reflect the continuity of learning, or “changed my understanding of what the task was” may be too abstract to obtain an adequate understanding.

In addition, I located five items that were invariant for Chinese and Canadian students across three time points, including EV14 (*made a judgment about the usefulness or value of the content*), EV16 (*assessed my goal attainment*), MON2 (*asked myself if I was understanding the task*), MON4 (*asked myself if I was understanding the material*), and AD22 (*altered the level of effort I was putting in*). These items reflected the importance of monitoring and evaluating (e.g., making judgements of task utility, assessing goal attainment, and monitoring task understanding) for Chinese and Canadian students’ learning process, which supported my argument that both Chinese notions of learning and Western SRL models acknowledge the importance of monitoring and evaluating in learning.

Testing of Latent Mean Differences

After the partial scalar invariance was established, I assessed the latent mean differences of the RLQ across Chinese and Canadian students. Evidence for scalar invariance is critical for the extent to which latent mean differences between groups reflect differences in the latent underlying construct rather than differences at the item-level (Whisman & Judd, 2016). Because I only established partial scalar invariance across the two groups at each time point, my results must be interpreted cautiously.

Based on my findings, Canadian students had significantly lower engagement in SRL processes than Chinese students with respect to task value, goal management, monitoring, and adaptation at time 1. Nevertheless, more than half of items were identified as noninvariant at time 1, indicating that latent mean differences between the two groups might just reflect differences varying from item to item in each factor, rather than differences in the latent constructs across Chinese and Canadian students. Similar interpretations can be applied to findings of significant latent mean differences of adaptation at time 2 and goal management at time 3 between Chinese and Canadian students, given that a majority of items related to these two factors was identified as noninvariant.

I also found that when approaching to the end of the semester at time 3, Canadian students showed lower engagement in SRL processes than Chinese students, with respect to task value and adaptation. In other words, compared with Canadian students, Chinese students tended to focus on reflecting on the reason of engagement in an academic task (i.e., task value) and simultaneously making adaptation to approach an academic task at the end of the semester. This result further supports the notion that Chinese learners emphasize persistence and effort in learning as to improve academic performance. Research studies did show that Chinese students put more effort into school and persisted longer after failure than Western students (Heine et al., 2001; Rosenthal & Feldman, 1991). Nevertheless, instrumental bias, particularly response bias, could also explain this finding. Past empirical research indicates that people from different cultures express different patterns of response to instruments with a Likert-type scaling format (Byrne & Watkins, 2003; Hui & Triandis, 1989; Smith et al., 2016). Specifically, participants may select scale points either consciously or unconsciously to convey a favorable impression of themselves (e.g., social desirability). This was evidenced in collectivism cultures where people's

responses to questions were more likely to be influenced by others (Smith et al., 2016). Given that this research study was situated in a university course, and the completion of the RLQ was one of the lab assignments, Chinese students may show a strong tendency to choose higher scale points (3 = *sort of* or 4 = *yes*) than lower scale points (1 = *not at all* or 2 = *not really*) to express their active engagement in learning in order to please their teachers (either lab instructors or lecturers). Yet, some studies showed that excluding or omitting a midpoint in response scales can minimize social desirability bias when respondents are likely to show satisfying behavior or under strong social desirability pressures (for a review, see Chyung et al., 2017; Garland, 1991).

Relations between SRL and Academic Performance for Chinese International and Canadian Domestic Students across Time

As Dimitrov (2010) suggested, based on the metric invariance, "the relations between the latent factor and external variables can be compared across groups because a one-unit change in one group would be equal to one-unit change in any other group" (p. 124). Therefore, the established metric invariance warranted meaningful comparisons of relations between students' engagement in SRL processes and academic performance between Chinese and Canadian students. My findings showed that goal management was slightly associated with academic performance for Canadian students at time 2 and time 3, which supported that setting academic goals was important for Canadian students regarding course grade and semester GPA. Goal setting, the second phase of Winne and Hadwin's (1998) model of SRL, is critical for effective and efficient task enactment and monitoring. Constructing academic goals help learners to create self-defined standards to metacognitively evaluate and monitor their learning processes (Hadwin & Webster, 2013). However, as for Chinese students, I did not find any significant correlation between goal management and academic performance for Chinese students. This finding again

confirmed that Chinese learners may find goals that contain learning virtues or moral growth more relevant to learning outcomes, such as course grade or GPA. In addition, monitoring was shown to be associated with semester GPA for Chinese students at time 2. Notably, items of the monitoring factor, including understanding and remembering, could effectively capture the way of how Chinese students monitored their learning processes. As Pratt et al. (1999) and Kember (2000) found, Chinese students tended to emphasize memorization and understanding through multiple continuous stages during their learning.

Overall, significant correlations between engagement in SRL processes and academic performance for Chinese and Canadians were absent in this study. A possible explanation for this finding might be that semester GPA and course grade may not truly reflect students' academic performance, and thus, other outcome measurements, such as academic engagement, self-efficacy, and perceived GPA, should be considered for future studies. In cross-cultural research studies, researchers should also be cautious with selected outcome measurements as students with diverse learning backgrounds may define academic achievement or success differently. Another possible explanation for this is that the process of developing SRL competency takes time and effort as it requires learners to proactively engage in (a) developing learning skills across various phases of learning, (b) strategically making tactic choices with adequate task understanding and studying goals, and (c) metacognitively monitoring, evaluating, and regulating learning processes (Hadwin & Winne, 2012). That being said, students, though enrolling in an educational psychology course that taught the science of learning and motivation, may not effectively apply what they learned about SRL to other disciplinary courses that they were taking in the same semester. Therefore, using a longitudinal data that extends the length of

one semester (i.e., four months) is necessary to detect whether SRL influences students' academic performance.

Lastly, I emphasized the adaptive nature of SRL as a dynamic process unfolding over time in contexts. However, using correlational analysis to examine how SRL influenced academic performance limited understanding of how students' SRL evolved or changed over time in order to predict students' academic performance. Therefore, it is important for future research to conduct longitudinal research to document how learners develop SRL over time and how SRL affect students' academic success over time.

Limitations

While the current study bridges the gap of the current literature regarding culture and SRL, the study is not without limitations, which provides opportunities for future research.

Sample Size

In this study, the sample size for Chinese students was not sufficiently large (N = 150). Research has shown that there is a need for sample sizes to be at least approximately 200 in SEM analyses because a smaller sample size has a greater chance to obtain a multivariate nonnormal dataset (Hoogland & Boomsma, 2016). This could explain why the four-factor-structure of the RLQ did not adequately fit for Chinese students across time. However, I did find a considerable number of noninvariant items across the two groups, which indicated that there might be a cross-cultural difference in perceiving survey items of the RLQ. Therefore, it might be difficult to draw a conclusion whether an inadequate fit of the four-factor-structure of the RLQ was due to sample size or a cross-cultural difference in SRL. As a result, future research should incorporate a large sample size in SEM analysis to eliminate an ambiguous explanation of findings.

Moreover, using CFI in testing measurement invariance may be less powerful if the groups under comparison are of unequal sample size (Cheung & Lau, 2012), which was the case for this study. Chen (2007) found that using changes in CFI, RMSEA, and SRMR are most powerful when the sample sizes are equal than when the sample sizes are unequal across groups. Cheung and Lau (2012) argued that when the groups being compared have unequal sample sizes, the one with the larger size will exert a greater influence on the parameter estimation process of the constrained model. Therefore, obtaining an equal or at least similar sample size across examined groups should be considered in future comparative research studies.

Using Self-Report to Examine SRL

In this study, I acknowledged that using self-report to evaluate students' engagement in SRL processes provide opportunities for students to enhance their metacognitive awareness of their own learning. Nevertheless, as Winne (2010) addressed, measuring SRL before or after learning sessions may not capture the essence of SRL as an adaptive behaviour rather as a static state. Also, one's beliefs or values may not be accurately retrieved or accessible to one's conscious reflection (Markus & Kitayama, 2010; Bjork et al., 2013), and thus, students may not accurately reflect on how they actually engaged in SRL processes during a specific study session. As a result, it is important for future research to employ multiple methods and collect different types of data to examine cross-cultural differences of SRL, which can provide a holistic picture of how students engage in SRL processes.

Moreover, given that questionnaires are usually structured within the framework of a Likert-type scaling point, it is highly possible that item scores rated by some cultural groups could be biased (Byrne & Watkins, 2003). In this study, Chinese and Canadian students might show a different response style to the Likert scale. As was discussed earlier, Chinese students

could take advantage of completing the RLQ to show that they were actively engaging in their learning by selecting higher scale points. Hui and Triandis (1989) stated that a cross-cultural difference in selecting the scale points of a Likert scale may affect the factor analysis of an instrument, which could sway the conclusions regarding the cross-cultural invariance of an instrument. Thus, it is important for future comparative research to carefully choose a Likert-type scale to reduce the response bias. In addition, while some researcher argued that using a four-point Likert scale could reduce the social desirability bias (e.g., Garland, 1991), some studies showed that a response scale without a midpoint may affect an instrument's validity and reliability (Chyung et al., 2017). Given the inconsistent findings of the use of a midpoint on the Likert scale, Chyung et al. proposed that researchers or survey designers should consider the following criteria when choosing a response scale: (a) being easy to use, (b) being quick to use, and (c) allowing respondents to adequately express their emotions or opinions sufficiently; subsequently, the authors recommended to use 5- or 7-point scales based on their reviewed studies.

Another limitation of using self-report in this study derives from item bias, which refers to distortions at the item level (Byrne & Watkins, 2003). My findings demonstrated that a large number of the RLQ items elicited differential meaning of their content across Chinese and Canadian cultures. Also, it might be difficult for Chinese international students to effectively capture the exact meanings of certain items in English, albeit that Chinese international students met university requirements of English language proficiency. Therefore, when assessing SRL engagement of learners from different cultures other than Canadian cultures, a cross-cultural modification of the RLQ items that may contain ambiguous meanings might be necessary in future research.

Generalizability

Participants in this study came from an undergraduate elective course, which focused on the science of learning and motivation using Winne and Hadwin's (1998) SRL model as the framework. Because all participants, including Chinese international students and Canadian domestic students, received the same training on developing SRL competency, they may share similar understandings of SRL measured by the RLQ, regardless of their cultural differences in learning beliefs. This shared knowledge of SRL may potentially lead students to answer the RLQ in a similar way, which could explain the obtained measurement invariance of the RLQ. In addition, this study's results may not be generalized to students who have not enrolled in this university course. These limitations warrant a need to replicate this study with students who have not received any training on SRL to see whether the measurement invariance of the RLQ could be obtained. Additionally, participants came from a Canadian university, which limited my findings to only university students. Given that learning contexts are significantly different between Canada and China, Chinese students studying in a Canadian university may not be representative of Chinese students studying in China.

Although this study drew samples from Western and Eastern cultures to address the call made by Henrich et al. (2010) about using WEIRD population in psychological research, samples of this study still largely represented a population that was educated, industrialized, and rich. Not only is SRL essential for university students' academic success, but also people with diverse backgrounds can significantly benefit from SRL to flourish in all kinds of learning. Hence, large-scale cultural studies that include more diverse samples and move beyond using WEIRD population are needed to address this limitation.

Contributions

Contributions to Theory

This thesis study contributes to theory in two major ways. First, I attempted to investigate the universality of SRL across Chinese and Canadian cultures by thoroughly reviewing and systematically comparing the extant literature of Chinese and Western theoretical understandings of SRL, along with critically reviewing the current empirical research regarding culture and SRL. Taking an emic approach to examine cross-cultural similarities and differences in the extant literature from bottom-up was a unique contribution of this study. I was also the first to argue that Chinese notion of learning is theoretically well aligned with many components of Winne and Hadwin's (1998) model of SRL, emphasizing SRL as a life-long, proactive, and metacognitive process that is socially situated. That is, this study attempted to address the possible universality of conceptual understanding of the psychological construct of SRL with samples of Chinese students studying in a Canadian university and Canadian domestic university students. Nevertheless, the nature of this research was exploratory, and hence, it is important for future research to examine whether the proposed universal conceptualization of SRL can be supported with empirical evidence.

Second, given that cross-cultural differences of four latent factors of SRL were found at the item-level, this finding suggested that students with different sociocultural experiences tend to express differences in SRL processes at the operational level. When using SRL models and measurements developed and validated in the West in a cross-cultural study, researchers must be cautious about whether indicators (survey items) of the SRL questionnaire reflect the same underlying latent constructs of SRL cross-culturally. For example, this thesis addressed a key area that may not have been explored in SRL research is how morality influences the

development of SRL competency. The absence of moral striving through learning, particularly in Western learning context, might explain why using SRL instruments established in the West could not capture how Chinese learners effectively and metacognitively regulate their learning. This issue is evidenced in this study as well as Li et al.'s (2019) meta-analysis. A future study with more focus on the effects of morality on SRL is therefore suggested.

Overall, this research study warrants the necessity of conducting cross-cultural research in SRL to gain insights into the cross-cultural similarities and differences in SRL. More importantly, to fully understand how culture influences SRL, using a bottom-up emic approach, starting with qualitative research, is essential for future research to uncover particular ways that different cultural groups self-regulate their learning for future research. By doing so, the universals of self-regulated learning can be achieved (McInerney & King, 2017).

Contributions to Research

This study contributes to research in three major ways. First, I addressed the call made by McInerney and King's (2017) review study of culture and SRL to adopt an advanced statistical method to examine SRL in a cross-cultural study. This study is the first to evaluate the psychometric properties of the RLQ based on Winne and Hadwin's (1998) SRL model. In addition, this study emphasized the importance of identifying noninvariant items to understand why the measurement invariance failed across the two cultural groups. This contributed greatly to the current literature since no existing empirical study paid attention to multigroup measurement invariance of SRL or investigated explicitly why an SRL instrument failed its measurement invariance across cultural groups.

Second, to be consistent with the essence of SRL defined as a dynamic process unfolding over time, this study evaluated the RLQ by using longitudinal data and examined its

measurement invariance across time. I found variations of noninvariant items of the RLQ across time, in turn affirming that SRL is a dynamic changing construct under different sociocultural conditions. It would have added strengths to this study if changes of students' engagement in SRL across time were examined, which should be addressed for future research.

Third, the RLQ was shown to hold strong psychometrics properties to appropriately use with Canadian domestic students. This result adds the confidence in using the RLQ to provide useful feedback for Canadian students to develop a strong metacognitive awareness of their learning processes and promote positive adaptation for their future learning. Weak reliability and validity of the RLQ for use with Chinese international students, could be (a) an artifact of a small sample size, (b) an indicator that the instrument is not culturally appropriate, or (c) an indicator that item wording is not culturally transparent. Certainly, whether the RLQ is appropriate to use with Chinese students needs to be examined with larger sample sizes in future studies.

Contributions to Practice

My study demonstrated that students with diverse cultural backgrounds may operate SRL in different ways. The importance of this finding addresses the need for educators to be aware of the complex dynamic interplay between culture and SRL. In other words, a meaningful engagement in SRL or a high-quality of learning may appear differently between the East and the West, and therefore, an effective teaching requires educators to consider learners with different learning beliefs, approaches, and emphasis. Then, intervention programs focusing on designing culturally relevant curriculum content and developing SRL competency to support diverse cultural learners' learning experiences can be effective in Canadian educational settings. Moreover, SRL is essential for students' academic success because self-regulated learners metacognitively monitor and evaluate their learning process in order to effectively adapt to

various challenges in learning. My study recommended that implementing self-report questionnaires of SRL during the learning process can promote students' self-awareness of their engagement in various stages of SRL. As the Government of Canada has recently announced to increase immigrants to support economic recovery due to the COVID-19 pandemic (IRCC, 2020), it is likely to increase the cultural diversity in Canada. Therefore, I advocate the importance of continuously investigating the cultural influence on many essential components of SRL to support not only educators in Canada but also learners with different cultures to improve the quality of learning experiences.

Conclusion

This thesis study aimed to fill a gap in the literature of how culture influences SRL and provide a holistic picture of how Chinese learners engage in learning, given a lack of research in this area. To achieve this purpose, I examined and compared Chinese international and Canadian domestic university students' engagement in SRL processes and academic performance through (a) a thorough and critical review of Winne and Hadwin's (1998) model of SRL and literature on Chinese notion of learning and (b) an advanced statistical analysis (MGCFA) to evaluate the measurement invariance of SRL constructs represented by the RLQ (Hadwin & McCardle, 2020). The results of this study supported essential components of SRL, including task value, goal management, monitoring, and adaptation, were conceptually equivalent across Chinese and Canadian students. However, differences were found at the item-level, which indicated a cross-cultural difference in the operation of SRL. Furthermore, significant correlations between students' reported engagement in SRL processes and academic performance were not found. Nevertheless, the sample size was rather limited and small, thereby findings being interpreted with caution. Despite its exploratory nature and limitations, this research has been one of the first

attempts to thoroughly examine the relation between culture and SRL. Future research needs to examine more closely the links between culture and SRL.

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Appendices

Appendix A

The Original Regulation of Learning Questionnaire

SECTION 1: Think of a recent challenge you have faced in your academic learning. When you answer the questions throughout this questionnaire, think about that specific challenge. (open-ended questions)

Q1. What was the course?
Q2. Describe the task.
Q3. Describe the challenge you faced.

SECTION 2: Whenever you study, you balance lots of different goals and intentions to tailor studying to this task and your own needs as a learner. Rate the extent to which you intended to engage each of the following in your study session. *I wanted to*…

Q1. thoroughly understand the task.
Q2. set good quality goals.
Q3. monitor my progress.
Q4. evaluate my progress.
Q5. adapt my learning.

SECTION 3: Think about the study session when you encountered the challenge you indicated above. Rate the extent to which you actually did each of the following from 1 (not at all) to 4 (yes). Before I got started, I…

Scale	Item	Label
Task Understanding	considered what I was being asked to know	TU1
	thought about why I am being asked to know this stuff	TU2
	identified what I need to learn or demonstrate	TU3
	made sure I understood terminology used in task instructions	TU4
	thought about the professor's standards for the task	TU5
	considered what knowledge or big ideas I should learn or demonstrate	TU6
	reflected on why this task is important	TU7
	thought about what documents/resources I should use for this task (files, notes, readings)	TU8
Goal Management	set goals for my work	GO9
	identified specific content, ideas, or terms in my goals	GO10
	decided on goals that focused on learning, understanding, or remembering	GO11
	set goals that would be useful for checking on my own progress	GO12
	chose goals that could be completed within a 1-2-hour work session	GO13
	created a Timeline or schedule	GO14
Monitoring	asked myself if I knew what was important	MON1
	asked myself if I was understanding the task	MON2
	asked myself if I was remembering	MON3

	asked myself if I was understanding the material	MON4
Evaluating	reflected on the way I did the task	EV5
	checked to see if I was staying on time	EV6
	considered whether my goals were appropriate for the task	EV7
	assessed my feelings for the task	EV8
	evaluated the effort I was putting in	EV9
	appraised my level of understanding	EV10
	considered feedback	EV11
	evaluated my progress toward my goal	EV12
	appraised my memory/recall of the information	EV13
	made a judgment about the usefulness or value of the content	EV14
	appraised the effectiveness of the strategies I was using	EV15
	assessed my goal attainment	EV16
Adaptation	changed my understanding of what the task was	AD17
	adjusted my goal(s)	AD18
	modified my plans for The Task	AD19
	switched to a different strategy or approach	AD20
	changed my feelings about The Task	AD21
	altered the level of effort I was putting in	AD22
	modified my beliefs about how well I would do on This Task	AD23

Appendix B

Department of Educational Psychology & Leadership Studies

Participant Letter of Information

Technology Integration and Evaluation Research Lab

Participant Consent Form

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

Purpose of the research

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

Participation in this research involves:

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

Participation is voluntary: You can withdraw at anytime

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

Data will be confidential even though coursework is not anonymous

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

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

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

Contacts

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

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

This research (*Evaluating Student Learning and the ED-D 101 Course)* is led by Dr. Allyson Hadwin (Principal Investigator) and funded by the Social Sciences and Humanities Research Council of Canada (SSHRC-INE grant) and the Canadian Foundation for Innovation (CFI-LOF).

Appendix C

Mean scores and standard deviations of each sub-scale of the RLQ across time

Factor	Semester	Time 1		Time 2		Time 3	
		Mean	SD	Mean	SD	Mean	SD
TU	Fall 2013	3.25	0.38	3.39	0.42	**3.48**	**0.46**
	Spring 2014	3.25	0.46	3.46	0.46	**3.48**	**0.43**
	Fall 2014	3.29	0.46	3.33	0.45	3.39	0.46
	Spring 2015	3.21	0.46	3.41	0.44	**3.32**	**0.47**
TV	Fall 2013	2.90	0.70	2.99	0.65	2.98	0.67
	Spring 2014	2.87	0.71	2.89	0.63	**3.10**	**0.62**
	Fall 2014	2.88	0.73	**2.83**	**0.80**	2.91	0.70
	Spring 2015	2.83	0.67	**3.05**	**0.70**	**2.79**	**0.74**
GM	Fall 2013	3.06	0.51	3.06	0.57	**3.11**	**0.58**
	Spring 2014	2.95	0.64	3.12	0.60	**3.27**	**0.45**
	Fall 2014	2.99	0.61	2.99	0.59	3.08	0.58
	Spring 2015	2.91	0.52	3.14	0.56	**2.94**	**0.58**
MA	Fall 2013	3.07	0.71	3.10	0.74	3.16	0.70
	Spring 2014	3.10	0.71	3.11	0.73	3.23	0.67
	Fall 2014	3.02	0.76	3.18	0.71	3.17	0.67
	Spring 2015	3.07	0.71	3.24	0.72	3.00	0.76
TM	Fall 2013	2.71	0.78	2.81	0.77	2.91	0.72
	Spring 2014	2.70	0.85	2.83	0.79	**3.09**	**0.63**
	Fall 2014	2.78	0.78	2.85	0.78	**2.76**	**0.74**
	Spring 2015	2.75	0.71	2.86	0.77	**2.77**	**0.70**
MON	Fall 2013	3.42	0.53	3.38	0.55	3.49	0.50
	Spring 2014	3.37	0.63	3.47	0.56	**3.59**	**0.47**
	Fall 2014	3.32	0.64	3.33	0.56	**3.34**	**0.63**
	Spring 2015	3.32	0.58	3.37	0.57	**3.35**	**0.54**
AD	Fall 2013	2.76	0.58	2.78	0.62	2.89	0.62
	Spring 2014	2.79	0.62	2.75	0.60	2.88	0.58
	Fall 2014	2.69	0.57	2.75	0.60	2.73	0.66
	Spring 2015	2.77	0.66	2.85	0.58	2.72	0.64

Note. TV = Task Value, TU = Task Understanding, TM = Time Management, MA = Motivation Appraisal, GM = Goal Management, MON = Monitoring, and AD = Adaptation. SD = Standard Deviation. Bolded indicated significant differences, $p < .05$.

Appendix D

Mean, Standard Deviations, Skewness and Kurtosis values of the RLQ items for Chinese and Canadians at time 1

		Canadian Domestic Student				Chinese International Student			
Factor	Item	Mean	SD	Skewness	Kurtosis	Mean	SD	Skewness	Kurtosis
TU	MON1	3.01	.90	-.55	-.59	3.38	.69	-.77	-.10
	TU4	3.30	.79	-.87	.05	3.11	.73	-.39	-.40
	TU5	3.06	.86	-.42	-.84	3.17	.82	-.63	-.45
	TU6	3.27	.71	-.64	-.09	3.40	.72	-1.10	.99
	TU8	3.50	.76	-1.41	1.15	3.48	.72	-1.21	.77
TV	TU2	2.69	.97	-.06	-1.04	3.09	.86	-.57	-.53
	TU7	2.72	.97	-.10	-1.05	3.16	.85	-.58	-.69
	EV14	2.93	.90	-.43	-.67	3.17	.89	-.81	-.24
GM	GO9	3.10	.80	-.38	-.81	3.39	.79	-1.13	.52
	GO10	2.93	.81	-.22	-.72	3.11	.77	-.74	.47
	GO11	2.91	.82	-.31	-.54	3.31	.72	-.75	.10
	GO12	2.55	.81	.10	-.54	3.07	.90	-.53	-.75
	EV7	2.85	.92	-.22	-.94	3.17	.83	-.69	-.28
	EV12	2.96	.88	-.42	-.67	3.28	.70	-.57	-.35
	EV16	2.97	.86	-.40	-.63	3.23	.77	-.79	.22
TM	GO13	2.88	1.06	-.41	-1.14	3.20	.89	-.81	-.29
	GO14	2.35	1.10	.15	-1.31	2.80	1.08	-.33	-1.21
	EV6	2.69	1.06	-.14	-1.24	3.04	.98	-.56	-.89
MON	MON2	3.31	.78	-.74	-.47	3.52	.66	-1.04	-.12
	MON3	3.16	.87	-.70	-.46	3.42	.73	-1.03	.40
	MON4	3.44	.72	-1.10	.59	3.60	.61	-1.25	.48
MA	EV8	2.83	1.03	-.29	-1.17	3.13	.89	-.72	-.36
	EV9	3.19	.81	-.74	-.11	3.26	.75	-.65	-.28
AD	AD17	2.52	.92	.10	-.83	2.81	.87	-.20	-.74
	AD19	2.71	.92	-.21	-.78	3.11	.80	-.68	.05
	AD20	2.41	1.01	.19	-1.04	2.79	.92	-.19	-.91
	AD21	2.49	1.01	.13	-1.09	2.74	.98	-.15	-1.07
	AD22	2.98	.89	-.44	-.72	3.08	.75	-.62	.31
	AD23	2.93	.91	-.50	-.56	3.20	.78	-.62	-.33
Multivariate[a]		56.44 (CR=13.70)				93.034 (CR=13.39)			
N		424				149			

Note. TV = Task Value, TU = Task Understanding, TM = Time Management, MA = Motivation Appraisal, GM = Goal Management, MON = Monitoring, and AD = Adaptation. SD = Standard Deviation; CR = Critical Ratio. [a]Multivariate kurtosis with critical ratio

Appendix E

Mean, Standard Deviations, Skewness and Kurtosis values of the RLQ items for Chinese and Canadians at time 2

		Canadian Domestic Student				Chinese International Student			
Factor	Item	Mean	SD	Skewness	Kurtosis	Mean	SD	Skewness	Kurtosis
TU	MON1	3.27	.82	-.81	-.27	3.49	.70	-1.27	1.12
	TU4	3.46	.70	-1.08	.49	3.28	.73	-.59	-.56
	TU5	3.22	.88	-.88	-.15	3.23	.77	-.60	-.52
	TU6	3.42	.74	-1.17	.93	3.44	.68	-.95	.27
	TU8	3.59	.69	-1.64	2.18	3.54	.67	-1.28	.95
TV	TU2	2.89	.96	-.26	-1.10	3.14	.87	-.53	-.89
	TU7	2.75	.98	-.17	-1.05	3.12	.82	-.45	-.80
	EV14	3.06	.92	-.53	-.82	2.92	.86	-.31	-.72
GM	GO9	3.10	.81	-.38	-.86	3.40	.72	-.89	-.15
	GO10	3.10	.87	-.56	-.61	3.24	.76	-.61	-.39
	GO11	2.95	.88	-.31	-.87	3.20	.73	-.55	-.27
	GO12	2.82	.84	-.13	-.77	2.97	.84	-.24	-.90
	EV7	2.95	.90	-.35	-.87	3.20	.70	-.42	-.41
	EV12	3.16	.83	-.64	-.39	3.15	.80	-.45	-.81
	EV16	3.12	.82	-.56	-.43	3.22	.73	-.48	-.64
TM	GO13	2.90	1.04	-.42	-1.08	3.13	.91	-.54	-.96
	GO14	2.56	1.09	-.07	-1.29	3.03	.93	-.53	-.78
	EV6	2.81	1.04	-.23	-1.23	3.05	.93	-.47	-.94
MON	MON2	3.49	.69	-1.05	-.02	3.44	.69	-1.10	.93
	MON3	3.20	.86	-.69	-.57	3.26	.74	-.65	-.17
	MON4	3.47	.70	-1.09	.31	3.38	.73	-.94	.27
MA	EV8	2.99	1.03	-.49	-1.06	3.01	.85	-.50	-.46
	EV9	3.38	.75	-1.02	.39	3.16	.79	-.63	-.19
AD	AD17	2.47	.94	.27	-.85	2.84	.87	-.40	-.46
	AD19	2.73	.92	-.14	-.89	3.23	.75	-.40	-1.14
	AD20	2.51	1.01	.10	-1.09	2.87	.89	-.21	-.92
	AD21	2.55	.95	-.02	-.92	2.94	.92	-.32	-.98
	AD22	2.94	.93	-.47	-.71	3.06	.82	-.64	-.01
	AD23	3.00	.92	-.56	-.58	3.22	.73	-.80	.62
Multivariate[a]		87.02 (CR=20.88)				74.02 (CR=10.47)			
N		414				144			

Note. TV = Task Value, TU = Task Understanding, TM = Time Management, MA = Motivation Appraisal, GM = Goal Management, MON = Monitoring, and AD = Adaptation. SD = Standard Deviation; CR = Critical Ratio. [a]Multivariate kurtosis with critical ratio

Appendix F

Mean, Standard Deviations, Skewness and Kurtosis values of the RLQ items for Chinese and Canadians at time 3

		Canadian Domestic Student				Chinese International Student			
Factor	Item	Mean	SD	Skewness	Kurtosis	Mean	SD	Skewness	Kurtosis
TU	MON1	3.27	.85	-.90	-.10	3.33	.76	-.64	-1.01
	TU4	3.46	.70	-.99	.03	3.31	.69	-.50	-.84
	TU5	3.32	.82	-.97	.08	3.31	.73	-.77	-.01
	TU6	3.44	.68	-.95	.25	3.45	.71	-.88	-.51
	TU8	3.64	.70	-1.96	3.18	3.46	.69	-1.02	.30
TV	TU2	2.93	.91	-.23	-1.09	3.19	.82	-.74	-.11
	TU7	2.73	.92	-.02	-1.01	3.07	.87	-.58	-.50
	EV14	2.94	.93	-.46	-.73	3.14	.78	-.52	-.44
GM	GO9	3.07	.82	-.46	-.60	3.50	.64	-1.04	.74
	GO10	3.06	.85	-.50	-.62	3.39	.68	-.65	-.68
	GO11	2.99	.84	-.43	-.52	3.37	.68	-.59	-.72
	GO12	2.83	.84	-.16	-.73	3.16	.77	-.46	-.63
	EV7	2.84	.88	-.10	-.99	3.23	.75	-.60	-.37
	EV12	3.18	.80	-.59	-.50	3.17	.74	-.28	-1.12
	EV16	3.15	.81	-.49	-.73	3.28	.68	-.55	-.24
TM	GO13	2.88	1.00	-.32	-1.11	3.15	.86	-.62	-.58
	GO14	2.64	1.11	-.19	-1.31	2.86	.91	-.26	-.87
	EV6	2.88	1.02	-.35	-1.09	3.16	.85	-.51	-.89
MON	MON2	3.52	.68	-1.22	.75	3.55	.66	-1.31	1.09
	MON3	3.16	.89	-.75	-.40	3.48	.70	-1.23	1.05
	MON4	3.52	.66	-1.24	1.09	3.52	.66	-1.20	.85
MA	EV8	2.88	1.00	-.39	-1.01	3.23	.75	-.60	-.37
	EV9	3.31	.78	-.84	-.12	3.25	.79	-.72	-.25
AD	AD17	2.47	.95	.17	-.91	2.92	.91	-.41	-.70
	AD19	2.82	.92	-.20	-.93	3.13	.78	-.59	-.12
	AD20	2.56	.98	.06	-1.04	2.70	.89	.08	-.96
	AD21	2.52	1.00	.09	-1.06	3.09	.82	-.32	-1.07
	AD22	2.97	.94	-.49	-.78	3.10	.78	-.44	-.48
	AD23	3.00	.88	-.49	-.58	3.17	.82	-.71	-.18
Multivariate[a]		83.78 (CR=20.22)				68.18 (CR=9.68)			
N		419				145			

Note. TV = Task Value, TU = Task Understanding, TM = Time Management, MA = Motivation Appraisal, GM = Goal Management, MON = Monitoring, and AD = Adaptation. SD = Standard Deviation; CR = Critical Ratio. [a]Multivariate kurtosis with critical ratio

Appendix G

Measurement Equivalence at the Item-Level at Time 1

Model	χ^2	df	CFI	RMSEA	90% CI	ΔCFI
A. Configural	486.101	292	.909	.034	.029, .039	/
B. Full Metric	514.132	307	.903	.034	.029, .040	.006
C. Full Scalar	606.624	326	.869	.039	.034, .044	.034
Constraining each intercept						
EV16	523.937	308	.899	.035	.030, .040	.004
EV12	528.922	308	.897	.035	.030, .041	.006
EV7	527.456	308	.897	.035	.030, .040	.006
GO12	549.135	308	.887	.037	.032, .042	.016
GO11	541.067	308	.891	.036	.031, .041	.012
GO10	517.715	308	.902	.035	.029, .040	.001
GO9	526.457	308	.898	.035	.030, .040	.005
AD17	523.532	308	.899	.035	.030, .040	.004
AD19	534.026	308	.894	.036	.031, .041	.009
AD20	528.478	308	.897	.035	.030, .041	.006
AD21	518.446	308	.901	.035	.029, .040	.002
AD22	513.337	308	.904	.034	.029, .039	.001
AD23	523.938	308	.899	.035	.030, .040	.004
EV14	519.315	308	.901	.035	.029, .040	.002
TU7	536.94	308	.893	.036	.031, .041	.010
TU2	534.558	308	.894	.036	.031, .041	.009
MON4	518.638	308	.901	.035	.029, .040	.002
MON3	525.376	308	.898	.035	.030, .040	.005
MON2	522.247	308	.900	.035	.030, .040	.003
Removing intercept equality constraints for partial scalar invariance						
Model 1: Free GO12, GO11, AD19, TU7, and TU2	564.882	321	.886	.037	.032, .041	.018
Model 2: Free GO12, GO11, AD19, TU7, TU2 + EV12, EV7, and AD20	555.458	318	.889	.036	.031, .041	.015
Model 3: Free GO12, GO11, AD19, TU7, TU2, EV12, EV7, AD20, + MON3, GO9, AD23 and AD17	538.996	314	.895	.035	.030, .040	.008

Appendix H

Measurement Equivalence at the Item-Level at Time 2

Model	χ^2	df	CFI	RMSEA	90% CI	ΔCFI
A. Configural	466.023	292	.927	.033	.027, .038	/
B. Full Metric	486.328	307	.924	.032	.027, .038	.003
C. Full Scalar	591.272	326	.888	.038	.033, .043	.036
Constraining each intercept						
EV16	488.367	308	.924	.035	.027, .038	.000
EV12	486.336	308	.925	.035	.027, .038	.001
EV7	497.042	308	.920	.035	.028, .039	.004
GO12	49.022	308	.923	.037	.027, .038	.001
GO11	497.382	308	.920	.036	.028 .039	.004
GO10	489.721	308	.923	.035	.027, .038	.001
GO9	503.283	308	.918	.035	.028, .039	.006
AD17	505.331	308	.917	.035	.029, .039	.007
AD19	524.235	308	.909	.036	.030, .041	.015
AD20	501.237	308	.919	.035	.028, .039	.005
AD21	504.76	308	.917	.035	.028, .039	.007
AD22	488.214	308	.924	.034	.027, .038	.000
AD23	495.12	308	.921	.035	.028, .038	.003
EV14	489.001	308	.924	.035	.027, .038	.000
TU7	504.576	308	.917	.036	.028, .039	.007
TU2	494.085	308	.922	.036	.027, .038	.002
MON4	488.051	308	.924	.035	.027, .038	.000
MON3	486.877	308	.925	.035	.027, .038	.001
MON2	486.873	308	.925	.035	.027, .038	.001
Removing intercept equality constraints for partial scalar invariance						
Model 1: Free AD19, AD17, AD21, TU7, and GO9	541.291	321	.907	.035	.030, .040	.017
Model 2: Free AD19, AD17, AD21, TU7, GO9 + AD20, GO11, and EV7	519.689	318	.915	.034	.028, .039	.009

Appendix I

Measurement Equivalence at the Item-Level at Time 3

Model	χ^2	df	CFI	RMSEA	90% CI	ΔCFI
A. Configural	498.701	292	.918	.035	.030, .041	/
B. Full Metric	522.681	307	.914	.035	.030, .040	.004
C. Full Scalar	654.643	326	.869	.042	.038, .047	.045
Constraining each intercept						
EV16	526.501	308	.913	.036	.030, .041	.001
EV12	522.689	308	.914	.035	.030, .040	.000
EV7	548.623	308	.904	.037	.032, .042	.010
GO12	541.009	308	.907	.037	.032, .042	.007
GO11	55.395	308	.903	.037	.032, .042	.011
GO10	543.136	308	.906	.037	.032, .042	.008
GO9	56.677	308	.899	.038	.033, .043	.015
AD17	548.043	308	.904	.037	.032, .042	.010
AD19	537.312	308	.909	.036	.031, .041	.005
AD20	525.266	308	.913	.035	.030, .041	.001
AD21	564.242	308	.898	.038	.033, .043	.029
AD22	525.236	308	.913	.035	.030, .041	.001
AD23	527.631	308	.912	.036	.030, .041	.002
EV14	528.901	308	.912	.036	.031, .041	.002
TU7	538.615	308	.908	.037	.031, .042	.006
TU2	532.302	308	.911	.036	.031, .041	.003
MON4	522.691	308	.914	.035	.030, .040	.000
MON3	54.869	308	.907	.037	.032, .042	.007
MON2	522.926	308	.914	.035	.030, .040	.000
Removing intercept equality constraints for partial scalar invariance						
Model 1: Free EV7, GO11, GO10, GO9, AD17, and AD21	582.694	320	.895	.038	.033, .043	.019
Model 2: Free EV7, GO11, GO10, GO9, AD17, AD21 + GO12 and MON3	557.879	318	.904	.037	.032, .042	.010
Model 3: Free EV7, GO11, GO10, GO9, AD17, AD21, GO12, MON3 + TU7	551.643	317	.906	.036	.031, .041	.008

Appendix J

Correlations between Engagement in SRL processes and Academic Performance for Canadian Domestic and Chinese International Students

	Canadian Domestic Student		Chinese International Student	
Variable	Course Grade	Term GPA	Course Grade	Term GPA
Time 1				
TV	.01	.03	-.16	-.11
GM	-.04	-.01	-.02	.08
MON	-.08	-.07	-.04	.02
AD	-.07	.02	-.08	.02
Time 2				
TV	-.01	-.00	.03	.09
GM	**.11***	**.14****	.05	.08
MON	.06	**.12***	.08	**.19***
AD	.01	-.01	-.08	-.03
Time 3				
TV	.08	.09	.04	-.02
GM	**.12***	**.16****	-.08	.03
MON	.03	.06	.15	.15
AD	.08	.01	-.14	-.14

Note. GM = Goal Management; AD = Adaptation; TV = Task Value; MON = Monitoring.
** $p < .01$; * $p < .05$ level.