VALIDITY EVIDENCE FOR A MEASURE OF
MOTIVATIONAL REGULATION STRATEGIES

BY

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Abstract

Motivation is positively related to performance and achievement. The ability to regulate motivation is essential for overcoming motivational barriers to success. Motivational regulation strategies is defined as the intentional use of thoughts and actions to manage motivation in order to accomplish a task (Wolters, 2003). This study examined two types of validity evidence for a measure of motivational regulation strategies: the internal structure of the measure and the relation between motivational regulation strategies measure and metacognitive strategies. Participants (N = 293) were undergraduate and graduate students from education programs at the University of Kansas. Students filled out a questionnaire with measures of motivational regulation strategies and metacognitive strategies. A series of confirmatory factor analysis models were fitted to data. Results showed that a nine-factor model was the best fit for the data. In addition, motivational regulation strategies and metacognitive strategies correlated positively. Overall, there is evidence for reliability for the measure of motivational regulation strategies, but its validity need to be further evaluated.

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Chapter 1: Introduction

Motivation is essential for learning. Motivated students are more likely to show interest, expend effort, and persist through learning difficulties. Research shows adaptive motivational states (e.g., high interest) are associated with higher performance and academic achievement (Eccles, Wigfield, & Schiefele, 1998; Pintrich, 2003). Motivational states, however, fluctuate over time due to task conditions (e.g., difficulty) and person conditions (e.g., emotions). Students' ability to overcome motivational barriers may be a key factor in explaining performance and achievement. Researchers have conceptualized this as the ability to regulate or control one's motivation to achieve a goal.

Several research traditions including motivation, self-regulated learning, and volition influence the conceptualization of the regulation of motivation or motivational regulation (Boekaerts, 1996; Kuhl, 1985; Kuhl & Kraska, 1989; Pintrich, 2004; Wolters, 2003). Despite slight differences in theoretical orientations among researchers, most definitions are consistent with Wolters's (2003) definition. He defines motivational regulation as the *intentional use of thoughts and actions to influence motivation* in order to accomplish a task. Wolters (2003) assumes motivational regulation is conscious, deliberate, and initiated by the learner. That is, individuals are not only aware of factors that affect their motivation, but they also shape their motivation through the manipulation of thoughts and actions.

Wolters's (2003; 2011) theory of motivational regulation includes three dimensions: metamotivational knowledge, motivational monitoring, and motivational regulation strategies. *Metamotivational knowledge* is defined as knowledge about one's motivation. *Motivational monitoring* is defined as awareness of one's motivational states. *Motivational regulation*

strategies is defined as plans or methods use to influence one's motivation. (These dimensions will be elaborated on in the literature review.)

To date, the majority of empirical research has focused on motivational regulation strategies. There have been studies on environmental structuring (Zimmerman & Martinez-Pons, 1990), interest enhancement (Sansone, Weir, & Morgan, 1992), self-efficacy enhancement (McCann & Garcia, 1999), and defensive pessimism (Norem & Illingworth, 1993). These studies link motivational regulation strategies to positive outcomes (e.g., high performance). A limitation of these studies, however, is a lack of consistency in defining and measuring motivational regulation strategies. Researchers are working from different theoretical frameworks and thus, it is not clear if the same construct—motivational regulation strategies—is being assessed across these studies.

Previous research has made progress in the development of a measure of motivational regulation strategies. There is a self-report measure that includes various motivational regulation strategies, such as interest enhancement and self-consequating (Wolters, 1999; Wolters & Benzon, 2013). Studies show the measure is reliable and that motivational regulation strategies can be distinguished from motivational beliefs, cognitive strategies, and metacognitive strategies. (Wolters, 1999; Wolters & Rosenthal, 2000; Wolters & Benzon, 2013). Since its initial development, the measure has been revised once and there is also a German version (Schwinger, von der Laden, & Spinath, 2007; Schwinger, Steinmayr, & Spinath, 2009; Wolters & Benzon, 2013).

The purpose of this study is to evaluate validity evidence for a measure of motivational regulation strategies. Validity evidence based on internal structure and relation to metacognitive strategies is evaluated. Results from this study will contribute to the development of a reliable

and valid measure of motivational regulation strategies, which will aid in theory development and future empirical study.

Chapter 2: Literature Review

Motivational Regulation

Wolters's (2003; 2011) theory includes three dimensions: metamotivational knowledge, motivational monitoring, and motivational regulation strategies.

Metamotivational knowledge. Metamotivational knowledge is defined as knowledge about one's motivation (Wolters, 2003; 2011). Within the academic domain, students have knowledge of academic topics and tasks they find intrinsically motivating and knowledge of strategies they can use to manage their motivation (Wolters, 2011). Metamotivational knowledge is essential for monitoring and controlling motivation. Without awareness or understanding of motivating factors or strategies, it would be difficult to target areas of low motivation and to execute strategies to regulate motivation (Wolters, Benzon, & Arroyo-Giner, 2011). Metamotivational knowledge, then, means that students recognize factors that motivate them; recognize a strategy as motivational (declarative knowledge), know how to enact the strategy (procedural knowledge), and can connect the strategy with an outcome (conditional knowledge).

Motivational monitoring. Motivational monitoring refers to the awareness of one's motivational states. Although Wolters (2011) does not elaborate on the mechanism for how students' monitor their motivational states, the concept is similar to other self-regulatory monitoring processes (e.g., Bandura, 1991; Carver & Scheier, 1981). Monitoring involves observing one's current motivational state and comparing it to a desired motivational state. If there is a discrepancy between current and desired states, adjustments are made to thoughts or behaviors to reduce the discrepancy. For example, students are often aware of their lack of

motivation when they have trouble starting an academic task. When they are aware of this lack of motivation, it can initiate changes in thoughts and behaviors (e.g., removing distractions, using self-rewards), which can help them overcome the initial motivational barrier.

Motivational regulation strategies. Motivational regulation strategies are plans or methods used to influence one's motivation (Wolters, 2003). Over time, individuals can learn various motivational regulation strategies and intentionally deploy these strategies (or create a new strategy) as needed. Motivational regulation strategies increase the likelihood of achieving a goal by affecting individuals' motivational states (Wolters, 2011; Kuhl, 1985). To illustrate, a student may use a strategy of positive self-talk to enhance feelings of competence for an academic task: that strategy raises her willingness to begin and to persist at the task when obstacles emerge. In another example, a student can protect the goal of studying for an exam by escalating the incentive value of studying—e.g., if he studies for two hours, he can then play the guitar for 30 minutes.

Measuring Motivational Regulation Strategies

History of measure development. This study uses a measure of motivational regulation strategies adapted from previous versions. In this section, I provide a brief history of measure development.

English version. In an exploratory study, Wolters (1998) used open-ended questions to ask undergraduate psychology students about strategies they used to overcome motivational challenges (e.g., low interest) they faced in completing common academic tasks (e.g., reading). He grouped the results into 14 categories that served as the basis for scale development in later studies. Wolters (1999) developed the first self-report measure of motivational regulation strategies that contained five scales (strategies): mastery self-talk, interest enhancement,

performance self-talk, self-consequating, and environmental control. Since then, the measure was revised once and the scales were renamed and an additional scale was added for a total of six scales: regulation of value, regulation of performance goals, self-consequating, environmental structuring, regulation of situational interest, and regulation of mastery goals (Wolters & Benzon, 2013).

German version. Schwinger and colleagues (2007) adapted Wolters's measure and translated it into German. The German version expanded the content coverage of the measure. The researchers divided the English version's regulation of performance goals scale into two separate scales: performance-approach self-talk and performance-avoidance self-talk. In addition, they added a proximal goal setting scale that was not included in the original English version. The German version contained eight scales: enhancement of situational interest, enhancement of personal significance, mastery self-talk, performance-approach self-talk, performance-avoidance self-talk, environmental control, self-consequating, and proximal goal setting (Schwinger et al., 2007; 2009).

Validity Evidence for a Measure of Motivational Regulation Strategies

This section reviews empirical studies that have provided validity evidence for the measure of motivational regulation strategies. To the best of my knowledge, nine empirical studies have been conducted on and with the measure (Chow, 2011; Schwinger et al., 2007; Schwinger et al., 2009; Schwinger, Steinmayr, & Spinath, 2012; Schwinger & Stiensmeier-Pelster, 2012; Wang, 2013; Wolters, 1999; Wolters & Rosenthal, 2000; Wolters & Benzon, 2013).

Internal structure. Four studies investigated the internal structure of the measure: two studies used exploratory factor analysis (EFA) and two used confirmatory factor analysis (CFA).

Wolters (1999) asked a sample of 9th and 10th graders to fill out a measure of motivational regulation strategies that contained five scales: mastery self-talk, interest enhancement, performance self-talk, self-consequating, and environmental control. Exploratory factor analysis showed five factors could be extracted based on scree plot analysis and a minimum eigenvalue criteria. Results also showed unexpected loadings and cross-loadings that lead to the removal of three items. The final scale consisted of 25 items and five scales: mastery self-talk (α = .85), interest enhancement (α = .90), performance self-talk (α = .84), self-consequating (α = .87), and environmental control (α = .73). These results provided some initial evidence for internal consistency and multi-dimensionality.

In a more recent work, Wolters and Benzon (2013) provided additional evidence for the internal structure of the measure using a sample of college students. They revised the measure by adding one scale for a total of six scales: regulation of value, regulation of performance goals, self-consequating, environmental structuring, regulation of situational interest, and regulation of mastery goals. Exploratory factor analysis showed six factors could be extracted based on scree plot analysis and a minimum eigenvalue criteria. Results showed cross-loadings for three items but they were retained because they loaded meaningfully on one factor; one item was dropped due to a low loading (less than .40). The final measure consisted of 30 items and six scales: regulation of value (α = .91), regulation of performance goals (α = .84), self-consequating (α = .91), environmental structuring (α = .77), regulation of situational interest (α = .88), and regulation of mastery goals (α = .88).

Moreover, in a doctoral dissertation, Wang (2013) tested the factor structure of a Chinese version. The researcher adapted and translated (and back translated) Wolters's (1999) measure into Chinese. The Chinese version included six scales: mastery self-talk, performance/extrinsic

self-talk, performance/relative ability self-talk, interest enhancement, relevance enhancement, and efficacy enhancement. Efficacy enhancement was a new scale added based on previous theoretical and empirical works. Confirmatory factor analysis showed a six-factor model was an adequate fit for the data, $\chi^2(410) = 2662.16$, RMSEA = .07, CFI = .88, TLI = .87, SRMR = .05. The findings suggested potential misspecification of the model but no further model evaluations were performed. Results also showed the scales were reliable: mastery self-talk (α = .85), performance/extrinsic self-talk (α = .88), performance/relative ability self-talk (α = .83), interest enhancement (α = .89), relevance enhancement (α = .87), and efficacy enhancement (α = .82). These results provided evidence that the measure can reliably assess Chinese students' motivational regulation strategies.

Lastly, Schwinger and colleagues (2007) translated Wolters's (1999) measure into German and conducted three validation studies on samples of high school and college students. Results provided evidence that an eight-factor model was the best fit for the data in those studies. The German version included eight scales: enhancement of situational interest, enhancement of personal significance, mastery self-talk, performance-approach self-talk, performance-avoidance self-talk, environmental control, self-consequating, and proximal goal setting. (There is limited information on this study because it was published in German).

In summary, there is evidence that the measure of motivational regulation strategies is reliable and has distinct dimensions (Schwinger et al., 2007; Wang, 2013; Wolters, 1999; Wolters & Benzon, 2013). That is, each strategy measures different aspects of the ability to regulate motivation. A limitation, however, is that the structure of the English version has not been tested or confirmed, only exploratory methods have been used. Conducting confirmatory factor analysis (CFA) is an important step in scale development because it allows the user to test

a priori hypotheses and evaluate the global and local fit of a model (Brown, 2006). In addition, there is a need to determine if the strategies from the German and Chinese versions will appear as distinct factors or dimensions on the English version.

Relations to other variables. Researchers have looked at the relations between motivational regulation strategies and five constructs: motivational beliefs, epistemic beliefs, academic achievement, cognitive strategies, and metacognitive strategies (Chow, 2011; Wang, 2013; Wolters & Rosenthal, 2000; Wolters & Benzon, 2013). Overall, results provide evidence that motivational regulation strategies and the five constructs are correlated. But the correlations are not high enough to suggest the same constructs are being assessed across the different measures.

***Motivational and epistemic beliefs*.** Four studies investigated the relations between motivational regulation strategies and motivational beliefs and epistemic beliefs. In one study, Wolters and Rosenthal (2000) investigated the relation between motivational regulation strategies and motivational beliefs. They sampled 8th grade students from mathematics class in a cross-sectional study. Motivational beliefs were measured as perceived task value (beliefs about the importance of a task), learning goal orientation (focus on attaining competence), performance goal orientation (focus on grades), and self-efficacy (judgments of competence). Motivational regulation strategies were measured using five strategies: mastery self-talk, interest enhancement, performance self-talk, self-consequating, and environmental control.

Results from Wolters and Rosenthal (2000) provided evidence that motivational regulation strategies and motivational beliefs positively correlated. In general, the correlations between motivational regulation strategies and motivational beliefs were small to moderate, *r* ranged from .04 to .59—significant correlations were above .21. However, there was one strong

correlation (r = .73) between learning goal orientation and mastery self-talk, which suggested possible overlap between the two constructs. For example, the learning goal orientation scale had items about wanting to attain competence or master learning material. Similarly, the mastery self-talk scale had items about challenging oneself and persuading oneself to acquire mastery. The difference between these two constructs is that the latter is conceptualized as a strategy and the former is conceptualized as a belief. Overall, this study provided evidence that motivational regulation strategies can be distinguished from motivational beliefs. However, a limitation of the study is the small sample size (N = 88).

In another study, Wolters and Benzon (2013) investigated the relation between motivational regulation strategies and motivational beliefs. They sampled college students in a cross-sectional study. Motivational beliefs were measured as value (beliefs about the usefulness or importance of a task), self-efficacy (judgments of competence), mastery orientation (focus on attaining competence), and performance approach orientation (focus on grades). Results showed correlations between motivational regulation strategies and motivational beliefs scales were small to large, r ranged from .02 to .62—significant correlations were above .20. This provided additional evidence that motivational regulation strategies can be distinguished from motivational beliefs.

Moreover, Wang (2013) found similar results in a cross-sectional study with Chinese 10th grade students. The researcher investigated the relation between motivational regulation strategies and achievement goals. Motivational regulation strategies were measured with six scales: mastery self-talk, performance/extrinsic self-talk, performance/relative ability self-talk, interest enhancement, relevance enhancement, and efficacy enhancement. Achievement goals were measured as mastery goals (focus on attaining competence), performance-approach goals

(focus on grades), and performance-avoidance goals (focus on avoiding incompetence). Results showed the correlations between motivational regulation strategies and achievement goals were small to large (*r* ranged from .09 to .52) and all were significant. Similar to previous studies, this provided evidence that motivational regulation strategies can be distinguished from motivational beliefs.

Furthermore, Chow (2011) investigated the relations among personal epistemology, goal orientation, and regulation of motivation. He used a pre-post study (beginning and end of semester) with 3rd and 4th year college students majoring in business. There were two groups that differed based on the course format: the treatment group had case presentations, small-group discussion, and whole class discussions while the control group received traditional lectures and homework. The measures included epistemic beliefs (defined as beliefs about the nature of knowledge), mastery and performance goal orientation, and motivational regulation strategies. There were seven motivational regulation strategies measured: mastery self-talk, relevance enhancement, interest enhancement, performance self-talk, self-consequating, environment structuring, and extrinsic self-talk. Chow (2011) added two scales to Wolters's (1999) version: relevance enhancement and extrinsic self-talk.

Findings from Chow (2011) showed motivational regulation strategies correlated positively with mastery and performance goal orientations: at pretest *r* ranged from .06 to .61 and at posttest *r* ranged from .07 to .62 (significant correlations were above .20). In addition, some motivational regulation strategies correlated positively with simple epistemic knowledge (beliefs). At both pretest and posttest, the correlations were small to medium, *r* ranged from .05 to .32—significant correlations were above .20. Overall, these results suggested that motivational

regulation strategies can be distinguished from epistemic beliefs. However, a limitation of the study is the small sample size ($N = 87$).

In summary, the four studies reviewed provide evidence that motivational regulation strategies can be distinguished from motivational beliefs and epistemic beliefs (Chow, 2011; Wang, 2013; Wolters, 1999; Wolters & Benzon, 2013). This distinction between the motivational beliefs and motivational regulation supports Wolters's (2003) theory. Motivational regulation is conscious and deliberate: learners are aware of factors that affect their motivation and they are able to directly shape their motivation. In contrast, most motivational belief theories do not make explicit assumptions about learners' motivational awareness or motivational regulatory capabilities.

Academic achievement. Four studies investigated the relations between motivational regulation strategies and academic achievement. In one study, Wolters (1999) showed that the strategy of performance self-talk was significantly related to GPA: students who reported using more performance self-talk to remind themselves of the importance of grades were more likely to have higher GPAs ($r = .26$, $p < .05$). This finding supported the study's hypothesis that greater use of motivational regulation strategies would positively relate to academic achievement.

In another study, Schwinger and colleagues (2009) showed that the relation between motivational regulation strategies and academic achievement was mediated by effort. They conducted a longitudinal study on a sample of 11th and 12th graders. Students filled out measures of intelligence, motivational regulation strategies, and effort management, defined as the willingness to invest effort. In addition, their mid-year GPAs were obtained five months after the initial assessment. During analyses, researchers created a motivational strategies index that represented all eight strategies. Results showed that the index directly predicted effort

management and effort management directly predicted mid-year GPA. The direct relation between the motivational strategies index and GPA was not significant. Overall, these results provided evidence for a predictive, although indirect, relation between motivational regulation strategies and academic performance.

Moreover, Schwinger and Steinsmeier-Pelster (2012) tested their mediation model with a different sample of 12th graders. The researchers measured students' motivational regulation strategies and effort management at two time points: Time 1 was two weeks before the exam and Time 2 was the lesson right before. After the exam, the researchers obtained students' grades. Similar to the previous study, they created a motivational strategies index to use in the mediation model. The results were similar to results from the previous study: the motivational strategies indirectly predicted exam grade through effort at Time 2. These results provided additional evidence for the indirect relation between motivational regulation strategies and GPA.

Lastly, Schwinger and colleagues' study (2012) looked at different motivational regulation profiles and their relations to academic achievement and effort. The researchers conducted latent profile analysis (LPA) to identify subgroups of students with different motivational regulation profiles. They conducted the longitudinal study on a sample of college students. At Time 1, students filled out measures of motivational regulation strategies and effort; at Time 2, four months later, they filled out a measure of effort and self-reported on two exam grades.

Results from Swinger and colleagues' (2012) study showed five motivational regulation strategies profiles: *low and high* in terms of frequency of strategies usage; *goal-focused profile* refers to students with higher scores for goal-oriented self-talk strategies; *interest-focused profile* refers to students with higher scores on interest enhancement strategies; and *performance self-*

talk refers to students with higher scores on the performance self-talk strategy. In addition, results also showed high profile students reported the highest effort at Time 2 compared to all other profiles, controlling for effort at Time 1. This suggested that students who reported high usage of motivational regulation strategies overall tend to put more effort into their studies. Moreover, high profile students also reported better grades compared to students with a performance self-talk profile. Overall, these results provided evidence that there are individual differences in the use of motivational regulation strategies.

In summary, the four studies reviewed provide evidence that motivational regulation strategies is indirectly related to GPA and that there are individual differences in the use of motivational regulation strategies (Schwinger et al., 2009; Schwinger et al., 2012; Schwinger and Steinsmeier-Pelster, 2012; Wolters, 1999). This supports empirical work in the self-regulated learning literature which shows that self-regulation strategies are positively associated with academic achievement (Crede & Phillips, 2011; Pintrich & DeGroot, 1990; Zimmerman, 1990) and that there are individual differences in the use of self-regulated learning strategies (Zimmerman & Martinez-Pons, 1990)

Cognitive strategies and metacognitive strategies. Studies that use measures of cognitive strategies and metacognitive strategies sometimes use the term interchangeably or use a global measure of both. But it is important to make a distinction between the two. Metacognition refers to knowledge of cognition and regulation of cognition (Schraw & Moshman, 1995). Knowledge of cognition includes knowledge about oneself as a learner and about strategies that are effective. Regulation of cognition are processes that help control thinking and learning (e.g., planning and evaluation). Metacognition is a higher level of awareness and can be thought of as systems that operate on lower level cognitions.

Theoretically, motivational regulation is distinguished from metacognition, but the two constructs are related (Wolters, 2003). The purpose of metacognitive strategies is to influence and enhance cognitive processing. In contrast, the purpose of motivational regulation strategies is to influence and enhance motivational states. The two constructs are related because they are thought to be part of a larger self-regulatory system. Empirical studies have supported the positive relation between the two constructs.

In one study, Wolters (1999) investigated the relation between motivational regulation strategies and seven cognitive and metacognitive strategies: rehearsal, elaboration, organization, planning, monitoring, regulation, and effort. Results showed correlations between motivational regulation strategies and cognitive and metacognitive strategies were small to moderate (*r* ranged from .11 to .47)—significant correlations were above .21. These results suggested that the measure of motivational regulation strategies is related to but distinct from measures of cognitive and metacognitive strategies. A limitation, however, is the lack of conceptual clarity between cognitive strategies and metacognitive strategies.

The limitation from the previous study was addressed in Wolters and Benzon (2013). They investigated the relations between motivational regulation strategies and two measures: cognitive strategies and metacognitive strategies. Cognitive strategies included items about rehearsal, elaboration, and organization; metacognitive strategies included items about planning, monitoring, and regulation. Results showed significant correlations between motivational regulation strategies and cognitive strategies: correlation coefficients were medium to large, *r* ranged from .40 to .60. Similarly, the correlations with metacognitive strategies were also medium to large, *r* ranged from .44 to .61. These results provided additional evidence that

motivational regulation strategies can be distinguished from cognitive strategies and metacognitive strategies.

Additionally, Wang (2013) investigated the relations between motivational regulation strategies and cognitive engagement, defined as rehearsal strategies and elaboration strategies. Results showed significant correlations between motivational regulation strategies and rehearsal: correlation coefficients were medium to large, *r* ranged from .38 to .50. Similarly, correlations with elaboration strategies were also medium to large, *r* ranged from .38 to .48. This study provided additional evidence that motivational regulation strategies can be distinguished from cognitive strategies.

In summary, the three studies reviewed provide evidence that motivational regulation strategies are related to, but can be distinguished from cognitive strategies and metacognitive strategies (Wolters, 1999; Wolters & Benzon, 2013; Wang, 2013). This distinction supports Wolters' (2003) theory, but the moderate to large relations among the two constructs suggest some overlap, which may be due to a common higher-order construct like a general self-regulation ability.

Current Study

The purpose of this study is to evaluate validity evidence for a measure of motivational regulation strategies. Previous studies have revealed four major findings. First, the ability to regulate motivation has different aspects represented by distinct strategies. Second, motivational regulation strategies is related to, but distinct from, motivational beliefs, epistemic beliefs, cognitive strategies, and metacognitive strategies. Third, motivational regulation strategies are indirectly related to academic performance. Fourth, there are individual differences in the use of motivational regulation strategies. Although previous studies have made progress in the

development of the measure, additional evaluation is needed and this study will address three limitations.

First, previous studies have revealed additional strategies that have not been tested or confirmed on the English version of the measure (Schwinger et al., 2009; Wang, 2013). From the German version there are two strategies: performance-avoidance self-talk and proximal goal setting. From the Chinese version, there is the efficacy enhancement strategy. There is a need to evaluate the reliability of these items and to determine if they also appear as distinct factors on the English version. I hypothesize that proximal goal setting and efficacy enhancement items will appear as a distinct strategy—regulation of efficacy. Regulation of efficacy is defined as the ability to manage expectations and perceptions of competence or self-efficacy (Wolters, 2003). The theory suggests that setting proximal goals and using self-talk to enhance efficacy are different forms of the same strategy: regulation of efficacy. In this study, I will test the hypothesis that there are eight first-order factors that represent the eight motivational regulation strategies or scales.

Second, the research is less clear on *how* motivational regulation strategies are related. That is, is there a higher-order latent construct(s) that explains their covariances? In other words, the strategies may relate to each other because they are influenced or caused by a common higher-order construct. Evidence from empirical studies show small to high relations among the strategies. For the English version, studies show small to moderate relations: correlation coefficients ranged from .15 to .66 in one study (Wolters, 1999; Wolters & Rosenthal, 2000; Wolters & Benzon, 2013). For the German version, studies also show small to moderate relations: correlation coefficients ranged from .11 to .56 in one study (Schwinger et al., 2009; Schwinger & Stiensmeier-Pelster, 2012). For the Chinese version, one study shows small to large

relations: correlations coefficient ranged from .29 to .78 (Wang, 2013). These results suggest some overlap among the strategies. But overall, no obvious patterns of relations (e.g., two strategies consistently correlated highly across studies) can be extracted from these studies. In this study, I will test the hypothesis that there is a second-order latent construct that explain the relations among the first-order latent constructs.

Third, only a few studies have investigated motivational regulation strategies in college students (Chow, 2011; Wolters & Benzon, 2013). The majority of the studies have been conducted on high school students (Schwinger et al., 2009; Wang, 2013; Wolters, 1999; Wolters & Rosenthal, 2000). College students have more freedom in setting their academic schedules, which can be liberating for those who are highly self-regulated and self-motivated. For others, however, it can exaggerate procrastination tendencies. There is a need to examine college students' motivational regulation strategies more in depth. In this study, I will investigate the use of motivational regulation strategies in an undergraduate and graduate student population.

Adapted measure. This study uses an adapted version of the motivational regulation strategies measure (see Appendix). There are a total of 39 items: 30 items from the original English version, six from the German version, and three from the Academic Volitional Strategy Inventory (AVSI; McCann & Garcia, 1999; Schwinger et al., 2009; Wolters & Benzon, 2013). The adapted version measures eight strategies: regulation of value, regulation of performance goals, self-consequating, environmental structuring, regulation of situational interest, regulation of mastery goals, regulation of performance-avoidance goals, and regulation of efficacy.

The 30 items from the original English version were kept in their original wording and they measure six strategies: regulation of value, regulation of performance goals, self-consequating, environmental structuring, regulation of situational interest, regulation of mastery

goals. The six items from the German version measure performance-avoidance self-talk and proximal goal setting. Items from the performance-avoidance self-talk scale were reworded for clarity. The three items from the AVSI measure self-efficacy enhancement, which is defined as the use of self-talk to increase confidence and persistence (McCann & Garcia, 1999). These items were kept in their original wording.

Research hypotheses. There are three primary hypotheses:

- Hypothesis 1: There are eight first-order factors that account for the eight motivational regulation strategies. Regulation of efficacy and regulation of performance-avoidance goals will appear as distinct factors.
- Hypothesis 2: There is a second-order factor that accounts for the relations among eight first-order factors.
- Hypothesis 3: Motivational regulation strategies will correlate positively with metacognitive strategies.

Chapter 3: Method

Participants

Participants were undergraduate (n_1 = 109) and graduate students (n_2 = 182) recruited from a research pool at the University of Kansas. The age range for undergraduates was 18-26; the age range for graduate students was 21-57. The majority of students were females (77.5%), White (80.9%), and enrolled in an undergraduate or graduate education program (e.g., Elementary Education, Higher Education).

Measures

Motivational regulation strategies. The motivational regulation strategies measure contains eight scales: regulation of value, regulation of performance goals, self-consequating,

environmental structuring, regulation of situational interest, regulation of mastery goals, regulation of performance-avoidance goals, and regulation of efficacy. The items are measured on a 7-point Likert-scale from 1 = *Strongly Disagree* to 7 = *Strongly Agree*.

The *regulation of value* scale has six items and measures students' efforts to make learning tasks seem relevant by relating it to their personal life or future (α = .88). (Reliabilities come from current sample). A sample item from the scale is, "I make an effort to relate what we're learning to my personal interests." The *regulation of performance goals* scale has five items and measures students' focus on grades and performance in the course (α = .86). A sample item from the scale is, "I remind myself about how important it is to get good grades." The *self-consequating* scale has five items and measures students' use of external rewards as a motivator for completing learning tasks (α = .80). A sample item from the scale is, "I promise myself some kind of reward if I get my readings or studying done." The *environmental structuring* scale has four items and measures students' efforts to prevent distractions and to change learning environments (α = .73). A sample item from the scale is, "I change my surroundings so that it is easy to concentrate on the work."

The *regulation of situational interest* scale has five items and measures students' efforts to make learning tasks seem interesting or fun to do (α = .88). A sample item from the scale is, "I think of a way to make the work seem enjoyable to complete." The *regulation of mastery goals* scale has five items and measures students' focus on learning the material and acquiring mastery (α = .91). A sample item from the scale is, "I challenge myself to complete the work and learn as much as possible." The *regulation of performance-avoidance goals* scale has three items and measures students' focus on the need to avoid failure and embarrassment in front of others (α = .80). A sample item from the scale is, "I imagine that my classmates make fun of my poor

performance." The *regulation of efficacy* scale has six items and measures students' ability to manage expectations and perceptions of competence (α = .71). A sample item from the scale is, "I tell myself, 'You can do this!'"

Metacognitive Strategies Scale. The metacognitive strategies scale comes from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia, & McKeachie, 1991). *Metacognitive strategies* items measure students' ability to plan, monitor, and regulate their cognition (α = .84). A sample item from the metacognitive regulation scale is, "When studying for this course I try to determine which concepts I don't understand well." There are a total of eight items measured on a 7-point Likert-scale from 1 = *Strongly Disagree* to 7 = *Strongly Agree*.

Demographics. There were seven demographic questions that asked participants to report on their sex, race/ethnicity, age, class year, course load, area of study, and employment.

Procedures

Approval for the study was obtained from the institutional review board of the University of Kansas (KU). Participants were recruited from a research pool. All undergraduate and graduate students were eligible to participate to obtain research credit for class. Data were collected for four semesters: spring, summer, and fall of 2014, and spring of 2015. First, participants read a brief introduction that defined motivational regulation strategies. Then they filled out a questionnaire with 54 items measuring motivational regulation strategies, metacognitive strategies, and demographics.

Statistical Analyses

Descriptive analyses. Analyses were conducted on N = 293. The percentage of missing data was 5.46% (listwise deletion would result in N = 277). The covariance coverage for the

variables was .99 to 1.0. Means and standard deviations for each of the eight motivational regulation strategies scales and the metacognitive strategies scale were computed. Internal consistency was estimated using Cronbach's alpha (α). The relations among motivational regulation strategies scales were computed using Pearson correlation coefficient (r).

Relation to metacognitive strategies. The relations between motivational regulation strategies scales and the metacognitive strategies scale were evaluated using Pearson correlation coefficients and latent factor correlations.

Confirmatory factor analyses. Confirmatory factor analyses were conducted to evaluate the internal structure of the motivational regulation strategies measure. Model fit was evaluated using global and local fit indices. Modifications to the models were made based on empirical (e.g., modification index) and substantive reasons (e.g., theory). The data were analyzed using Mplus version 7.0 and the WLSMV estimator was used because the data were at the ordinal level. The WLSMV estimator used a diagonal weight matrix (W), robust standard errors, and an adjusted χ^2 test statistic (Brown, 2006).

Model identification. The models were identified by fixing each latent factor variance to one. There were at least three indicators per factor and all measurement errors were assumed to be uncorrelated. The models were also constrained so there were no double-loading indicators and covariances among latent factors were freely estimated.

Evaluating fit. Overall goodness of fit was evaluated using the root mean square error of approximation (RMSEA) and its 90% confidence interval, comparative fit index (CFI), and the Tucker-Lewis index (TLI). Hu and Bentler's (1999) guidelines for acceptable model fit were RMSEA ($\leq .06$), CFI ($\geq .95$), and TLI ($\geq .95$). Multiple fit indices were used because they provide different information about model fit. Local model fit was evaluated by assessing factor

loadings: items that did not load well were dropped. An overall assessment of model fit was evaluated based on global and local fit.

Original six-factor model. The factor structure of the original English version of the motivational regulation strategies measure was tested. The original version had six scales: regulation of value, regulation of performance goals, self-consequating, environmental structuring, regulation of situational interest, and regulation of mastery goals. The six-factor model had 30 indicators (items) and six latent factors (Figure 1). The model was over-identified with 390 degrees of freedom. Note that the six-factor model is not nested in the subsequent models (e.g., eight-factor) because the six-factor model does not include the same amount of indicators.

Proposed eight-factor model. The proposed eight-factor model had 39 indicators (items) and eight latent factors: regulation of value, regulation of performance goals, self-consequating, environmental structuring, regulation of situational interest, regulation of mastery goals, regulation of performance-avoidance goals, and regulation of efficacy (Figure 2). The model was over-identified with 674 degrees of freedom.

Alternative nine-factor model. An alternative nine-factor model was tested because of the way the measure was adapted for this study (Figure 3). (It is possible that proximal goal setting and self-efficacy enhancement will appear as two distinct strategies instead of one strategy as hypothesized.) The nine-factor model had 39 indicators (items) and nine latent factors: regulation of value, regulation of performance goals, self-consequating, environmental structuring, regulation of situational interest, regulation of mastery goals, regulation of performance-avoidance goals, proximal goal setting, and self-efficacy enhancement. The model was over-identified with 666 degrees of freedom.

Second-order model. The second-order model identification rules were slightly different: the first-order factors were indicators instead of the items; the second-order factor variance was set to one; and all first-order factor unique variances were assumed to be uncorrelated. Brown (2006) suggested a three-step process for fitting a higher-order factor model: first, develop a good-fitting, conceptually valid first-order solution; second, examine magnitude and pattern of correlations among first-order factors; and third, fit the second-order factor model, as justified on conceptual and empirical grounds.

Chapter 4: Results

Descriptive Analyses

Descriptive statistics and bivariate correlations among the study variables are shown in Table 1. The scales ranged from 1 = *Strongly Disagree* to 7 = *Strongly Agree*. The means for the motivational regulation strategies scales ranged from 3.04 to 5.46. The mean for the regulation of performance-avoidance goals (M = 3.04, SD = 1.55) was relatively small compared to other scales. All scales had acceptable internally reliability (i.e., > .70): Cronbach's alphas ranged from .71 to .95.

Results indicated significant bivariate correlations among all scales—*r's* ranged from .12 to .69—with one exception: there was not a significant correlation between the regulation of performance-avoidance goals and environmental structuring scales, r = .02, p > .05. The regulation of value scale had the largest correlations with other scales. For example, the correlation coefficient between regulation of value and regulation of mastery goals was .69. In contrast, the self-consequating scale had the lowest correlations with other scales. For example, the correlation coefficient between self-consequating and regulation of mastery goals was .12.

There were significant correlations between the eight motivational regulation strategies scales and the metacognitive strategies scale, *r* ranged from .24 to .67. There was one exception, which was the relation between metacognitive strategies and the regulation of performance-avoidance goals, $r = .10$, $p > .05$.

Confirmatory Factor Analyses

Original six-factor model. Results for the six-factor models are shown in Table 2. The six-factor model showed poor fit, $\chi^2(390) = 1432.04$, $p < .01$, CFI = .94, TLI = .94, RMSEA = .10 (90% CI = .090 - .101). A modification was made by including correlated errors between two regulation of situational interest items. (The two items may have correlated errors due to wording: both items refer to turning learning into a game.) With the modification, results showed improved fit and was considered a reasonable fit, $\chi^2(389) = 1009.71$, $p < .01$, CFI = .97, TLI = .96, RMSEA = .07 (90% CI = .068 - .079).

Proposed eight-factor model. Results for the eight-factor models are shown in Table 3. The eight-factor model showed poor fit, $\chi^2(674) = 1980.39$, $p < .01$, CFI = .93, TLI = .92, RMSEA = .08 (90% CI = .077 - .085). As with the six-factor model, modification indices suggested model fit could be improved by allowing correlated errors between two regulation of situational interest items. With the modification, results showed improved fit and is considered an adequate fitting model, $\chi^2(673) = 1632.77$, $p < .01$, CFI = .95, TLI = .94, RMSEA = .07 (90% CI = .065 - .074).

To test the eight-factor model against the null one-factor model, constraints were placed on all latent factors to correlate at one (nested model). The chi-square difference test was significant, $\chi^2(28) = 1764.58$, $p < .01$. Thus, the hypothesis that the null one-factor model fits as well as the eight-factor model was rejected.

Alternative nine-factor model. Results for the nine-factor models are shown in Table 4. The nine-factor model showed poor fit, $\chi^2(666) = 1916.32$, $p < .01$, CFI = .93, TLI = .93, RMSEA = .08 (90% CI = .076 - .084). Similar to previous models, a modification was made by including correlated errors between two regulation of situational interest items. With the modification, results showed improved fit and fit was considered adequate, $\chi^2(665) = 1551.54$, $p < .01$, CFI = .95, TLI = .95, RMSEA = .07 (90% CI = .063 - .072).

To test the nine-factor model against the eight-factor model, a constraint was placed on the two regulation of efficacy factors to correlate at 1.0 (nested model). The chi-square difference test was significant, $\chi^2(1) = 29.72$, $p < .01$. Thus, the hypothesis that the eight-factor model fits as well as the nine-factor model was rejected.

Overall, results suggested a nine-factor model was the best fit for the data. The final model had nine factors and one correlated error between two regulation of situational interest items. The final model had nine latent factors: regulation of value ($\alpha = .88$), regulation of performance goals ($\alpha = .86$), regulation of performance-avoidance goals ($\alpha = .80$), regulation of mastery goals ($\alpha = .91$), self-consequating ($\alpha = .80$), environmental structuring ($\alpha = .73$), regulation of situational interest ($\alpha = .88$), self-efficacy enhancement ($\alpha = .62$), and proximal goal setting ($\alpha = .64$).

Standardized parameter estimates and R-square statistics for the loadings of the 9-factor model are shown in Table 5. All parameter estimates were statistically significant, *p*'s < .001. On average, the indicators were strongly related to the factors they were hypothesized to measure, R^2 ranged from .36 to .90.

Latent factor correlations are shown in Table 6. In addition, latent factor correlations among the motivational regulation strategies scales were positive and significant, φ ranged from

.17 to .78. However, there were two exceptions: 1) the correlation between environmental structuring and regulation of performance-avoidance goals, φ = -.01, $p > .05$ and 2) the correlation between proximal goal setting and regulation of performance-avoidance goals, φ = .00, $p > .05$.

Second-order factor model. A higher-order model was not tested because there was only adequate fit at the lower level. Brown (2006) suggested that a good-fitting first-order solution should be derived first before fitting a higher-order model.

Relation to Metacognitive Strategies

There were small to large factor correlations between the nine motivational regulations strategies scales and the metacognitive strategies scale, φ ranged from .37 to .84. There was one exception, which was the correlation between metacognitive strategies and proximal goal setting, φ = .11, $p > .05$.

Chapter 5: Discussion

The purpose of the study was to evaluate two types of validity evidence for a measure of motivational regulation strategies: the internal structure and the relation to metacognitive strategies. The adapted measure used in this study was designed to measure eight distinct motivational regulation strategies. Overall, the findings indicated that a nine-factor model was the most reasonable structure for the data. Findings also indicated that metacognitive strategies were significantly correlated with eight of the nine motivational regulation strategies scales. In summary, there was evidence for reliability of the measure but its validity needs to be further evaluated.

Hypothesis 1: Internal Structure

There was good to high internal consistency for seven of the nine scales on the motivational regulation strategies measure. These results are similar to previous studies (Schwinger et al., 2009; Schwinger & Stiensmeier-Pelster, 2012; Wang, 2013; Wolters, 1999; Wolters & Benzon, 2013; Wolters & Rosenthal, 2000). Overall then, there is evidence for the reliability of the measure, which is a necessary but not sufficient condition for validity.

As an ancillary analysis, the internal structure of the original English version, which includes six scales, was tested. Results showed reasonable fit for a six-factor model: the six strategies are distinct factors and their indicators are strongly related to the factors they are hypothesized to measure. These results support a previous exploratory study that used principal component analyses to extract six factors (Wolters & Benzon, 2013).

The first hypothesis that there are eight first-order factors that accounts for eight motivational regulation strategies was not supported. Results showed a nine-factor model was the best fit for the data, allowing for correlated errors between two regulation of situational interest items. It is important to note, however, that the differences in fit indices between the eight-factor model and the nine-factor model was very small. In addition, the chi-square difference test can be sensitive to sample size (Brown, 2006); thus a case could also be made for the eight-factor model based on parsimony.

Given how the measure was adapted for this study, however, the nine-factor model is preferred because the strategies are consistent with previous studies. Six of these strategies are from the original English version (Wolters & Benzon, 2013), two strategies are from the German version (Schwinger et al., 2009), and one strategy is from a measure of volition (McCann & Garcia, 1999). The main difference between the nine-factor and eight-factor model is that the

strategies of proximal goal setting and self-efficacy enhancement are modeled differently. Results from this study show these two strategies are best represented as distinct strategies instead of one strategy—regulation of efficacy—as suggested by Wolters's (2003) theory.

In addition, the results support the theory that there are many different strategies that can be used to regulate motivation (Wolters, 2003). Whether or not the strategies represent different dimensions of the same construct—the ability to regulate motivation—needs to be evaluated in future studies by testing a higher-order model. An alternative to a higher-order latent construct model is that the construct of motivational regulation is best represented as an index; that is, the different strategies can be summed and represent one's ability to regulate motivation (Law, Wong, & Mobley, 1998). This aggregate model does not assume there is an overall common latent construct that exists and accounts for the various strategies; rather, each strategy is a component of the ability to regulate motivation.

The nine factors (i.e., strategies) correlations were small to large. Among the strategies, self-efficacy enhancement had the highest correlations with other strategies. A study with the Chinese version of the measure showed similar results with bivariate correlations (Wang, 2013). The self-efficacy enhancement scale is from another measure and there were higher correlations with this scale than with the scales developed from the same framework. This is evidence for poor convergence among the original motivational regulation strategies scales.

Although the nine-factor model was the best fit compare to the eight-factor model in this study, it is still considered only adequate fit according to Hu and Bentler's (1999) guidelines. There are a few potential reasons for model misfit. One source of misspecification is due to correlated errors between items. In this study, a modification is made to correlate two items from the regulation of situational interest scale; these are the only items on the scale that refer to

turning learning into a game to enhance interest. Thus, these items may correlate due to similar wording. Modification indices also suggest that there are other items that may have correlated errors. Those modifications were not made but should be investigated in future studies.

Another source of model misfit was the regulation of performance-avoidance goals scale. Items on this scale are taken from the translated German version and have not been tested on an English speaking population before this study. Therefore, item wording or content may be not be appropriate for the study sample. (In the German version, Schwinger and colleagues (2007; 2009) use a high school sample to test the items.) In addition, it is the only scale that had non-significant correlations with other motivational regulation strategies scales. Moreover, the scale also had the lowest mean compare to other motivational regulation strategies scales. This suggests some misalignment between what the regulation of performance-avoidance goal scale is measuring and what the other scales are measuring.

In addition, another source of model misfit was from items that do not distinctly measure one construct. For example, one item from the regulation of mastery goals, "I challenge myself to complete the work and learn as much as possible" was suggested to cross load onto three other scales. Cross-loadings, however, are not supported by theory and thus were not allowed in analyses. Cross-loadings may reflect considerable overlap and a lack of conceptual clarity among constructs in the motivation literature (Bong, 1996).

Overall, results provide adequate but not strong evidence for validity of the measure based on its internal structure. Future studies should focus on item development and refinement. More specifically, the two regulation of situational interest items that have correlated errors should be revised or dropped from the scale because they are very different from other items on the scale. Other items that may have correlated errors should also be investigated. In addition,

more items need to be written for the regulation of performance-avoidance scale to increase reliability and to test model fit. Lastly, items that may be measuring multiple constructs should be revised to be more precise. Item revision and development should be supported by empirical results from this study and theoretical work.

Hypothesis 2: Second-Order Factor Model

The second hypothesis that there is a second-order factor that accounts for the relations among the eight first-order factors could not tested because there was only adequate fit at the lower, first-order level. The goal of a higher-order factor model is to provide a more parsimonious account for the relations among lower-order factors. To test a higher-order model, however, a good-fitting model needs to be established at the lower level (Brown, 2006). Future studies can investigate model misspecification at the lower level, which is suggested above.

Hypothesis 3: Relations to Metacognitive Strategies

The third hypothesis that there are positive correlations between motivational regulation strategies and metacognitive strategies was supported. These results are consistent with previous studies (Wolters, 1999; Wolters & Benzon, 2013). Results also showed that eight of the nine motivational regulation strategies latent factors correlate positively with the metacognitive strategies latent factor. The only exception was the correlation between metacognitive strategies and regulation of performance-avoidance goals, which was small and not significant. This provides more evidence that there may be a misfit in the regulation of performance-avoidance goals scale. Items on this scale may not assessing the same construct of motivational regulation.

These results support the theory that metacognitive strategies are positively related to motivational regulation strategies because they are part of the same self-regulatory system (Wolters, 2003). The two constructs, however, differ in the target of regulation. Metacognitive

strategies are thought to affect the cognitive system: strategies are used to aid the processing of information. In contrast, motivational regulation strategies are thought to affect the motivation system: strategies are used to help maintain or increase motivation.

The results, however, do not provide strong discrimination between metacognitive strategies and motivational regulation strategies. Some of the correlations between metacognitive strategies and the motivational regulation strategies scales were higher than the correlations among the motivational regulation strategies scales. Similar results have been found in previous studies but in those studies, results were interpreted as providing discriminant evidence (Wolters, 1999; Wolters & Benzon, 2013). Future studies should reevaluate the theoretical relation between metacognitive strategies and motivational regulation strategies.

Limitations

This study has a few limitations due to statistical and study procedures. First, results from undergraduate and graduate samples were pooled to get a higher sample for estimation of models. It is possible that the construct of motivational regulation strategies may not have the same structure in these two groups. A multi-group analysis would be able to test this hypothesis. Second, participants may require more specific instructions for responding to items. For example, they could be instructed to think about situations where motivation was a problem that needed to be overcome.

Conclusion

In conclusion, there was evidence for reliability, but the validity of the motivational regulation strategies measure is still in question. The measure of motivational regulation strategies is designed to assess different strategies individuals use to intentionally influence their motivation. In the field, this measure—Wolters's version—was the first and most widely used

measure that assesses a wide range of strategies. The measure has been used in several research programs investigating the relations to motivational beliefs, academic achievement, cognitive strategies, and metacognitive strategies (e.g., Schwinger et al., 2009; Wolters & Benzon, 2013). But the psychometric properties of the measure have not been investigated in depth. Empirical research results cannot be valid if the measure used in those studies are not valid. Thus, more validation studies need to be conducted to improve the measure and increase confidence in the measure, which could then be used to understand and investigate the ability to regulate motivation.

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Tables

Table 1

Descriptive Statistics and Bivariate Correlations among Variables

Variable	M	SD	α	1	2	3	4	5	6	7	8	9
1. Regulation of Value	5.27	1.10	.88	----								
2. Regulation of Performance Goals	5.81	0.95	.86	.14*	----							
3. Regulation of Performance-Avoidance Goals	3.04	1.55	.80	.20**	.21**	----						
4. Regulation of Mastery Goals	4.84	1.27	.91	.69**	.22*	.24**	----					
5. Self-Consequating	5.45	1.33	.95	.12*	.17**	.16**	.12*	----				
6. Environmental Structuring	5.45	0.99	.73	.27**	.32**	.02	.34*	.23**	----			
7. Regulation of Interest	4.21	1.37	.88	.61**	.14*	.38**	.55**	.28**	.20**	----		
8. Regulation of Efficacy	5.46	0.81	.71	.50**	.52**	.16**	.54*	.35**	.50**	.46**	----	
9. Metacognitive Strategies (MSLQ)	5.20	0.96	.84	.62**	.30**	.10	.61**	.24**	.53**	.50**	.67**	----

Note. $^{**}p < .01$; $^{*}p < .05$; MSLQ = Motivated Strategies for Learning Questionnaire (Pintrich, et al., 1991)

Table 2

Confirmatory Factor Analysis: Original Six-Factor Model

Model	χ^2	df	RMSEA (90% CI)	CFI	TLI	Notes
6-factor	1432.042*	390	.095 (.090, .101)	.943	.937	
6-factor w mod	1009.705*	389	.074 (.068, .079)	.966	.962	Correlated errors: SI3 with SI4 (MI = 451.263)

Note. *$p < .01$; Mod = modification; MI = modification index

Table 3

Confirmatory Factor Analysis: Proposed Eight-Factor Model

Model	χ^2	df	RMSEA (90% CI)	CFI	TLI	Notes
Null	7521.413*	702	.182 (.178, .186)	.636	.615	Overall one-factor model
8-factor	1980.392*	674	.081 (.077, .085)	.930	.923	
8-factor w/mod	1632.774*	673	.070 (.065, .074)	.949	.944	Correlated errors: SI3 with SI4 (MI = 375.602)
χ^2 test	1764.579*	28				Reject the hypothesis that the null will fit as well as the 8-factor w/mod

Note. *$p < .01$; Mod = modification; MI = modification index

Table 4

Confirmatory Factor Analysis: Alternative Nine-Factor Model

Model	χ^2	df	RMSEA (90% CI)	CFI	TLI	Notes
Null	7521.413*	702	.182 (.178, .186)	.636	.615	Overall one-factor model
9-factor	1916.319*	666	.080 (.076, .084)	.933	.926	
9-factor w/mod	1551.543*	665	.067 (.063, .072)	.953	.947	Correlated errors: SI3 with SI4 (MI = 392.659)
8-factor (nested)	1571.030*	666	.068 (.064, .072)	.952	.946	Correlated REA with REB at 1.0
χ^2 test	29.723*	1				Reject the hypothesis that the 8-factor (nested)will fit as well as the 9-factor w/mod

Note. *$p < .01$; Mod = modification; MI = modification index

Table 5

Nine-Factor Model Factor Loadings and R-Squared

Item	1	2	3	4	5	6	7	8	9	R-Squared
Regulation of Value										
I try to make the material seem more useful by relating it to what I want to do in my life.	.73									.53
I tell myself that is important to learn the material because I will need it later in life.	.75									.57
I try to connect the material with something I like doing or find interesting.	.76									.58
I make an effort to relate what we're learning to my personal interests.	.88									.77
I try to make myself see how knowing the material is personally relevant.	.89									.79
I think up situations where it would be helpful for me to know the material or skills.	.81									.65
Regulation of Performance Goals										
I convince myself to keep working by thinking about getting good grades.		.82								.68
I tell myself that I need to keep studying to do well in this course.		.80								.64
I remind myself how important it is to do well on tests and assignments in this course.		.87								.75
I remind myself about how important it is to get good grades.		.80								.64
I remind myself how my grade will be affected if I don't do my reading or studying.		.82								.67
Regulation of Performance-Avoidance Goals										
I tell myself that I have to push myself more so I won't be made fun of.			.86							.74
I imagine that my classmates make fun of my poor performance.			.77							.60
I think about how unpleasant it is to perform worse than others.			.82							.68
Regulation of Mastery Goals										
I tell myself that I should study just to learn as much as I can.				.85						.73
I tell myself that I should keep working just to learn as much as I can.				.87						.76
I persuade myself to keep at it just to see how much I can learn.				.89						.79
I convince myself to work hard just for the sake of learning.				.81						.66
I challenge myself to complete the work and learn as much as possible.				.80						.64
Self-Consequating										
I make a deal with myself that if I get a certain amount of work done I can do something fun afterwards.					.79					.63
I promise myself some kind of reward if I get my readings or studying done.					.87					.75
I promise myself I can do something I want later if I finished the assigned work now.					.93					.87
I tell myself I can do something I like later if right now I do the work I have to get done.					.95					.90
I set a goal for how much I need to study and promise myself a reward if I reach that goal.					.92					.85
Environmental Structuring										
I make sure I have as few distractions as possible.						.76				.58
I try to get rid of any distractions that are around me.						.82				.67
I change my surroundings so that it is easy to concentrate on the work.						.64				.41
I try to study at a time when I can be more focused.						.66				.44
Regulation of Situational Interest										
I think of a way to make the work seem enjoyable to complete.							.80			.65
I try to get myself to see how doing the work can be fun.							.88			.78
I try to make a game out of learning the material or completing the assignment.							.68			.46
I make studying more enjoyable by turning it into a game.							.64			.41
I make doing the work enjoyable by focusing on something about it that is fun.							.84			.71
Self-Efficacy Enhancement										
I tell myself, "Get to it and concentrate, this is an important exam/paper/assignment."								.70		.49
I tell myself, "You can do this!"								.60		.36
I tell myself that I will be able to understand and remember this course material.								.67		.44
Proximal Goal Setting										
To feel like I am capable of mastering the material, I set short-term goals.									.67	.45
In order to feel like proceeded well, I approach the study material one step at a time.									.73	.54
In order to feel capable of handling the learning material, I break it into small chunks.									.62	.38

Model fit: $\chi^2(665, N = 293) = 1551.543$, $p < .01$; CFI = .953; TLI = .947; RMSEA = .067, 90% CI [.063, .072]

Table 6

Factor Correlations (φ)

Factor	1	2	3	4	5	6	7	8	9	10
1. Regulation of Value	-----									
2. Regulation of Performance Goals	.25**	-----								
3. Regulation of Performance-Avoidance Goals	.25**	.24**	-----							
4. Regulation of Mastery Goals	.76**	.33**	.30**	-----						
5. Self-Consequating	.17**	.35**	.20**	.19**	-----					
6. Environmental Structuring	.36**	.48**	-.01	.44**	.34**	-----				
7. Regulation of Interest	.75**	.23**	.48**	.67**	.30**	.25**	-----			
8. Self-Efficacy Enhancement	.66**	.78**	.33**	.66**	.37**	.61**	.65**	-----		
9. Proximal Goal Setting	.51**	.57**	.00	.61**	.51**	.72**	.43**	.72**	-----	
10. Metacognitive Strategies (MSLQ)	.73**	.46**	.11	.71**	.37**	.69**	.61**	.77**	.84**	-----

Note. $^{**}p < .01$; MSLQ = Motivated Strategies for Learning Questionnaire (Pintrich, et al., 1991)

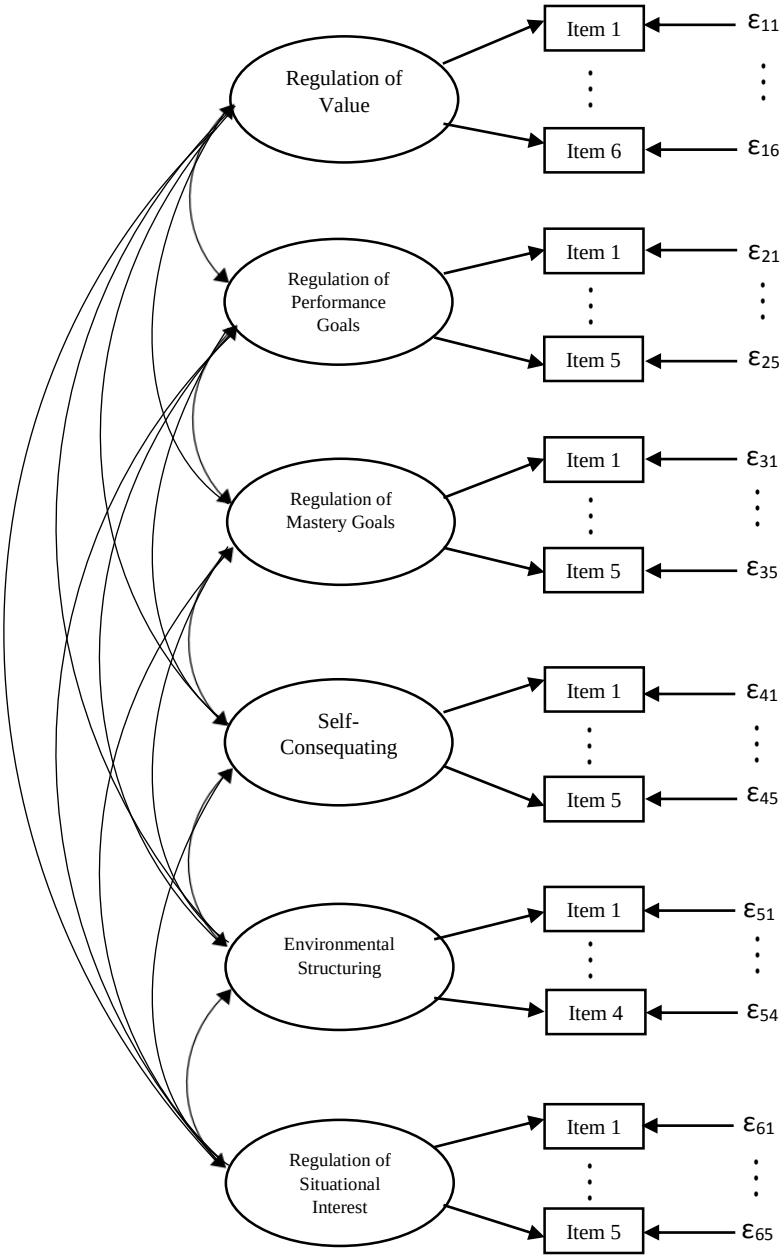

Figure 1. Six-Factor Measurement Model for Motivational Regulation Strategies Measure

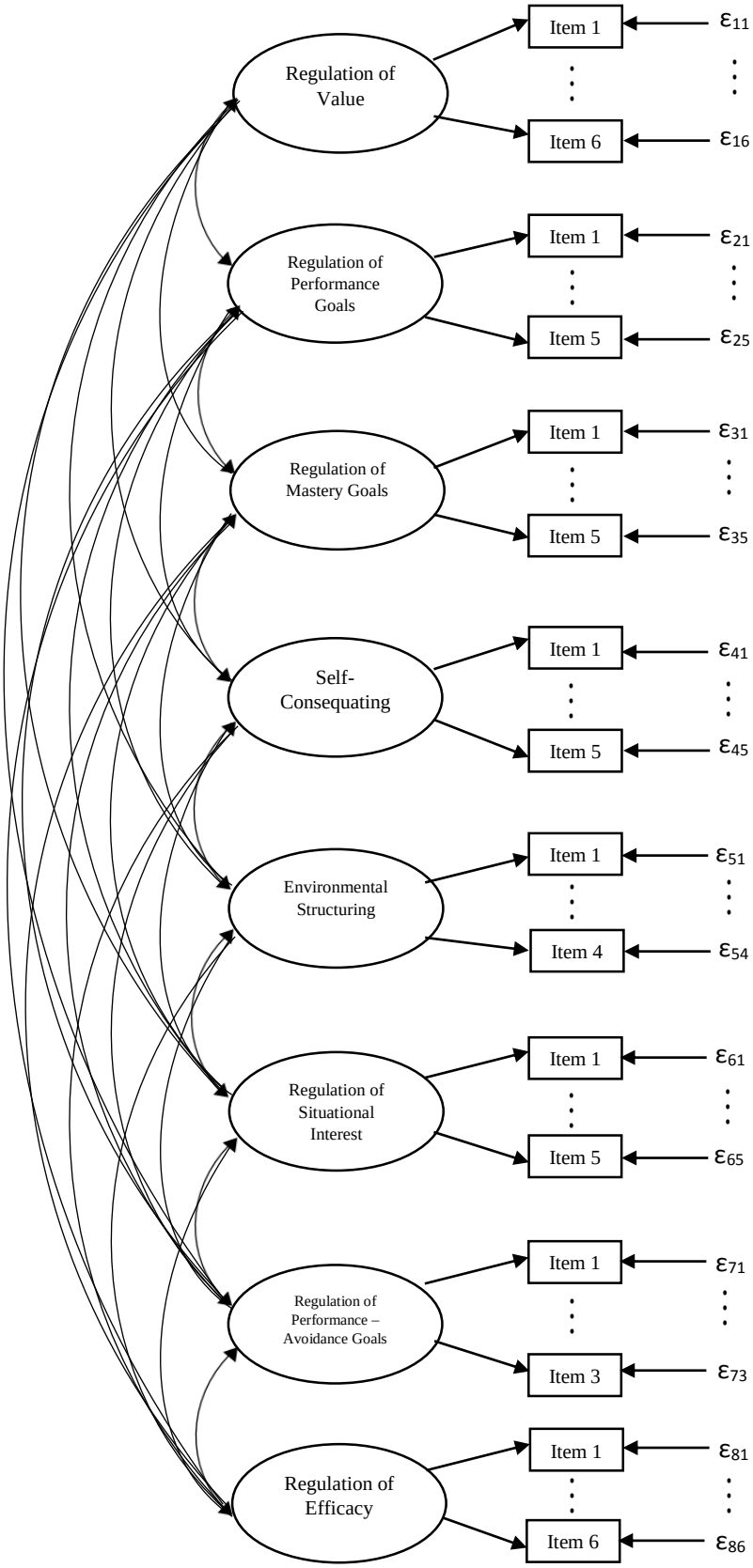

Figure 2. Eight-Factor Measurement Model for Motivational Regulation Strategies Measure

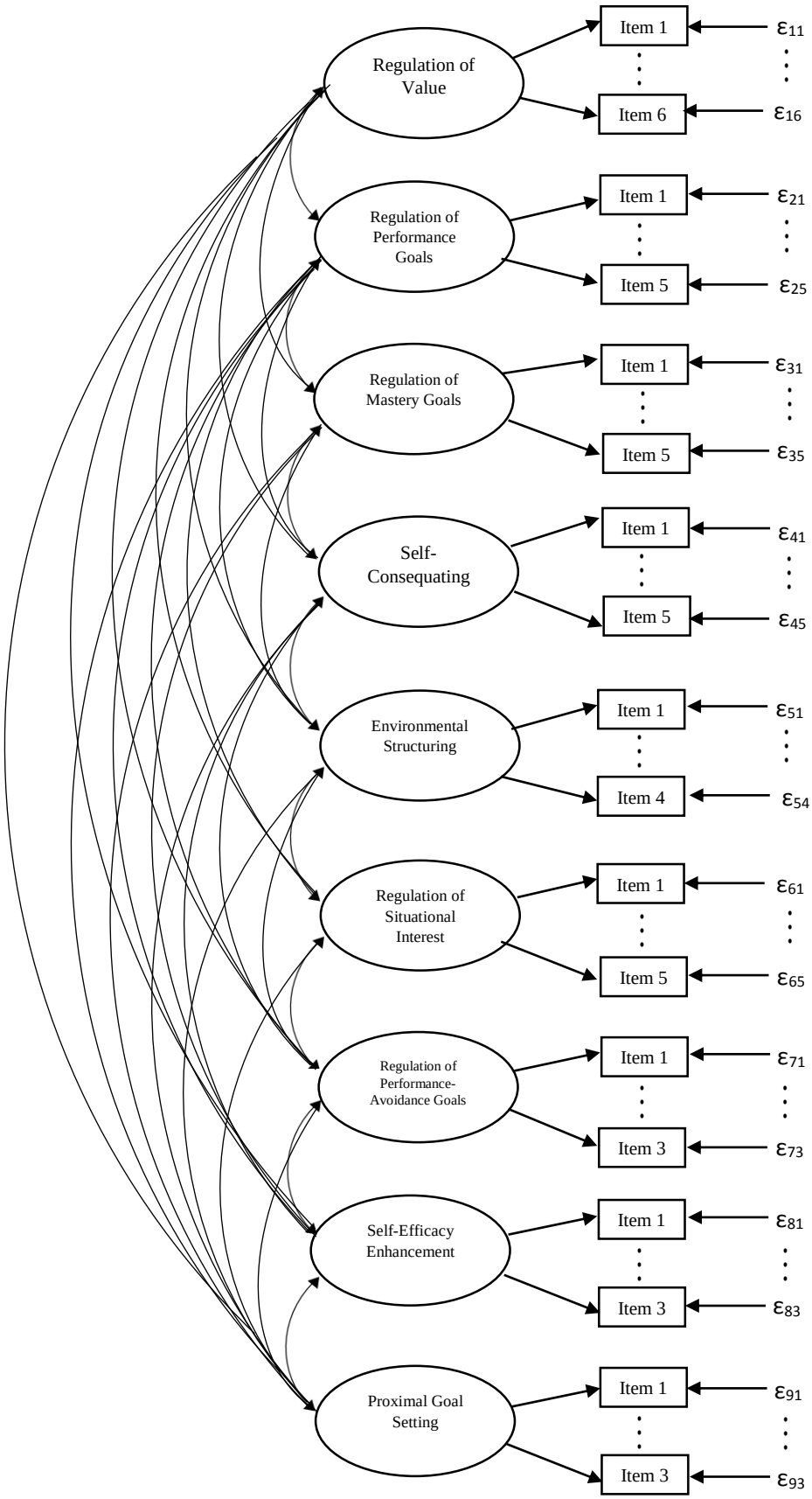

Figure 3. Nine-Factor Measurement Model for Motivational Regulation Strategies Measure

Appendix

Regulation of Motivation and Metacognition Questionnaire

What course are you completing this study for?

Instructions: Part 1 contains questions #1-47 which as assessed using a scale from (1) Strongly Disagree to (7) Strongly Agree.

Please answer the following in reference to the course you indicated above using a scale from (1) Strongly Disagree to (7) Strongly Agree.

1. I make sure I have as few distractions as possible.
2. I make a deal with myself that if I get a certain amount of work done I can do something fun afterwards.
3. I tell myself that I have to push myself more so I won't be made fun of.
4. I try to make the material seem more useful by relating it to what I want to do in my life.
5. I tell myself that I should study just to learn as much as I can.
6. I tell myself, "Get to it and concentrate, this is an important exam/paper/assignment."
7. I tell myself that I should keep working just to learn as much as I can.
8. To feel like I am capable of mastering the material, I set short-term goals.
9. I convince myself to keep working by thinking about getting good grades.
10. I tell myself that I need to keep studying to do well in this course.
11. I imagine that my classmates make fun of my poor performance.
12. I think of a way to make the work seem enjoyable to complete.
13. I try to get rid of any distractions that are around me.
14. I remind myself how important it is to do well on tests and assignments in this course.
15. I try to get myself to see how doing the work can be fun.
16. I persuade myself to keep at it just to see how much I can learn.
17. I try to make a game out of the learning the material or completing the assignment.
18. I make studying more enjoyable by turning it into a game.
19. I change my surroundings so that it is easy to concentrate on the work.
20. I tell myself that I will be able to understand and remember this course material.
21. I think about how unpleasant it is to perform worse than others.
22. I remind myself about how important it is to get good grades.
23. I promise myself some kind of reward if I get my readings or studying done.
24. When studying for this course I try to determine which concepts I don't understand well.
25. I convince myself to work hard just for the sake of learning.
26. I tell myself that it is important to learn the material because I will need it later in life.
27. If course materials are difficult to understand, I change the way I read the material.
28. I tell myself, "You can do this!"
29. Before I study new course material thoroughly, I often skim it to see how it is organized.
30. I try to connect the material with something I like doing or find interesting.
31. In order to feel like I proceeded well, I approach the study material one step at a time.
32. I challenge myself to complete the work and learn as much as possible.
33. I promise myself I can do something I want later if I finish the assigned work now.
34. When I study for this class, I set goals for myself in order to direct my activities in each study period.
35. In order to feel capable of handling the learning material, I break it into small chunks.

36. I tell myself I can do something I like later if right now I do the work I have to get done.
37. I remind myself how my grade will be affected if I don't do my reading or studying.
38. When I become confused about something I'm reading for this class, I go back and try to figure it out.
39. If I get confused taking notes in class, I make sure I sort it out afterwards.
40. I ask myself questions to make sure I understand the material I have been studying in this class.
41. I try to think through a topic and decide what I am supposed to learn from it rather than just reading it over when studying.
42. I make an effort to relate what we're learning to my personal interests.
43. I try to make myself see how knowing the material is personally relevant.
44. I make doing the work enjoyable by focusing on something about it that is fun.
45. I think up situations where it would be helpful for me to know the material or skills.
46. I try to study at a time when I can be more focused.
47. I set a goal for how much I need to study and promise myself a reward if I reach that goal.

Instructions: Part 2 contains questions #1-7 which are a mix of open-ended and multiple-choice questions. Please be specific in your answers when possible.

1. Please indicate your sex: (Male/Female).
2. Please indicate your race/ethnicity: (White/Caucasian/European-American, Black/African-American, Latina(o)/Hispanic, Asian/Asian-American, Native American/Pacific Islander, Multiracial, Other (please indicate)).
3. Please type in your age.
4. What is your class level? (Freshman, Sophomore, Junior, Senior, Graduate Student, Other (please indicate)).
5. What is your major or area of study?
6. How many credit hours are you taking this semester?
7. Approximately how many hours a week do you work for pay?

Items and Scales

Regulation of Value: 4, 26, 30, 42, 43, 45

Regulation of Performance Goals: 9, 10, 14, 22, 37

Regulation of Performance-Avoidance Goals: 3, 11, 21

Regulation of Mastery Goals: 5, 7, 16, 25, 32

Self-Consequating: 2, 23, 33, 36, 47

Environmental Structuring: 1, 13, 19, 46

Regulation of Situational Interest: 12, 15, 17, 18, 44

Regulation of Efficacy: 6, 8, 20, 28, 31, 35

Metacognitive Regulation: 24, 27, 29, 34, 38, 39, 40, 41