SELF-REGULATED LEARNING STRATEGIES AND ACHIEVEMENT GOALS AMONG PHYSICAL EDUCATION PRESERVICE TEACHERS

A Dissertation

by

JILING LIU

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Chair of Committee,	Ron E. McBride
Co-Chair of Committee,	Ping Xiang
Committee Members,	Carl Gabbard
	Laura M. Stough
Head of Department,	Richard Kreider

December 2016

Major Subject: Kinesiology

ABSTRACT

The ultimate goal of education is to develop self-regulated learners. To teach students self-regulation, teachers must have knowledge and skills of self-regulated learning (SRL). Utilizing both quantitative and qualitative methodologies, this dissertation addressed the dearth of SRL research among physical education (PE) preservice teachers. Specifically, four research questions guided this dissertation: (1) How do PE preservice teachers define SRL? (2) To what degree do PE preservice teachers apply SRL strategies in their learning? (3) How do PE preservice teachers employ SRL strategies during their field-based teaching practices? And, (4) do PE preservice teachers' achievement goals predict the use of SRL strategies? In addition, one question preceded the four above-mentioned: Do the measures of the Cognitive and Metacognitive Learning Strategies Scales (CMLSS) demonstrate acceptable psychometric properties among PE preservice teachers? This is to examine construct validity and score reliability of the CMLSS through factor analyses.

Data were collected among 419 preservice teachers from five Texas physical education teacher education (PETE) programs. Instruments included a biographical data questionnaire, the CMLSS, the 2×2 Achievement Goal Questionnaire (AGQ), two open-ended questions, and an interview protocol. All items on the CMLSS and the AGQ were on a 7-point Likert scale. Preservice teachers filled out the questionnaires in 20 minutes, and 11 of them participated in a semi-structured interview. The interview lasted for 20 minutes and was audiotaped.

Regarding psychometric properties of the CMLSS, a modified bifactor model with one general factor and two group factors fit the data well. Score reliability for the general factor was good. Preservice teachers' degree of SRL strategies use turned out to be at a medium level. The use of learning strategies was predominantly predicted by mastery-approach goals. The preservice teachers described some indicators of SRL, but their definitions were far from complete. Nevertheless, their disclosure of field teaching experiences indicated that PETE programs afforded opportunities for SRL.

Based on the results, it is suggested that researchers use the bifactor modeling approach for studies with a large sample; whereas for studies with a small sample, they can calculate a single composite score of all items to represent the overall SRL level. PE teacher educators should promote SRL among preservice teachers, particularly start with explicit instruction. To facilitate SRL strategies use, a learning environment focusing on mastery can be created. Future research can examine the CMLSS' bifactor structure in other populations and how SRL strategies determine student academic achievement.

ACKNOWLEDGEMENTS

At the end of my journey at Texas A&M University as a doctoral student, I would like to thank my committee chairs, Dr. Ron E. McBride and Dr. Ping Xiang, and my committee members, Dr. Carl Gabbard and Dr. Laura Stough, for their guidance and support throughout the course of this research.

Thanks to those who helped me with data collection: the late Dr. Susan Wager at Texas A&M University, Dr. Jianmin Guan at University of Texas at San Antonio, Dr. Karen Meaney at Texas State University, Dr. José Santiago at Sam Houston State University, Dr. Sandy Kimbrough at Texas A&M University-Commerce, Dr. Tao Zhang at University of North Texas, and Dr. Harry Meeuwsen at University of Texas at El Paso.

Thanks also go to my friends and colleagues and the department faculty and staff for making my time at Texas A&M University a great experience. I also want to extend my gratitude to the SHAPE America Graduate Research Grant Program, Texas A&M University CEHD Graduate Student Research Grant Program, and to all the Texas PE preservice teachers who participated in the study.

Finally, thanks to my mother, sister, and brothers for their support and to my wife for her patience and taking care of our little daughter.

TABLE OF CONTENTS

LIST OF FIGURES

Page

LIST OF TABLES

CHAPTER I

INTRODUCTION

"The ultimate goal of the education system is to shift to the individual the burden of pursuing his own education" (Gardner, 1963, p. 21). One approach to achieving the ultimate goal of education is to foster students' use of self-regulated learning (SRL) strategies. SRL refers to "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment" (Pintrich, 2000b, p. 453). Self-regulated learners tend to display personal initiative, perseverance, and adaptive strategies to acquire academic achievement (Zimmerman, 2008) and succeed in the workforce (Sitzmann & Ely, 2011). SRL can also promote active citizenship that, in turn, generates a positive impact on society (Pearce, 2001).

SRL, by and large, is comprised of "skills and will" (e.g., Garcia & Pintrich, 1996; Zusho, Pintrich, & Coppola, 2003). "Skills" refer to specific strategies such as critical thinking and metacognition that students use during learning. "Will" indicates how students are motivated to use the strategies in their learning processes. Therefore, motivation has an immediate effect on strategies use which, in turn, directly affects student success. For example, SRL research using achievement goal theory to represent motivation has found that students oriented by mastery-approach goals (focusing on acquisition of knowledge and self-improvement) tend to use learning strategies more effectively than those oriented by performance-approach goals (trying to outperform others) or those oriented by avoidance goals (afraid of failure in learning or being outperformed) (e.g., Bernacki, Byrnes, & Cromley, 2012; Mouratidis, Vansteenkiste, Michou, & Lens, 2013; Muis & Franco, 2009).

To develop self-regulated students, teachers must have adequate knowledge and skills of SRL. Educators and researchers believe that teachers who model and self-regulate their own learning have a positive impact on students' SRL (e.g., Bembenutty, White, & Vélez, 2015; Keller-Schneider, 2014). Empirical studies, however, have found few teachers are able to self-regulate their learning and implement SRL instructions (e.g., Kistner et al., 2010; Peeters et al., 2014). This could be due to a lack of SRL instruction during their teacher preparation. Thus, teaching preservice teachers to conceptualize, learn, and apply SRL in their learning and teaching practices may benefit them in their future jobs.

As an important component of education, physical education (PE) aims to develop physical literacy and a physically active lifestyle among students (SHAPE America, 2013). Achieving this goal, again, entails SRL in students, teachers, as well as preservice teachers. In fact, SRL studies in PE (e.g., Cleary, Zimmerman, & Keating, 2006; Kolovelonis, Goudas, & Dermitzaki, 2011) have evidenced that SRL strategies such as goal setting and self-monitoring are effective in promoting students' motor skill learning and performance, motivation, and affect. These strategies can also increase students' daily physical activity levels outside of school and bring about lifelong benefits (Shimon & Petlichkoff, 2009).

Nevertheless, the SRL research in PE has rarely paid attention to preservice teachers. Thus, little is known regarding PE preservice teachers' understanding of SRL, motivation, and strategies use in learning and field-based practices. A lack of such information may hinder physical education teacher education (PETE) programs in preparing effective teachers. The major objective of this dissertation, therefore, is to identify SRL indicators such as learning strategies use and motivational goal orientations and to examine their relationships and applications among PE preservice teachers. Specifically, four research questions are asked:

1. To what degree do PE preservice teachers apply SRL strategies in their learning?
2. Do PE preservice teachers' achievement goals predict SRL strategies use?
3. How do PE preservice teachers define SRL?
4. How do PE preservice teachers employ SRL strategies during their field-based teaching practices?

Both qualitative and quantitative methodologies are used to answer the four questions. Specifically, to answer research questions #1 and #2, two questionnaires are used to gather quantitative data. To address research questions #3 and #4, an interview and an open-ended question assist collecting qualitative data.

One of the two questionnaires, the Cognitive and Metacognitive Learning Strategies Scales (CMLSS; Pintrich, Smith, Garcia, & McKeachie, 1991) has been widely used to assess SRL strategies in a variety settings, but validation studies across disciplines (e.g., Cho & Summers, 2012; Cook, Thompson, & Thomas, 2011; Roces, Tourón, & Gonzalez, 1995) have not found the scales' psychometric properties satisfactory. To ensure the precision of estimation and trustworthiness of research results, it is important to establish adequate construct validity and score reliability. Therefore, another objective of this dissertation is to provide evidence for the CMLSS' psychometric properties (i.e., construct validity and score reliability). Specifically for this objective, the research question asked is: Do the measures of the CMLSS demonstrate acceptable psychometric properties among PE preservice teachers?

This dissertation is significant because few empirical studies have examined SRL in PE preservice teachers. This study will contribute to the PETE research by revealing preservice teachers' knowledge and SRL strategies use in their learning and teaching practices. The present study also recognizes important motivational goals that drive SRL strategies use. Results of this study can inform PE preservice teachers' understanding and implementation of SRL. Such information may assist faculty to infuse SRL into their PETE programs for better preparing future effective teachers who, in turn, develop physically literate individuals.

The present study is also innovative due to an employment of bifactor analysis in validating the CMLSS. The bifactor analysis proposes one general factor underlies all items while at the same time unique subfactors account for variances over and above the general factor. Research utilizing bifactor analysis constantly demonstrates this approach's superiority to first-order and second-order factor analyses (e.g., Chiu & Won, 2016; Chung, Liao, Song, & Lee, 2016; Kranzler, Benson, & Floyd, 2015). Previous validation studies relied on first-order exploratory factor analysis and failed to reveal the

CMLSS' hierarchical structure. Using bifactor analysis, this study contributes to the methodology of SRL research in PETE.

This dissertation consists of five chapters. Chapter I introduces and briefly overviews SRL, as well as discusses the purpose, significance, and innovation of the present study. Chapter II provides an extensive review of literature of SRL research, including definitions, theoretical models, measurements, and SRL studies in physical education. Chapter III examines construct validity and score reliability of the CMLSS through bifactor analysis and thus answers the prerequisite research question. For the other four research questions, Chapter IV calculates descriptive statistics and employs structural equation modeling to reveal the degree of SRL strategies use and how achievement goals predict the use of strategies. At the same time, content analysis notifies PE preservice teachers' definitions of SRL and their self-regulation in field practices. Chapter V summarizes previous chapters and discusses research and practical implications.

CHAPTER II

SELF-REGULATED LEARNING AND PHYSICAL EDUCATION

Regarding the importance of self-regulated learning (SRL), this chapter explains what SRL represents, two theoretical models related to SRL components, measurements of the SRL components, relationships among these components, SRL research in physical education (PE), and points out the literature gap and future research directions.

Definition

According to Vancouver (2000), regulation means keeping a system in a desired status in the presence of external disturbances; self-regulation, then, refers to how the system maintains its desired status on its own. In educational psychology, Zimmerman (2000) refers to self-regulation as "self-regulated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (p. 14). While self-regulation is a broad concept, SRL is more specific to learning contexts (Weiss, 1990). Particularly in educational settings, SRL generally means how students take control of their own learning processes (Zimmerman, 1986; Zimmerman, 1989).

A variety of definitions for SRL exist. Butler and Winne (1995) regard SRL as,

> A style of engaging with tasks in which students exercise a suite of powerful skills: setting goals for upgrading knowledge; deliberating about strategies to select those that balance progress toward goals against unwanted costs; and, as steps are taken and the task evolves, monitoring the accumulating effects of their engagement. (p. 245)

In this definition, goals can be specific (e.g., scoring 90 out of 100 in a test) or broad (e.g., learning as much as one can), and strategies refer to "purposive personal processes and actions directed at acquiring or displaying skills" (Zimmerman, 2000, p. 17). While Butler and Winne emphasize the use of strategies and goal setting, Zimmerman (1986) proposes three key elements of SRL: learning strategies, self-efficacy, and goals. He refers to self-regulated learners as those who are "metacognitively, motivationally, and behaviorally active participants in their own learning process" (p. 308). Zimmerman (1998) summarizes SRL as "self-regulated thoughts, feelings, and actions for attaining academic goals" (p. 73).

Considering the interactions between learners and contexts, Pintrich (2000b) further takes environmental factors into account. He defines SRL as "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment" (p. 453).

Self-Regulated Learning Theoretical Models

A model is a representation of a system or a process (Shoemaker, Tankard, & Lasorsa, 2004). It identifies the key factors and their relationships in the system or process. Models help people understand how factors function individually or as a whole. Many SRL models have been proposed across disciplines, such as Winne and Hawin's (1998) four-stage model and Borkowski, Chan, and Muthukrishna's (2000) process-oriented model, Zimmerman's (1989, 2000) three-phase feedback loop model, and Pintrich's (2000b) four-phase four-domain model. In educational research, the latter two are the most dominant.

Zimmerman's Three-Phase Feedback Loop Model

Based on Bandura's (1986) social cognitive theory, Zimmerman (1989, 2000) proposed a three-phase feedback loop model that includes: forethought, performance, and self-reflection. During the forethought phase, individuals perceive a task, set goals, and strategically plan for performing the task. These actions are based on personal motivational beliefs such as self-efficacy and interests. The performance phase involves self-control and self-observation. Such strategies as self-instruction (e.g., self-talk), imagery, and self-recording are employed. Finally, individuals self-evaluate and react to their actions during the self-reflection phase. Attribution and adaptation are also made. Although Zimmerman's (1986) definition does not reflect the importance of environmental factors, he postulates that social and environmental influences are essential in SRL. Feedback provided by social environment, for example, can affect self-directed behaviors. According to Zimmerman (1989, 2000), feedback from a self-reflection phase can influence a future forethought phase and thus make SRL a cyclic process.

Pintrich's Four-Phase Four-Domain Model

Pintrich (2000b) proposed a four-phase four-domain theoretical model. The four phases include (1) forethought, (2) monitoring, (3) control, and (4) reaction and reflection; each phase can occur in four domains: cognition, motivation, behavior, and context. The forethought phase involves perceptions of context, task analysis, goal setting, and strategic planning. During this phase, learners first identify and analyze requirements of a task and contextual constraints/support. They then activate relevant knowledge about the task and set specific goals in the cognitive domain. In the motivational domain, learners assess the task's difficulty and value as well as their own capability to perform the task. Behaviorally, they schedule time and place for study.

The monitoring and control phases require awareness of self and tasks, regulation of effort, and adoptions of cognitive strategies. In the contextual domain, learners are conscious of task requirements and learning environments such as classroom rules. Motivationally, they can monitor and control their self-confidence through positive feedback. Cognitively, learners select strategies for learning and employ metacognitive judgment to monitor their strategies use. In the behavioral domain, they monitor time management and adjust effort levels according to task requirements.

The reaction and reflection phase refers to when evaluation of a task and attributions of the task's results occur. During this phase, behavioral and contextual reactions and reflection are more cognitive and motivational. Cognitively, self-regulated learners will assess their performance in terms of the task goals and attribute their success or failure to various factors such as high/low effort, good/poor strategies use, or sufficient/insufficient ability. Motivationally, they may experience happiness or sadness depending on success or failure. These reactions and reflection can influence their future SRL decisions (Pintrich, 2000b).

Pintrich and colleagues (e.g., Pintrich, 1988b; Pintrich & De Groot, 1990; Pintrich & Schrauben, 1992) included cognitive learning strategies frequently used in academic contexts such as rehearsal, elaboration, and organization (see Weinstein &

Mayer, 1983). Students use rehearsal strategies to memorize information, while elaboration helps students paraphrase the materials under study and connect prior knowledge. Additionally, organizational strategies allow students to distinguish key ideas in contrast to general texts. Another important cognitive learning strategy is critical thinking, which concerns applying information, making decisions, and solving problems. SRL also engages metacognitive strategies, also called metacognition or metacognitive self-regulation. Metacognitive strategies involve planning, monitoring, and regulating cognitive strategies use. Use of metacognitive strategies often represents an effective learning means and outcome (Schunk, 2008; Sperling, Howard, Staley, & DuBois, 2004; Weinstein & Mayer, 1983).

Besides cognitive and metacognitive strategies, resource management strategies are also important for learners to manage contextual factors. Four resource management strategies identified are time and study environment, effort regulation, peer learning, and help seeking. Self-regulated learners can manage time spent on studying and control the learning environment. They are able to control their effort and persistence in completing tasks. In addition, effective learners know when and how to find helpful sources and collaborate with peers.

Pintrich (2000b) regards this four-phase four-domain model as a representation of a general sequence of engagement in a task. At the same time, he posits that the phases are not linearly or hierarchically structured because the last three phases often occur simultaneously. Also, individuals’ goals and strategies use may adjust according to feedback. In addition, he states that monitoring and control phases should not be independent of one another, which is in line with Zimmerman (2000) that the performance phase involves both self-control and self-monitoring.

Although emphasizing different features, the two SRL models share similarities. First, they both agree that SRL is a process involving pre-action, action, and post-action phases. Second, uses of specific strategies are important throughout a SRL process. Third, motivation determines SRL strategies use. Zimmerman (2000) argues that SRL strategies “are of little value if a person cannot motivate themselves to use them” (p. 17). As reflected in the literature (Bernacki et al., 2012; Kolovelonis et al., 2011; Pintrich, 1988a; Pintrich, 2000a, 2000b; Zimmerman & Kitsantas, 1996, 1997), learning strategies and motivation are two key components of SRL.

It needs pointing out that in Pintrich’s (2000b) model, explanations of motivation are primarily based on previously developed motivational theories, such as the intrinsic/extrinsic goals theory and the expectancy-value theory. These theories have not been updated in contemporary educational psychology research and may not help our understanding of students’ motivation from another perspective. Meanwhile, as a key component of SRL, goal orientations have received much attention (e.g., Pintrich, 1988a; Pintrich, 1999; Zimmerman, 1986; Zimmerman, 1990). Goal orientations explain the reason for which individuals pursue desired outcomes (Meece, 1994; Pintrich, 2000b). Especially in achievement settings, goals serve as reference points that guide students’ learning behaviors such as employing specific learning strategies (Boekaerts, Pintrich, & Zeidner, 2000). One theory that represents goal orientations is the theory of achievement goals.

Achievement Goal Theory

The Achievement Goal Theory (AGT) is a theory about different goals individuals may adopt according to their competence (Elliot & Dweck, 2005). Achievement goals are defined as the purpose or reason for students' learning behavior (Maehr, 1989). In the past three decades, AGT has evolved from a dichotomous (Ames, 1992; Dweck & Leggett, 1988; Nicholls, 1989) to a trichotomous (Elliot, 1997; Elliot & Church, 1997; Elliot & Harackiewicz, 1996), to a 2×2 (Elliot, 1999; Elliot & McGregor, 2001), and most recently to a 3×2 (Elliot, Murayama, & Pekrun, 2011) theoretical model. The dichotomous model includes two orientations: mastery goals and performance goals. Mastery goals orient learners to tasks and acquisition of knowledge and skills based on self-referenced standards, while performance goals aim learners at receiving recognition for superior performance and demonstrating competence based on normative standards.

In the trichotomous model, performance goals are differentiated between performance-approach (PAp) and performance-avoidance (PAv) goals. PAp goals are similar to performance goals in that learners compare themselves to others based on normative competence, whereas PAv goals center on normative incompetence when comparing one's performance to others. Individuals with PAv goals try to avoid being outperformed. Similarly, in the 2×2 model, mastery goals were differentiated between mastery-approach (MAp) and mastery-avoidance (MAv) goals. The former emphasizes intrapersonal competence by focusing on improvement of self in learning, while the latter is based on intrapersonal incompetence while focusing on the avoidance of failure in learning. In the newest 3×2 model, competence is evaluated based on three standards: task, self, and other. A task-approach goal addresses obtaining task-based competence such as individuals focusing on doing a task correctly. Self-approach goals focus on self-based competence based on intrapersonal standards, while other-approach goals are analogous to PAp goals. Individuals with task-avoidance goals, self-avoidance goals, and other-avoidance goals seek to avoid looking incompetent in learning outcomes. Research revealed that different achievement goals are differential predictors of cognitive, behavioral, and affective learning outcomes including SRL strategies use (e.g., Ames, 1992; Cellar, Stuhlmacher, Young, Fisher, & et al., 2011; Mouratidis et al., 2013).

Links between Achievement Goals and Self-Regulated Learning Strategies

The integration of achievement goal constructs into SRL models has long been advocated (e.g., Pintrich, 2000a, 2000b; Pintrich & Schunk, 1996). The relationship between achievement goals and SRL strategies has been documented in the literature (e.g., Ames, 1992; Cellar et al., 2011; Mouratidis et al., 2013). To be noted, early research (Weinstein & Mayer, 1983) categorizes SRL strategies as surface cognitive learning strategy (e.g., rehearsal), deep cognitive learning strategy (e.g., organization, critical thinking), metacognitive learning strategy (e.g., metacognitive self-regulation), and strategic learning strategy (e.g., resource and time management). The predictions of goal orientations were examined primarily based on the trichotomous model.

Although research generally identified that mastery goals promoted the use of deep learning strategies such as elaboration and critical thinking across academic levels (e.g., Greene, Miller, Crowson, Duke, & Akey, 2004; Liem, Lau, & Nie, 2008; Mouratidis et al., 2013; Somuncuoglu & Yildirim, 1999; Vrugt & Ourt, 2008), empirical evidence has yet to arrive at a conclusion about the predictive roles of performance goals. Of studies conducted among secondary school students, Liem et al. (2008) and Mouratidis et al. (2013) found PAp goals were positively correlated with deep learning strategies use. However, Wolters (2004) and Greene et al. (2004) did not observe the same relationship between the two constructs. While Liem et al. (2008) reported that PAv goals positively predicted surface learning strategies use, other studies (Greene et al., 2004; Mouratidis et al., 2013; Wolters, 2004) did not detect the same effect.

Similar mixed results regarding performance goals exist among studies conducted at the college level. While Diseth and Kobbeltvedt (2010) observed that PAp goals promoted both deep and strategic learning strategies use, Dupeyrat and Mariné (2005) found PAp goals were only associated with surface learning strategies use, and other studies (Bernacki et al., 2012; Cao & Nietfeld, 2007; Cho & Shen, 2013; Ismail & Sharma, 2012) did not find any relationship between the two. Bernacki et al. (2012) recorded a negative association between PAv goals and deep learning strategies use, while Diseth and Kobbeltvedt (2010) found that PAv goals were positively correlated with surface learning strategies use and negatively associated with strategic learning strategies use. Other studies (Artino et al., 2012; Cao & Nietfeld, 2007; Cho & Shen, 2013; Vrugt & Ourt, 2008) did not find any relationship between PAv goals and SRL strategies use.

Previous studies on the relationship between achievement goals and SRL strategies face two challenges. First, they assessed MAp goals exclusively but did not involve MAv construct. Thus, effects of MAv goals on SRL strategies use remain unknown. Second, specific learning strategies were not examined; instead, elaboration, organization, and critical thinking were grouped as deep learning strategies. As a result, it is unclear which achievement goal affects which type of SRL strategies use. Lack of this information may hinder advances in theoretical research and practical implications. Therefore, it is necessary to examine how the four specific achievement goals in the 2×2 model determine the use of specific learning strategies.

Measurement of Self-Regulated Learning

A variety of instruments are used to assess SRL, such as the learning and study strategies inventory (Weinstein, Schulte, & Palmer, 1987), think-aloud protocol (Ericsson & Simon, 1984), trace logs (Howard-Rose & Winne, 1993), and observations (Perry, 1998; Turner, 1995). Among these measures, the Self-Regulated Learning Interview Schedule (SRLIS; Zimmerman & Martinez-Pons, 1986, 1988) and the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991) are the most frequently used in education settings.

Self-Regulated Learning Interview Schedule

Guided by SRL theory, the Self-Regulated Learning Interview Schedule (SRLIS; Zimmerman & Martinez-Pons, 1986, 1988) was first developed as a structured interview protocol to explore learners' use of self-regulatory strategies in different learning contexts (e.g., in the classroom, at home). The protocol includes 14 categories of SRL strategies such as goal setting and planning, rehearsing, organizing, help seeking, and self-evaluation. A non-SRL category (i.e., other) is also included when learning is not self-initiated but originated by others such as teachers or parents.

The interviewer asks questions such as, “Most students find it necessary to complete some assignments or prepare themselves for class at home. Do you have any particular methods for improving your study at home?” (Zimmerman & Martinez-Pons, 1988, p. 285). If a student fails to answer the question, a probe is given, “What if you are having difficulty? Is there any particular method you use?” (Zimmerman & Martinez-Pons, 1986, p. 617). If the student is still unable to come up with any SRL strategies, questioning is terminated. If indicators of SRL strategies use are provided, three measures are used for documentation. First, a dichotomous score of strategies use (SU) records the use of a specific strategy. Second, according to how many times the specific strategy is mentioned, a frequency of strategies use (SF) is calculated. Third, frequencies of all possible strategies are compared and rated on a 4-point Likert scale (SC) from 1 to 4 (1 = *seldom*, 2 = *occasionally*, 3 = *frequently*, and 4 = *most of the time*).

The reliability of the protocol was examined in a pilot study (Zimmerman & Martinez-Pons, 1986), where two graduate students coded approximately 25% of the protocols independently. They reached an 80% agreement when identifying the categories of SRL strategies mentioned by participants. Using the three measures to distinguish two achievement groups through a discrimination analysis, the authors found that 91% of the students were correctly classified into categories. The standardized discrimination coefficients for the SU, SF, and SC measures were -.66, .41, and 1.12, respectively. All the coefficients were significant at .001 level.

Motivated Strategies for Learning Questionnaire

The 81-item Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991) was initially developed to assess college students' SRL through motivation and learning strategies scales. Three components under the motivation scale are value components (assessing intrinsic and extrinsic goal orientations, task value), expectancy components (assessing control beliefs and self-efficacy), and affective components (assessing test anxiety). These scales are largely influenced by earlier motivation theories. Under learning strategies scales, there are two subscales: cognitive and metacognitive strategies and resource management strategies. The first subscale measures rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulation. The second subscale measures time and study environment, effort regulation, peer learning, and help seeking.

All items in the questionnaire are declarative. An example item assessing critical thinking is, "I often find myself questioning things I hear or read in this course to decide if I find them convincing." Participants rate their responses to each item on a 7-point Likert scale from 1 (*not at all true for me*) to 7 (*very true for me*). Reverse-coded items can use 8 to subtract their original scores for further analysis. A scale's scores are the average of all its subscales. For interpreting a score, Pintrich et al. (1991) suggest that students are "doing well" if their scores are above three on one scale. When using the MSLQ, a demographic information sheet is distributed to collect data such as gender, educational classification, and ethnicity, etc.

Pintrich, Smith, Garcia, and Mckeachie (1993) examined the MSLQ's construct validity and score reliability among 340 college students. Confirmatory factor analyses (CFA) were performed using the Linear Structural Relations IV (LISREL; Jöreskog & Sörbom, 1984). The four model fit indices used were the Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Chi-Square to Degree of Freedom Ratio (χ^2/df), and Root Mean Residual (RMR). For these fit indices, the authors used GFI or AGFI ≥ .90, $\chi^2/df < 5$, and RMR ≤ .05 as cutoff values to indicate whether the proposed model fits the data well. In their study, CFA of the motivation scales' measurement model resulted in GFI = .77, AGFI = .73; $\chi^2/df = 3.49$; RMR = .07, while the fit indices for the learning strategy scales were GFI = .78, AGFI = .75; $\chi^2/df = 2.26$; RMR = .08. The authors acknowledged, "While the goodness of fit indices are not stellar, they are, nevertheless, quite reasonable values … Overall, the models show sound structures, and one can reasonably claim factor validity for the MSLQ scales" (Pintrich et al., 1991, pp. 79-80). They also stated that the MSLQ "has relatively good reliability in terms of internal consistency" (Pintrich et al., 1993, p. 811).

However, the original values of the MSLQ construct validity and score reliability are subject to argument. Contemporary CFA standards note that the GFI and AGFI should not be used due to sensitivity to sample size (Sharma, Mukherjee, Kumar, & Dillon, 2005). A certain value of χ^2/df index also has not been universally agreed upon. In addition, the RMR has been replaced by an easier-to-interpret index SRMR (standardized RMR). Moreover, in CFA, any item with a factor loading lower than .30/.40 is an ineffective indicator of its corresponding construct and should be removed

(Bowen & Guo, 2011). In their original reports (Pintrich et al., 1991, 1993), under help seeking construct, two items' factor loadings were .20 and .17. While these values are much lower than the recommended cutoff values, the authors kept the items in their original measurement model.

While the cognitive and metacognitive constructs are often used in empirical studies (Al-Harthy, Was, & Isaacson, 2010; Dahl, Bals, & Turi, 2005; Ghanizadeh, 2011; Olaussen & Bråten, 1999; Phan, 2010; Sitzmann & Ely, 2011; UzuntİRyakİ-KondakÇI & ÇApa-Aydin, 2013), the motivational scales in the MSLQ were less employed. This is probably because the motivational scales were developed under the influence of earlier motivational theories (e.g., expectancy-value theory). As mentioned previously, with the advance of motivational theories, research interests have focused on goal orientations (Meece, 1994; Pintrich, 2000b). Therefore, the Achievement Goal Questionnaire (AGQ; Elliot & McGregor, 2001) that examines different goal orientations can be used to replace the original motivational scales in the MSLQ.

Achievement Goals Questionnaire

The Achievement Goal Questionnaire (AGQ; Elliot & McGregor, 2001) consists of 12 items. Each goal orientation is measured by three items. Participants respond to the items on a 7-point Likert scale from 1 (*not at all true of me*) to 7 (*very true of me*). Elliot & McGregor's (2001) initial exploratory factor analysis (EFA) of the AGQ among 180 undergraduate students had a good result: 81.5% of the total variance in the factors was accounted for, and factor loadings were all above .70. Following CFAs among 148 undergraduate students indicated the AGQ had a good model fit: $\chi^2_{(48)} = 60.49$, $p = .11$;

CFI = .99; RMSEA= .042. Factor loadings were all above .80 except one item in the PAv goal construct that scored .64. Cronbach's alphas were .83–.94. These results confirmed the questionnaire's acceptable construct validity and internal consistency. The AGQ has been adopted and validated across disciplines (e.g., Baranik, Stanley, Bynum, & Lance, 2010; Chiang, Yeh, Lin, & Hwang, 2011; Guan, McBride, & Xiang, 2007).

SRL Literature in Physical Education

SRL research in PE is limited. Of 14 studies that examined SRL, 12 employed an experimental design where participants were randomly assigned to an experimental group or a control group. One study (Kolovelonis, Goudas, Hassandra, & Dermitzaki, 2012) had both pre- and post-tests. One was an observational study (Kermarrec, Todorovich, & Fleming, 2004), and another correlational (Ommundsen, 2003). Seven studies occurred in the U.S, six in Greece, and one in France. Eleven studies examined SRL in motor skill learning, while two focused on how curriculum and teaching styles facilitate SRL. All the studies examined how SRL affected students' physical performance and motivational outcomes. Motor skills studied included basketball dribbling and free throwing, soccer dribbling, passing and shooting, and dart throwing. Motivational outcomes included self-efficacy, satisfaction, enjoyment, interest, and effort.

Finally, participants in the earlier studies were homogeneous. For example, Zimmerman and Kitsantas (1996, 1997), Kitsantas and Zimmerman (1998), and Kitsantas, Zimmerman, and Cleary (2000) involved only high school girls. Participants in the other studies included both sexes. In all studies, sample sizes ranged from 30 to

601. Participants were across educational classification, from elementary school to college, with mean ages ranging from 8.3 to 21.7 years old.

Effects of SRL on Motor Skill Learning and Performance

The majority of these studies focused on how SRL strategies such as goal setting and self-recording could affect students' sports skill performance and motivation. Two types of goals were primarily compared: process goals and performance-outcome goals (refer to Kolovelonis et al., 2011). Process goals focus on mastery of skills, while performance-outcome goals aim to achieve the best outcomes (e.g., a 100% shooting accuracy). Whether setting process goals is superior to performance-outcome goals, or vice versa, is not conclusive. According to Zimmerman and Kitsantas (1996, 1997) as well as Kitsantas and Zimmerman (1998), students with process goals outperformed those with performance-outcome goals in a dart-throwing task. Kolovelonis, Goudas, and Dermitzaki (2012) and Kolovelonis et al. (2011), however, found no difference in performance between students with process goals and those with performance-outcome goals.

Combinations of goals were also studied. Findings showed that setting process and performance-outcome goals simultaneously was effective in motor skill learning. For instance, Zimmerman and Kitsantas (1997) reported that students setting multiple types of goal had a higher level of dart-throwing performance than those with only performance-outcome goals. Kolovelonis et al. (2011) found the group with combined process and performance-outcome goals performed equally well as the groups with either process or performance-outcome goals in a practice session. Shifting from process goals to performance goals (shifting goal) during practice is another effective approach to improving student motor skill performance. According to Zimmerman and Kitsantas (1997), girls with a shifting goal scored significantly higher than those with either process or combined goals. They suggested students focus on process goals during initial motor skill learning for mastery purposes; for maximizing skill performance, students can focus on performance-outcome goals after mastery of the skill.

Self-recording has consistently demonstrated a positive impact on students' motor skill performance. In their experiments, Zimmerman and Kitsantas (1996, 1997) found that girls with self-recording outscored those without self-recording in the dart-throwing test. Later studies (e.g., Cleary et al., 2006) compared basketball free throwing performance between a group who self-recorded and another group who did not self-record among college students. They found the former group significantly outperformed the latter. Similarly, Kolovelonis et al. (2011) reported that self-recording had a significant main effect on elementary students' dart-throwing performance: Students who self-recorded achieved higher than those who did not self-record. Specifically, the average scores for the experimental group were 5.26 out of 10 and for the control group were 4.57.

Goal setting and self-recording were not only examined in motor skill learning but also in daily physical activity. Shimon and Petlichkoff (2009) used pedometers to track daily step counts among 113 junior high school PE students over a 5-week period. The students were randomly divided into three groups. Students in group one were asked to record their daily step counts on a chart and also discuss their goal settings for next week's walk. Students in group two recorded their steps on a form. Group three, the control group, had no special requirements. All students wore pedometers in the daytime for four days in a row during a week. The first week's data served as a baseline, and no differences were found across three groups. Comparing the next four weeks' data, Shimon and Petlichkoff (2009) found group one and group two had significantly more daily steps than the control group. Among the three groups, students who used self-recording and goal setting recorded the highest daily step counts.

Besides goal setting and self-recording, other SRL strategies were also under examination. For example, Kolovelonis, Goudas, and Dermitzaki (2012) found self-talk had a significant main effect on students' dart-throwing performance. The students who self-talked during practice scored higher in a dart-throwing test than those who did not self-talk. Unlike most studies that only focused on a limited number of SRL strategies, Kermarrec et al. (2004) investigated what SRL components students employed during motor skill learning from a macro-analytic perspective. They videotaped 23 French high school students during a PE lesson. Then, they asked the students to watch the videos and describe what they were thinking during their skill learning. The transcriptions were analyzed and 17 SRL strategies were identified in three categories: (1) learning strategies such as attention focus and repetition in practice, (2) management strategies such as evaluation and help seeking, and (3) knowledge about learning.

Effects of SRL on Motivational Outcomes

Results of the impact of SRL strategies on motivation were mixed. Zimmerman and Kitsantas (1996, 1997) reported that students who were directed to process goals tended to have a higher level of self-efficacy, satisfaction, and intrinsic motivation. However, in a series of studies conducted by Kolovelonis and colleagues (Kolovelonis, Goudas, & Dermitzaki, 2010; Kolovelonis et al., 2011; Kolovelonis, Goudas, & Dermitzaki, 2012; Kolovelonis, Goudas, Hassandra, et al., 2012), they did not find the same results. Instead, they found no difference in the motivational variables across groups. Note that experiments in these studies all lasted only a short time ranging from 10-20 minutes. One study (Kolovelonis, Goudas, Hassandra, et al., 2012) was done among college students. Three involved the same group of Greek elementary school girls (Kolovelonis et al., 2010, 2011; Kolovelonis, Goudas, & Dermitzaki, 2012), and participants in Zimmerman and Kitsantas' (1996, 1997) studies were all American high school girls. The differences in age, education, and culture may explain the disparities in the results of these studies.

Impacts of Instructions on Self-Regulated Learning

Different curriculum designs and teaching styles may facilitate or hinder the development of SRL. Grim, Petosa, Hortz, and Hunt (2013) designed a fitness curriculum based on SRL theory. The curriculum was aimed at students' understanding and development of self-regulation for physical activity. Eight SRL components of the curriculum were targeted: goal setting, self-monitoring, self-efficacy, time-management, self-reinforcement, social support, environmental aid, and tailoring. Seventy-two 6-8th graders participated in 17 lessons over a 25-day period. Comparing pre- and post-test scores, Grim et al. (2013) found a significant increase in students' knowledge about seven SRL skills.

Another study (Chatzipanteli, Digelidis, & Papaioannou, 2015) examined how different teaching styles might affect students SRL in PE classes. In this study, 32 PE classes from eight junior high schools were assigned into two groups. Five teachers whose teaching experience averaged 20.8 years taught the control group where no requirements were specified. Another five teachers with teaching experience averaging 11.4 years taught the experimental group using either reciprocal, self-check, inclusion, convergent, or divergent teaching styles. Students had three lessons every week, and each lesson lasted for 45 minutes. In the beginning and at the end of the experiment, students' metacognitive processes were assessed using items all on a 5-point Likert scale. After 38 lessons over 16 weeks, the authors found the experimental group significantly outscored the control group on metacognitive processes such as planning, self-monitoring, problem solving, and self-evaluation. In addition, compared to the control group, the experimental group scored higher on intrinsic motivation, identified regulation, and satisfaction and also scored lower on extrinsic motivation and amotivation.

In contrast to the large volume of SRL literature in general teacher education, there is a paucity of SRL research in physical education teacher education (PETE). As Paris and Winograd (2003) argued, teachers play a key role in promoting students' SRL, and developing SRL in teachers is an important prerequisite to foster young self-regulated learners. If teachers have knowledge about cognitive and motivational aspects of learning, they may be able to design and deliver effective teaching approaches. If teachers are aware of their own thinking, they can become more reflective on their own teaching. To cultivate reflective and thoughtful practitioners, PETE program educators need to pay attention to preservice teachers' SRL development. Due to the absence of valuable empirical studies on PE preservice teachers' SRL, much research needs to be done.

Summary

Self-regulated learning (SRL) refers to a process in which learners self-initiate effort and use strategies to attain desired outcomes. Zimmerman's (1989, 2000) three-phase feedback loop model and Pintrich's (2000b) four-phase four-domain model both capture the key elements of SRL. The two scholars each developed an instrument to assess students' SRL levels. Qualitative research can use the Self-Regulated Learning Interview Schedule (SRLIS; Zimmerman & Martinez-Pons, 1986, 1988) as a reference. Quantitative studies may consider the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991); however the questionnaire needs further validation. The Achievement Goal Questionnaire (AGQ; Elliot & McGregor, 2001) can be used to replace the motivational scales if goal orientations are a research focus. SRL research has been ample in academic settings, but the number of studies in PE is limited and in PETE is scarce. More studies are needed to fill the literature gap.

CHAPTER III

PSYCHOMETRIC PROPERTIES OF THE MSLQ AMONG PHYSICAL EDUCATION PRESERVICE TEACHERS: A BIFACTOR ANALYSIS

Introduction

The goal of physical education (PE) is to develop sustainable physical activity and healthy lifestyles in physically literate individuals (SHAPE America, 2014). Achieving this goal entails self-regulated learning (SRL), which refers to "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment" (Pintrich, 2000b, p. 453). SRL studies in PE have evidenced that SRL strategies such as goal setting and self-monitoring promoted students' motor skill learning and performance, motivation, and affect (e.g., Cleary et al., 2006; Kolovelonis et al., 2011), as well as daily physical activity levels outside of school (Shimon & Petlichkoff, 2009).

It is important to develop PE preservice teachers as self-regulated learners. As college students, using SRL strategies helps them acquire content and pedagogical knowledge more effectively. As prospective teachers, their demonstration of SRL during field teaching practices can generate a positive impact on their pupils and thus foster younger self-regulated generations. Research on SRL, however, has rarely paid attention to this particular population. As such, the present study is going to address the research gap from PE preservice teachers' perspectives, specifically through validating an instrument used to assess SRL.

The Motivated Strategies for Learning Questionnaire

The Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991) might be the most frequently used instrument to measure motivation and learning strategies under the umbrella of SRL. The MSLQ consists of two major categories of scales—motivation scales and learning strategies scales. The motivation scales include three subcategories, namely, value components, expectancy components, and affective components. The value components focus on intrinsic goal orientation, extrinsic goal orientation, and task value; the expectancy components target control beliefs and self-efficacy for learning and performance; and the affective components center on test anxiety. The learning strategies scales are composed of two subcategories—cognitive and metacognitive strategies and resource management strategies. The cognitive and metacognitive strategies measure rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulation. The resource management strategies assess time and study environment, effort regulation, peer learning, and help seeking.

Although the MSLQ has frequently been used across disciplines, validation studies have not found its construct validity acceptable. Pintrich et al. (1993) initially examined psychometric properties of the motivation scales and the learning strategies scales separately. The measurement model fit indices for the motivation scales were χ^2/df = 3.49, GFI = .77, AGFI = .73, RMR = .07, while the learning strategies scales were χ^2/df = 2.26, GFI = .78, AGFI = .75, RMR = .08. Although the authors claimed that both scales had a good factorial structure, current standards do not support their assertion. According to Kline (2016), for a model to have an acceptable fit in relation to the data, the Goodness-of-Fit index (GFI) and the Adjusted Goodness-of-Fit index (AGFI) values should be greater than .90.

Later validation studies of the MSLQ did not find its construct validity convincible. For example, Cook et al. (2011) focused on the 31-item motivation scales among a group of medicine residents, and they found the original theoretical model did not fit the data well, $\chi^2 = 1106.7$, $df = 419$, $p < .001$; GFI = .82, AGFI = .73, RMR = .079, RMSEA = .089. Dunn, Lo, Mulvenon, and Sutcliffe (2012) examined two subscales of the MSLQ, metacognitive self-regulation and effort regulation, in a combination of graduate and undergraduate students. After exploratory factor analysis (EFA), they removed four items due to low loadings on their supposed factor. Subsequently they found the items mingled and emerged as two new scales that measure general strategies and clarification strategies, respectively.

Cross-cultural variation of the MSLQ failed to obtain supportive evidence, either. Büyüköztürk, Akgün, Özkahveci, and Demirel (2004) validated a Turkish version at two universities. After EFA for the motivation scales, they deleted one item with cross-loadings, loaded four items from an original factor to two new factors, and correlated item residuals under each factor. Their final CFA model fit was not good, $\chi^2/df = 4.47$, GFI = .88, AGFI = .85, RMR = .18, and SRMR = .06. Following the same procedure, they deleted 14 items and identified nine factors that were different from the original scales. The final CFA model fit was not acceptable, $\chi^2/df = 4.73$, GFI = .80, AGFI = .77, RMR = .22, and SRMR = .06. Alkharusi et al. (2012) examined the construct validity of the MSLQ among Sultan university students and found the fit indices for the original scales were not acceptable. Other validation studies in different countries (e.g., Feiz, Hooman, & kooshki, 2013; Saks, Leijen, Edovald, & Õun, 2015) resulted similar unsatisfactory results.

The Cognitive and Metacognitive Learning Strategies Scales

Because a large number of items tend to compromise model fit to the data (Kline, 2016), the present study focuses on one subscale of the MSLQ, the Cognitive and Metacognitive Learning Strategies Scales (CMLSS). The CMLSS consists of 31 items that are hierarchically ordered based on the degree of cognitive processing (Pintrich et al., 1993). These items were designed to measure rehearsal (REH), elaboration (ELA), organization (ORG), critical thinking (CT), and metacognitive self-regulation (MSR). Pintrich et al. (1993) proposed the five subscales of the CMLSS as five parallel latent factors within a first-order measurement model (Figure on p. 42). Subsequent validation studies, however, provided no solid evidence for the proposed 5-factor model. Rather, problems were found at structural as well as item levels.

At the structural level, studies were inconsistent with the number of latent factors emerged from the 31 items. For example, Roces et al. (1995) found that most items clasped into three latent factors—ELA and CT grouped together, while two items from REH clustered with ORG, and most items from MSR held together. Saks et al. (2015) also identified three latent factors but found that REH and ORG tended to converge, ELA and CT united, while the third latent factor comprised items from four original factors. Cook et al. (2011) found REH, ELA, ORG and MSR loaded on a single latent factor while CT was left distinctive. Alkharusi et al. (2012) found the five factors could be represented by a single second-order factor. Credé and Phillips' (2011) meta-analysis also supported using one single factor to represent all strategies.

Problems with the CMLSS also occurred at the item level. First, validation studies (e.g., Büyüköztürk et al., 2004; Saks et al., 2015) found that the two reverse-coded items often fell together and generated a method effect that challenges interpretability. These studies also detected cross-loadings among different items. For example, in Cho and Summers' (2012) EFA, each of 30 items cross-loaded on 2–4 individual factors. This problematized the discriminant validity of the constructs.

Note that the majority of previous validation studies relied on EFA without a follow-up CFA. EFA is an effective approach to discover latent structures, but it allows cross-loadings and residual correlations. CFA, on the other hand, is often congeneric where item cross-loadings and residual correlations are disallowed, so that the variances in a set of indicators are explained by one corresponding latent factor only. Without CFA, results of EFA remain at exploratory levels and may not reflect true latent factor structures. Therefore, CFA should be carried out to verify the latent factor structure identified by EFA.

Another potential problem with previous validation studies might be their dependency on first-order models. In a multiple-factor first-order model, latent factors are parallel to each other. These factors may or may not correlate. This parallel structure is favorable in calculations, but it often fails to represent complex multidimensionality.

In the current case of the CMLSS, the five latent factors are hierarchically constructed, so their relationships may not be parallel only. Therefore, more advanced techniques such as hierarchical modeling can be a better alternative.

Bifactor Analysis

One of the hierarchical modeling approaches is bifactor analysis. This approach was first employed by Holzinger and Swineford (1937) to examine the dimensionality of cognitive ability. Bifactor analysis proposes that one general factor underlies all indicators while some indicators form their own group factors. In other words, the general factor explains variances and covariances among all indicators, and group factors count for the variances and covariances among these (≤ all) indicators over and above the general factor. By default, the general factor and group factors are orthogonal to each other, meaning there is zero correlation among them.

Bifactor analysis has recently gained wide recognition in hierarchical modeling applications (Reise, 2012). Due to its multifaceted nature, bifactor analysis is able to identify whether a group factor coexists with a general factor; it can also simultaneously test differential effects of the general factor and group factors (Chen, Hayes, Carver, Laurenceau, & Zhang, 2012). In a surge of publications in the fields of psychology (e.g., Żemojtel-Piotrowska, Czarna, Piotrowski, Baran, & Maltby, 2016), cognition (e.g., Chiu & Won, 2016), and intelligence (e.g., Kranzler et al., 2015), researchers concurred superiorities of bifactor analysis over other modeling (i.e., first-order and second-order modeling) in identifying and understanding complex latent factorial structures of instruments. For example, Chung et al. (2016) compared a one-factor model, a first-order multiple-factor model, a second-order model, and a bifactor model in addressing the multidimensionality of a physical self-perception measurement. They found that the bifactor model was the best fit in their cross-validation studies. This technique has never been used in validating the MSLQ scales. Therefore, employing bifactor analysis in the historically problematic MSLQ may provide new perspectives of its latent structure.

To construct a bifactor model, both theoretical ground and statistical evidence are important. For example in the CMLSS (Pintrich et al., 1991), the five factors are hierarchically arranged based on how much cognitive processing is engaged, and they are put under one general category (i.e., cognitive and metacognitive learning strategies). Therefore, it is theoretically plausible to fit the CMLSS to a bifactor model, in which a general factor involving universal cognitive processing strategies underlies all items; at the same time group factors account for the variances unexplained by the general factor. Statistically, eigenvalues can be an important index for employing bifactor analysis. If the ratio between the largest eigenvalue and the second largest is greater than 4 or 5, it indicates the presence of a prominent factor that underlies all items, and it is feasible to continue with bifactor analysis (Embretson & Reise, 2000). Together with theoretical proposals, researchers can decide whether or not to utilize bifactor modeling.

To estimate score reliability in latent structures, Cronbach's α is not as useful as it usually is (Brown, 2015). A better alternative is Omega (ω), which represents the proportion of the true score variance to the total score variance. If a first-order CFA model is congeneric (i.e., no cross-loadings, no residual correlations), the numeric values of ω are similar to that of Cronbach's α. In the presence of cross-loadings or correlated residuals, however, using Cronbach's α can either overestimate or underestimate score reliability. Under the same situation, ω can take into account cross-loadings and residual correlations and estimate score reliability with more accuracy.

In bifactor models, ω, however, only reflects how much mixed variances are explained by the general factor and group factors together. It cannot measure the amount of variance explained by either the general factor or group factors individually. Thus, specific estimates such as $\text{Omega}_{Hierachical}$ (ω_h) and Omega_{Scales} (ω_s) are more appropriate (Reise, 2012). The two indices represent the interpretability of one score (either the general factor or a group factor) when controlling for the other factor(s). Specifically, ω_h refers to the proportion of the variance explained by the general factor in a scale's total variance when partialling out the variance explained by group factors. Similarly, ω_s refers to the ratio of the variance explained by a group factor and its corresponding subscale's total variance, controlling for the general factor's influence. Reise (2012) has detailed how to calculate ω_h and ω_s, so it is not elaborated here.

Provided inconsistencies and problems among previous studies, the present study is to validate the CMLSS among PE preservice teachers. Specifically, it asks: Do the CMLSS demonstrate acceptable construct validity and score reliability?

Method

Participants and Setting

Participants were 419 preservice teachers from five Texas PETE programs. Their average age was 23.05 years (*SD* = 4.28). Ethnicities consisted of 73 African-American (17.4%), 4 Asian-American (1.0%), 134 Hispanic (32.0%), 189 White (37.9%), and 18 other (4.3%). There were 40 sophomores (9.5%), 155 juniors (37.0%), 214 seniors (51.1%), and 9 other classified types (2.1%). Freshmen were not included, as they had not entered the professional development phase in the preparation programs.

Data Collection

Instrumentation

A biographic data questionnaire (Appendix B), the CMLSS (Appendix C), and open-ended questions were used to collect data. The biographic data questionnaire collected participants' information such as age, gender, ethnicity, and educational classification. The 31-item CMLSS assessed REH, ELA, ORG, CT, and MSR. For example, one of four items assessing REH was, "When I study for this class, I practice saying the material to myself over and over." Six items assessed ELA, and an example was, "When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions." Four items measured ORG using items such as, "When I study the readings for this course, I outline the material to help me organize my thoughts." Of five items measuring CT, one asked, "I often find myself questioning things I hear or read in this course to decide if I find them convincing." Twelve items assessed MSR such as, "When I become confused about something I'm reading for this class, I go back and try to figure it out." Among the 12 items, two were reverse-coded. They were "During class time I often miss important points because I'm thinking of other things" and "I often find that I have been studying for this class but don't know what it was all about." Each item was on a 7-point Likert scale from 1 "*not at all true of me*" to 7 "*very true of me*."

Procedure

Permissions were initially obtained from the Institutional Review Board of the five PETE programs that represented Texas demographically and academically. Data were then collected through the 2014 and 2015 academic years. The investigator administered the instruments in the participants' classrooms. It took about 20 minutes for each participant to read the consent form (Appendix A), ask questions, and fill out the consent form and questionnaires. All participants in the study were automatically entered into a lottery pool. Twenty-five randomly selected participants won a $10 gift certificate.

Data Analysis

Five steps of analysis (Figure 1) were conducted: (1) data preparation, (2) initial confirmatory factor analyses (CFAs), (3) exploratory factor analyses (EFAs), (4) bifactor CFAs, and (5) model respecifications and score reliability analyses. The SPSS (Version 23.0; IBM Corp., 2014) and the Mplus (Version 7.4; Muthén & Muthén, 1998-2015) were used to assist data analyses.

Data Preparation

Data preparation began with identifying and removing incomplete questionnaires (i.e., missing more than two responses consecutively) and patterned responses (e.g., choosing one scale for all questions, repeating "7, 6, 5, 4") to establish appropriateness and precision for subsequent statistical analyses. Two reverse-coded items were recalculated using 8 minus their original values. Little's MCAR tests (Little, 1988) were then used to identify whether the data were missing completely at random or not.

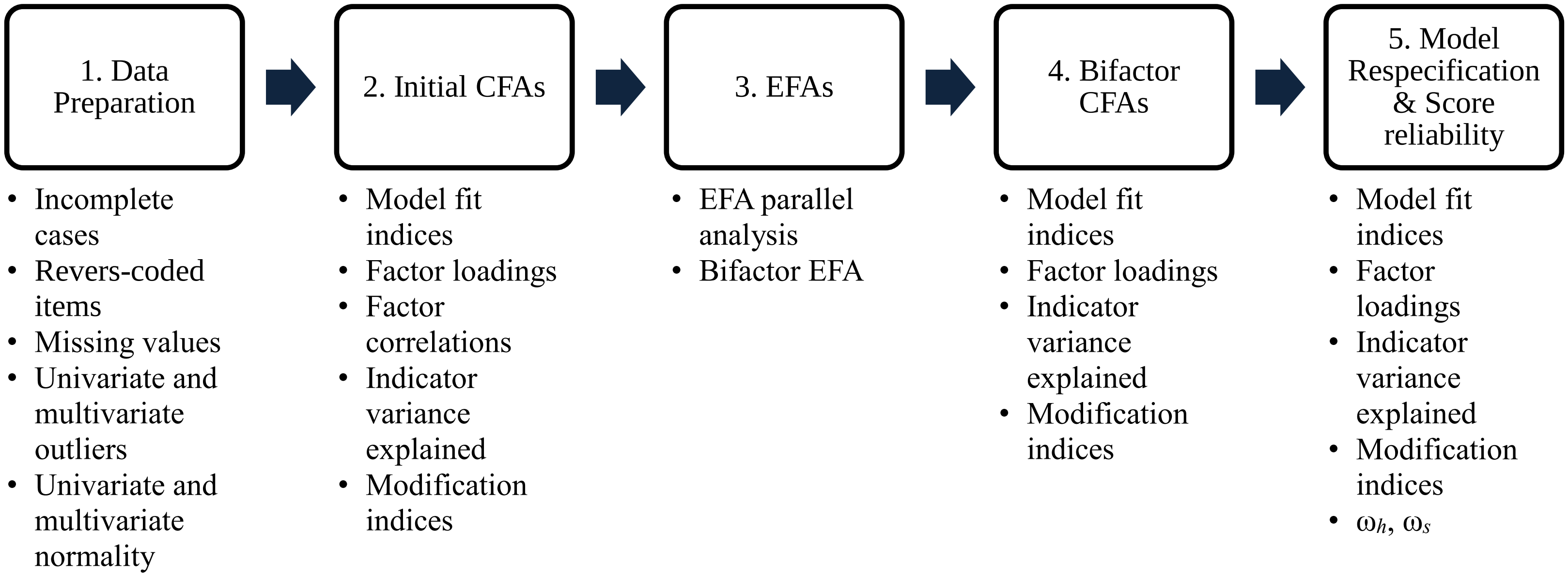

Figure 1. Quantitative data analysis procedure. CFA = confirmatory factor analysis; EFA = exploratory factor analysis.

Both univariate and multivariate outliers were identified and processed. Univariate outliers were identified when a score's standardized value (i.e., *Z* score) was greater than 3. The outliers were then winsorized by replacing the out-of-bound scores with the closest within-bound scores. Multivariate outliers were processed based on their probabilities of each case's Mahalanobis Distance (MD) values. If the MD probability < .001, then the corresponding case was removed.

To increase the accuracy of estimation, univariate and multivariate normality were checked. To reach approximate normality, the absolute values of univariate Skewness and Kurtosis should be smaller than 3 and 10, respectively (Kline, 2005). Multivariate normality was checked through two-sided Skewness and Kurtosis tests. If either test is statistically significant, multivariate normality is not reached. In this case, robust estimation approaches can be used in factor analysis.

Confirmatory Factor Analysis

Construct validity for the CMLSS was examined by analyzing the original 5-factor model proposed by Pintrich et al. (1993). Criteria used to evaluate construct validity included: global model fit indices, factor loadings, factor correlations, indicator variance explained, and modification indices. Global model fit indices used were (1) Chi-Square test (χ^2), (2) Root Mean Square Error of Approximation (RMSEA), (3) Comparative Fit Index (CFI), and (4) Standardized Root Mean Square Residual (SRMR). The χ^2 test examines the discrepancy between a proposed model and data, and a p value greater than .05 indicates the model fits the data well (Kline, 2016). For the other three global model fit indices, Hu and Bentler (1999) recommend RMSEA $\leq$ .08, CFI < .90, and SRMR < .08 as cut-off values for an acceptable model fit and RMSEA ≤ .05, CFI < .95, and SRMR < .05 as cut-off values for a good model fit.

In first-order CFAs, factor loadings should be greater than .30 or .40, so all indicators are effective in assessing their corresponding construct; correlations between factors should be lower than .80, so the factors have a good discriminant validity. In bifactor analysis, however, there is no such a rule of thumb. For indicators in these models, the variance explained by a factor should be statistically significant. If not, the indicator has no relationship with the factor and should be removed from the model. Modification indices can reflect whether indicators tend to cross-load (i.e., significant indices in BY statements in Mplus) and if an indicator's residuals correlate with other indicators' residuals (i.e., significant indices in WITH statements in Mplus). If an indicator loads on more than one factor, the indicator does not specifically measure one construct and should be deleted. If an indicator's residuals correlate with other indicators' residuals, the indicator often causes problems and should be removed. A default value of 10 is used to detect substantial problems in modification indices.

Exploratory Factor Analyses

Due to the CMLSS' poor CFA model fit, EFAs were conducted to recheck the underlying latent structure. Specifically, EFA parallel analysis (Horn, 1965) was used to determine the number of factors. Compared to commonly used approaches, such as the "eigenvalue > 1" rule (Kaiser, 1960) and the scree plot test (Cattell, 1966), parallel analysis adjusts for sampling errors and reduces subjectivity and thus has more accuracy in estimation. Based on the results of parallel analysis, a bifactor EFA was conducted.

Bifactor CFAs

A bifactor CFA model for the CMLSS was constructed to verify the bifactor EFA results. The criteria for model evaluation were checked.

Model Respecifications & Score Reliability

Cross-loadings and correlations among items make an item not specific to one factor and also interpretability difficult (Brown, 2015). During model respecifications, items that had cross-loadings and/or residual correlations were removed. Then, score reliability for the respecified bifactor model was estimated using ω, ω_h and ω_s.

Results

Data Preparation Results

After checking incomplete and patterned responses, five participants were removed from the CMLSS dataset. There were also 10 missing values on eight variables. Missing percentages ranged from .2–.5%. Little's MCAR significance test was greater than the critical value of .05, meaning the data were missing completely at random. Based on Little's MCAR tests' results, the missing values were computed using expectation maximization (EM) algorithm (Little & Rubin, 2002).

After multivariate outlier processing, 380 participants were retained in the data. Among them, 137 were female (36.1%) and 243 were male (63.9%). Their average age was 23.13 years (SD = 4.32). Sixty-seven African-American (17.6%), 4 Asian-American (1.1%), 125 Hispanic (32.9%), 167 White (43.9%), and 16 others (4.2%). One participant did not specify his ethnicity. They included 36 sophomore (9.5%), 140 junior (36.8%), 195 senior (51.3%), and 8 other types (2.1%).

Normality was then checked. Univariate Skewness and Kurtosis were both within an acceptable range, Skewness = -1.405–.525, Kurtosis = -1.096–1.112, meaning the univariates were approximately normally distributed. Two-sided Skewness and Kurtosis tests were all significant (*p*s < .001), indicating they did not reach normality at the multivariate level. To increase the precision of estimation, subsequent CFAs used Maximum Likelihood Estimation with Robust Standard Errors (MLR) as the estimator.

Initial CFA Results

The original 5-factor model (Figure 2) fit did not reach an acceptable level, $\chi^2_{(424)} = 1121.061$, $p < .001$; RMSEA = .066; CFI = .836; SRMR = .066. MSR was highly correlated with the other four factors, *r*s > .813. All factor loading sizes were greater than .40, and indicator R^2s were statistically significant except the two reverse-coded items. Because the reverse-coded items often generated a method effect and were not useful in the current study, they were excluded in subsequent analyses.

The CFA without the reverse-coded items generated similar results presented in Appendix E: The model fit was not acceptable, $\chi^2_{(367)} = 931.830$, $p < .001$; RMSEA = .064; CFI = .861; SRMR = .062. While all factor loadings were greater than .40, high correlations between latent factors indicated the factors were not discriminant from each other. The largest value in the modification indices was 49.368. The BY statements reflected that several indicators were not specific to one factor (e.g., S8, S28), and the WITH statements showed a large amount of residual correlations (e.g., S7 WITH S6, S13 WITH S8). These results suggested that the original 5-factor model did not represent the data's latent structure.

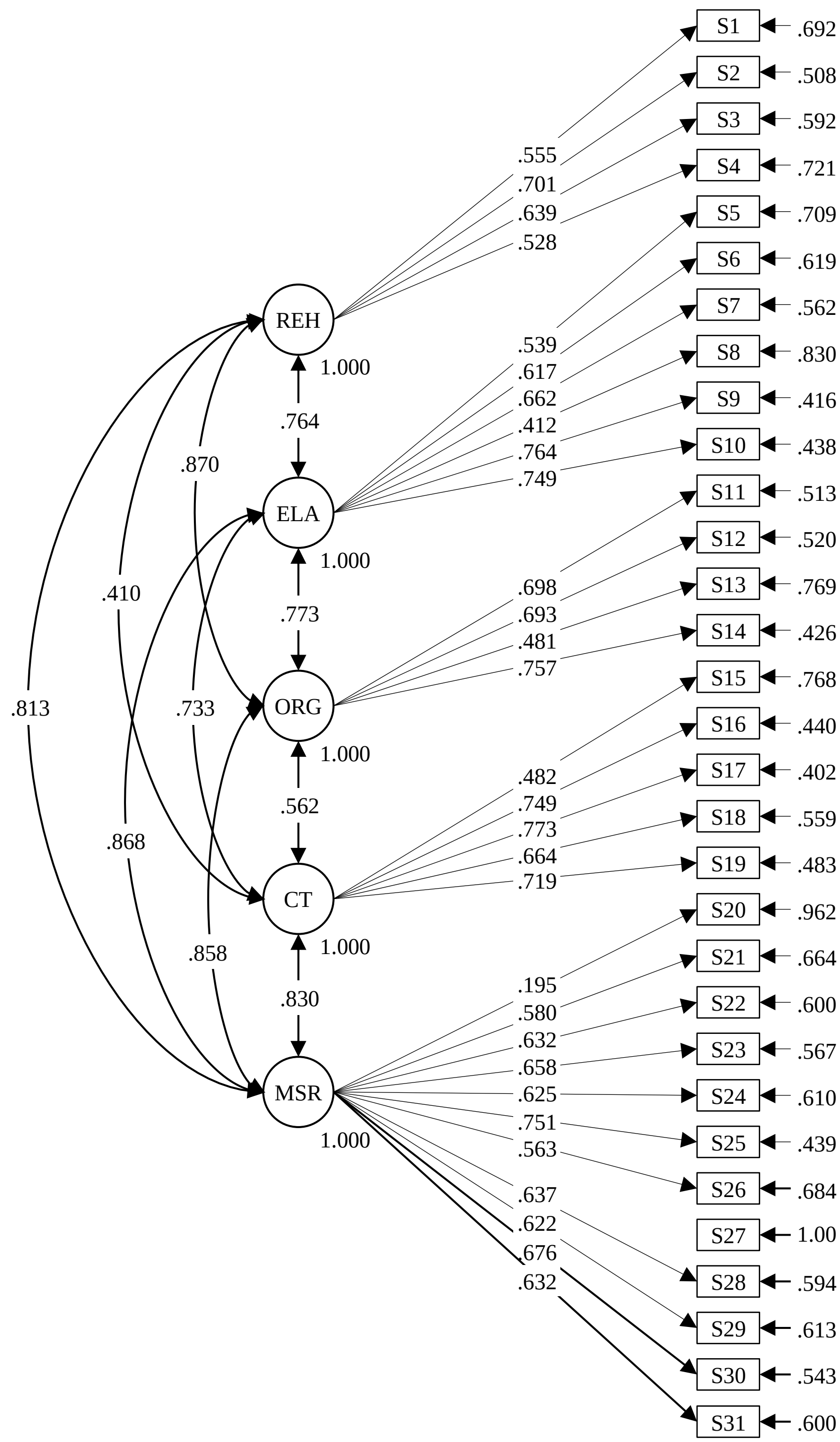

Figure 2. The original 5-factor CFA model. REH = rehearsal; ELA = elaboration; ORG = organization; CT = critical thinking; MSR = metacognitive self-regulation. All paths were significant at .05 level.

EFA Parallel Analysis

An EFA parallel analysis with Varimax rotation resulted in an acceptable model fit, $\chi^2_{(322)} = 684.355$, $p < .001$; RMSEA = .054; CFI = .925; SRMR = .035. Three latent factors emerged from the current data (Figure 3). The three eigenvalues were 10.698, 2.057, and 1.824, respectively. The ratio between the largest eigenvalue and the second largest was greater than 5, indicating the existence of a prominent factor. Therefore, a bifactor EFA was conducted to check whether the structure could be represented by a bifactor model where a general factor underlined all indicators.

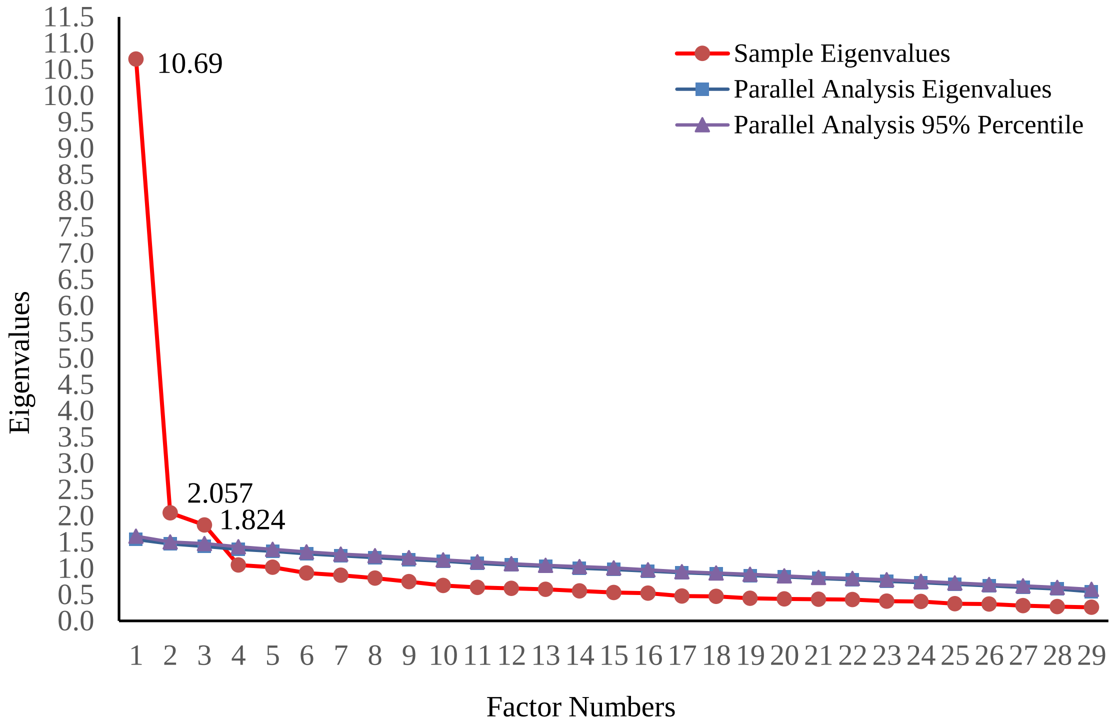

Figure 3. Factor numbers determined by EFA parallel analysis

Bifactor EFA

The bifactor EFA with bi-geomin (orthogonal) rotation had the same acceptable model fit as the EFA parallel analysis. Table 1 shows all indicators loaded on a general factor while some indicators loaded on two other group factors. Since the learning strategies were hierarchically arranged based on the degree of cognitive processing, the general factor thus was named general cognitive strategies (GCS). The majority of items under Factor 1 were from the original elaboration construct, so Factor 1 was named after elaboration (ELA). Similarly, Factor 2 was named critical thinking (CT) because the majority of items were from the original CT construct. The bifactor EFA results were then submitted to bifactor CFA for verification of the latent structure.

Table 1 Standardized factor loadings of bifactor EFA for the CMLSS

Items	General Factor	Factor 1	Factor 2
S1	.480*	-.090	-.236*
S2	.562*	.169	-.397*
S3	.534*	.310*	-.270*
S4	.479*	-.153	-.230*
S5	.501*	.147	-.114*
S6	.520*	.313*	.058
S7	.562*	.435*	.024
S8	.534*	-.403*	-.004
S9	.683*	.330*	-.016
S10	.659*	.281*	.056
S11	.620*	-.180	-.266*
S12	.649*	.164	-.203*
S13	.506*	-.384*	.037
S14	.668*	-.134	-.274*
S15	.327*	-.055	.386*
S16	.619*	-.027	.391*
S17	.625*	.025	.447*
S18	.526*	.153*	.449*
S19	.607*	-.073	.375*
S21	.598*	-.247*	.002
S22	.621*	.312*	-.044
S23	.646*	-.047	.057
S24	.611*	-.031	.127*
S25	.748*	-.004	-.063
S26	.555*	-.066	.117*
S28	.613*	.145*	.290*
S29	.600*	.165*	.086
S30	.674*	-.137	.007
S31	.635*	-.069	-.108*

*$p < .05$

Bifactor CFA

Figure 4 illustrated the bifactor CFA model. Detailed results were presented in Appendix F. The model had an acceptable fit, $\chi^2_{(353)}$ = 731.327, p < .001, RMSEA = .053, CFI = .907, SRMR = .047. Factor loadings on the GCS factor were from .332–.749, and factor loadings on ELA and CT were -.345–.469. According to the bifactor model specification, the three factors, GCS, ELA, and CT were not correlated with each other. Indicator R^2s = .258–.601, meaning the variances in the indicators were explained 25.8% to 60.1% in this model. The largest value in the modification indices was 26.938. Values in the BY and the WITH statements showed that the current 29-item bifactor CFA model could be improved through respecifications.

Model Respecifications & Score Reliability

Based on the deletion criteria (i.e., cross-loadings, correlated residuals, either or both), 11 items were removed from the initial bifactor model. There were three pairs of items correlated due to being similarly phrased. S7 and S6 are about connecting knowledge by focusing on “relating” ideas or materials. S26 and S23 emphasize “changing the way” of studying for a better understanding of materials. S14 and S11 both center on “outlining” materials or concepts. Because removing similar items can boost the model fit and make the measures more economically efficient (Brown, 2015), S6, S11, and S26 were removed.

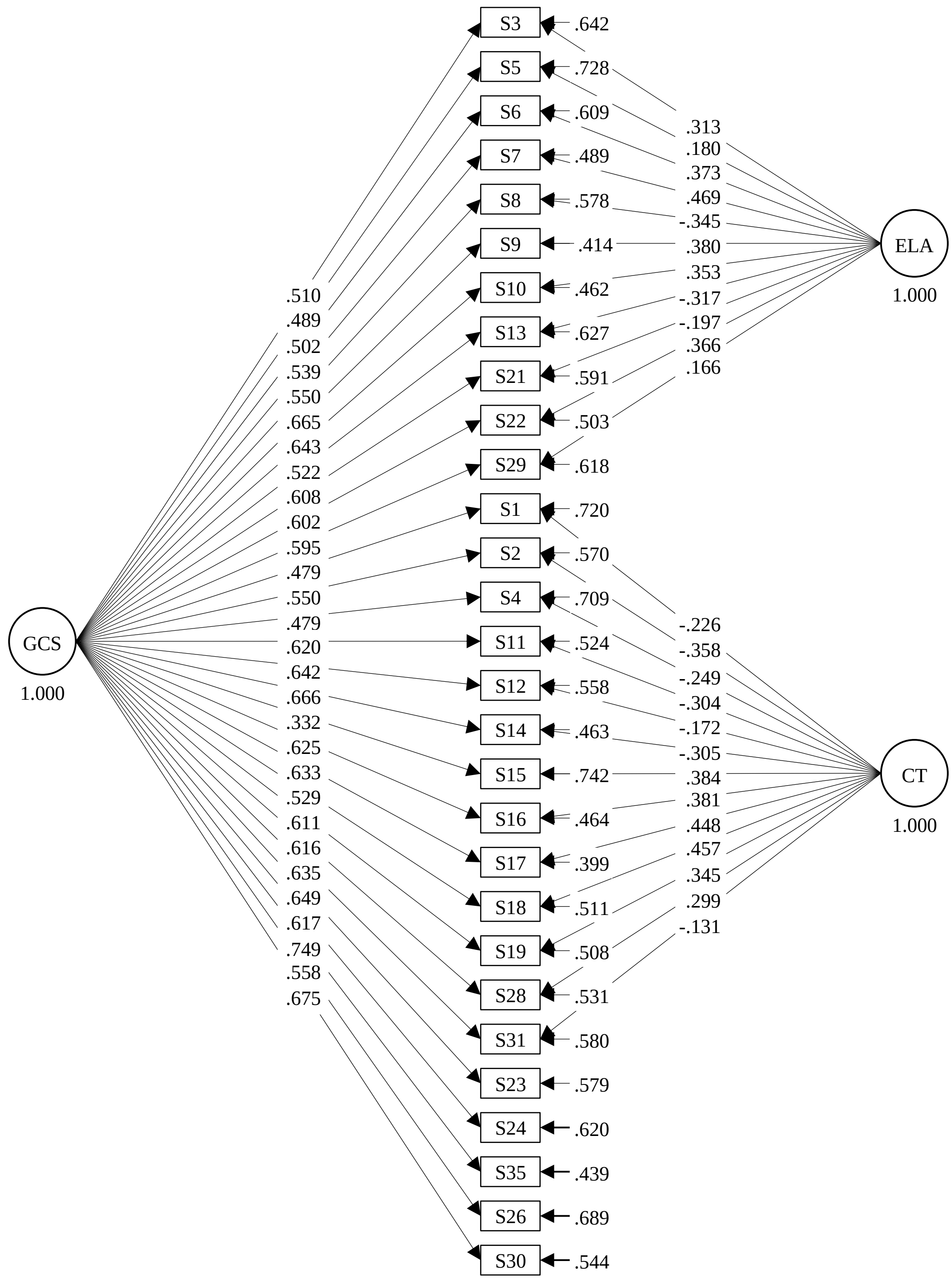

Figure 4. The bifactor model for the CMLSS. GCS = general cognitive strategies; ELA = elaboration; CT = critical thinking. All paths were significant at .05 level.

Five items were phrased similarly to other items and also cross-loaded on other factors or correlated with other items. Specifically, both S2 and S1 focus on repeating to oneself "over and over again," and S2 also cross-loaded on both ELA and CT. S25 and S21 focus on questioning, and S25 also correlated with S14. S3 cross-loaded on both group factors and also correlated with S12. S28 cross-loaded on the two group factors, and S29 also correlated with S4 and S18. Thus, S2, S3, S25, S28 and S29 were deleted.

Three more items were removed due to their cross-loadings or residual correlations with other items. Specifically, S12 cross-loaded on both group factors and correlated with S4. S24 correlated with S17 and S18, and S18 correlated with S10 and S28. Deleting these items made the measurement more parsimonious and easier to interpret the relationships between factors and indicators. The remaining 18 items were displayed in Appendix H, a shortened CMLSS that was named the Cognitive Processing Strategies Scales (CPSS).

The respecified 18-item bifactor model (Figure 5) had a good model fit, $\chi^2_{(120)}$ = 161.384, $p < .001$; RMSEA = .030; CFI = .980; SRMR = .034. Factor loadings on the GCS factor were from .309–.690, and on ELA and CT were -.332–.483. GCS, ELA, and CT were uncorrelated by default. Indicator R^2s = .248–.637, meaning the variances in the indicators were explained about 25% to 64% in this model. All values in the modification indices were lower than 10. These results signified that the bifactor model fit the data well.

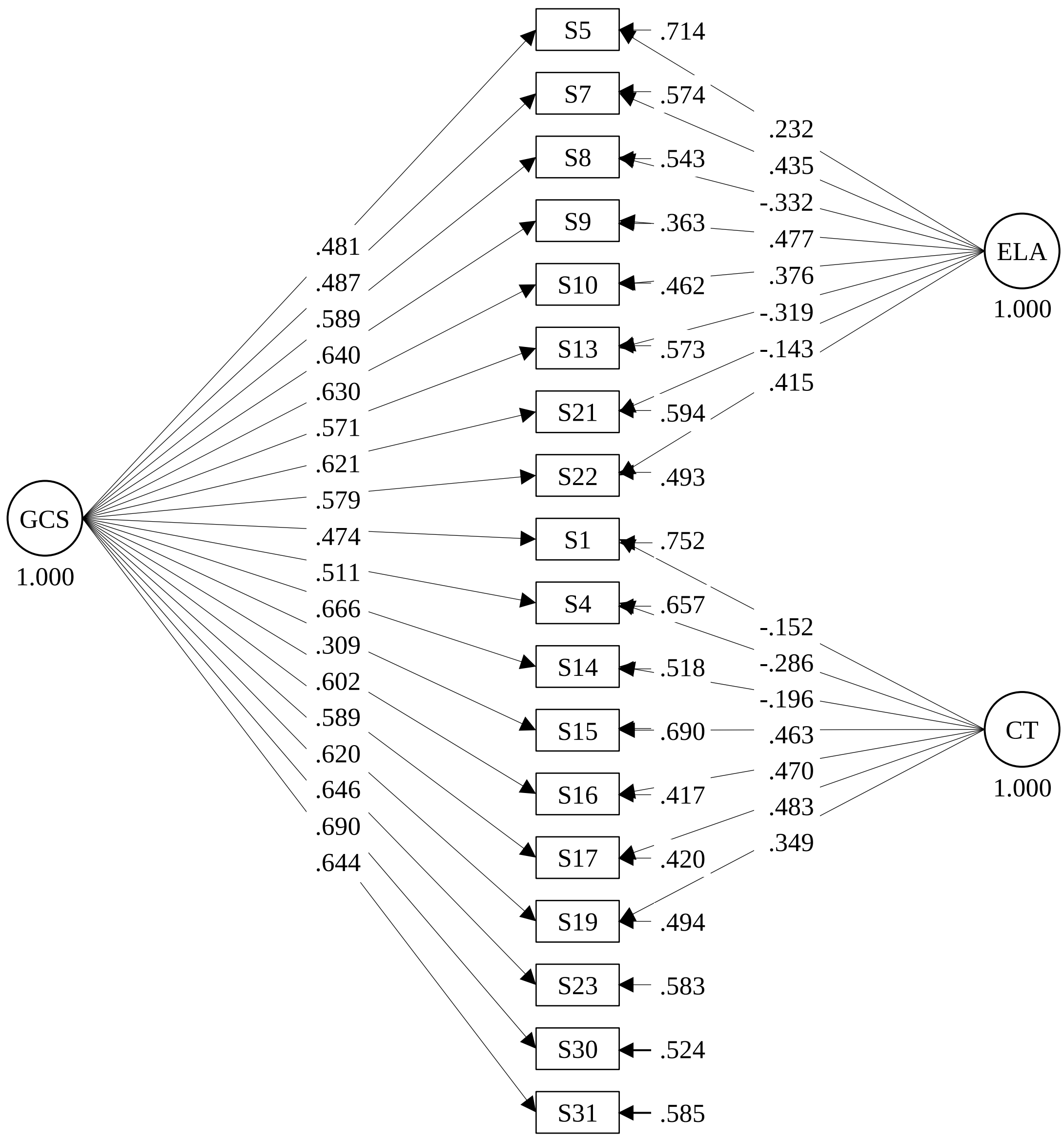

Figure 5. The respecified bifactor model for the CMLSS. GCS = general cognitive strategies, ELA = elaboration, CT = critical thinking. All paths were significant at .05.

Score reliability ω for GCS, ELA, and CT were .920, .861, and .830, respectively. That means, 92.0% of variances in the 18-item model were explained by the three factors together, while 86.1% of variances in the eight items were explained by

ELA and GCS, and 83.0% of variances in the seven items were explained by CT and GCS. As mentioned before, ω in bifactor models represents the ratio of a mixed variance explained by the general factor and a group factor together to a total variance in all items. To obtain score reliability of one factor after removing effects of the other factor(s), ω_h and ω_s were computed. For GCS, ω_h = .825, meaning 82.5% of variances in the model were explained by GCS alone. While for the group factors ELA and CT, their ω_s values were .211 and .238, respectively. These low reliability values indicated that a relative small amount of variance in the items was explained by the two group factors. In practice, therefore, using composite scores for ELA and CT will not be meaningful.

Discussion

The Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991) has been widely used in SRL research across disciplines, but its construct validity has not been well established. Considering the complexity of the SRL theory, this study examined the construct validity and scale reliability of a subscale of the MSLQ—the Cognitive and Metacognitive Learning Strategies Scales (CMLSS)—among PE preservice teachers through bifactor analysis. To date, this is the very first attempt to validate the CMLSS among PE preservice teachers as well as the first attempt at using bifactor analysis in the CMLSS validation. This study demonstrated a useful application of bifactor analysis in revealing complex dimensionality of instruments such as the CMLSS that are hierarchically structured.

Pintrich et al. (1991) originally proposed five latent factors (i.e., rehearsal [REH], elaboration [ELA], organization [ORG], critical thinking [CT], and metacognitive self-regulation [MSR]) under the CMLSS, but they did not provide supportive evidence; the 5-factor model fit indices in their original report were far from acceptable. The model fit in this study was not acceptable, either. In the present study, all factor correlations were above .70 except that among CT, REH, and ORG (*r*s < .60). In particular, MSR were highly correlated to the other four cognitive strategies, and ORG and REH correlated above .85. These high correlations are similar to the true score correlations reported by Credé and Phillips (2011) and Alkharusi et al. (2012). From a psychometric perspective, these scales were not discriminant from each other. Rather, they measured the same construct. As such, the original 5-factor model was not defended in this study.

In discovering the latent structure of the CMLSS, EFA parallel analysis was used to determine the number of factors. Three latent factors emerged with one factor's eigenvalue predominant (see Figure 3). This result prompted a bifactor EFA, which identified a general factor and two group factors with an acceptable model fit. In this bifactor EFA model, previously labeled REH, ORG, and MSR dissolved into one single factor—general cognitive strategies (GCS). ELA and CT appeared to be individual factors over and beyond the general factor. This might indicate that PE preservice teachers often use these strategies simultaneously; at the same time, their learning entails elaboration to summarize and paraphrase, as well as critical thinking to apply knowledge to new contexts (Pintrich & Zusho, 2007).

A bifactor CFA verified the bifactor EFA model's acceptability. The bifactor CFA model was further refined by removing 11 items that had cross-loadings and/or residual correlations. The respecified bifactor CFA model had a good fit to the data. All factor loadings on the general factor were above .30, and all factor loadings on the group factors were significant at the .05 level (see Figure 3). All items had a higher factor loading on GCS than on the group factors except item S15, which had a higher factor loading on CT than on GCS. This result suggests the prominent unidimensional feature of the CMLSS, and it further supports previous research (e.g., Alkharusi et al., 2012; Credé & Phillips, 2011) that all items seemed to measure a common factor.

Compared to the general factor, the two group factors' loadings were less consistent. The two negative factor loadings on ELA might reflect the fact that when PE preservice teachers focused on elaboration, they used cognitive strategies such as "writing brief summaries" (S8) and "making up questions" (S21) less than other strategies. Similarly, when they engaged in critical thinking, they depended less on rehearsal strategies such as "saying materials to myself over and over" (S1), "memorizing the lists" (S4), and organizing information by "going over notes and outlining important concepts" (S14). These negative factor loadings were not expected, so future research is invited to provide evidence to support or refute the assumption.

Score reliability ω for the three factors were all high. But as mentioned earlier, ω represents the proportion of variance explained by the general factor and group factor (s) together. For specificity in estimation and practical implications, ω_h and ω_s should be consulted. The former stands for how precise a single composite score measures a complex latent construct. For GCS, $\omega_h = .825$, which means that using one composite score to represent all SRL strategies is credible. Low values of ω_s (i.e., .211 and .238) for ELA and CT, on the other hand, indicate that little reliable variances exist over and beyond the variance accounted for by GCS. Since ω_s speaks for how reliable a group factor's composite score is after controlling for the general factor, using composite scores for the two individual strategies will challenge interpretations. Therefore, even though it is appropriate to use bifactor model to represent the CMLSS' latent structure, and consequently appropriate to use a general factor composite score as a measure of all SRL strategies, calculating composite scores for the two group factors seems weakly buttressed.

Until this study, the bifactor analysis approach had not been associated with the MSLQ in any research fields. Supporting previous research (e.g., Chiu & Won, 2016; Kranzler et al., 2015; Żemojtel-Piotrowska et al., 2016), the present study has provided evidence for the superiority of bifactor analysis over first-order factor analysis in dealing with complex latent structures. Relying on first-order factor analysis, previous validation studies (e.g., Cook et al., 2011; Saks et al., 2015) failed to reach a consensus about the latent structure of the CMLSS. Using bifactor analysis, the present study revealed the CMLSS' structural complex multidimensionality (i.e., one general factor and two group factors). This result also reflects that the cognitive and metacognitive learning strategies assessed by the CMLSS were hierarchically structured based on the degree of cognitive processing (e.g., Garcia & Pintrich, 1994; Pintrich et al., 1993).

In addition to revealing the CMLSS' latent structure, the present study identified problematic items. For example, this study found that the two reverse-coded items (i.e., S20, S27) were ineffective to measure SRL strategies, as did previous validation studies (Büyüköztürk et al., 2004; Roces et al., 1995; Saks et al., 2015). The present study is in agreement with previous studies that commonly detected item cross-loadings and residual correlations. Items not specifically measuring a factor may lower the measure's validity and its scale reliability (Brown, 2015); therefore, eight items (i.e., S2, S3, S12, S18, S24, S25, S28, and S29) were removed from the final bifactor model due to their cross-loadings and residual correlations. Three more items (i.e., S6, S11, and S26) were deleted because they were similarly phrased as other items, and similarly phrased items usually have highly correlated residuals. Without correlating their residuals, their factor loadings are inflated. As this is the first study using bifactor analysis on the CMLSS, the problematic items identified in this study await further examination by measurement developers as well as instrument users.

Limitations & Implications

There are a few limitations that need to be addressed in future research. First, although it has revealed a complex multidimensionality of CMLSS, the current study is the very first attempt of using bifactor analysis. More studies should be done to validate the stability of the CMLSS' bifactor structure. Second, participants in this study were exclusively PE preservice teachers from Texas. Results of the study, therefore, may not apply to other populations across the nation. As such, future research can replicate the present study among more diverse populations such as general college students and expand sampling nationwide. Third, this study did not examine measurement invariance of the new cognitive processing strategies scales (CPSS) across gender and educational classification. This is because the ratio between female and male participants was unequal and the majority were senior undergraduate students. Therefore, further studies can include a more evenly distributed sample to test the CPSS' measurement invariance.

Results of this study have practical implications. The bifactor analysis used in this study demonstrated its superiority to first-order factor analysis in untangling complex multidimensional structures, especially when the structure was hierarchically ordered like the CMLSS. This technique can be used in further studies dealing with measures similarly constructed.

Score reliability of the general factor exhibited that using one composite score to represent SRL strategies use is applicable and credible, whereas calculating composite scores for group factors is neither unjustifiable nor interpretable. Therefore, in future research where large samples are unavailable, computing a single composite score to represent SRL strategies use is appropriate, but further calculating group factor composite scores is not.

Finally, a shortened version of the CMLSS—the CPSS—was generated and presented as Appendix G. It is expected to advance measurement economic efficiency of SRL strategies use. Future research can test the stability of the 18-item CPSS and use it to assess general cognitive processing strategies.

CHAPTER IV

SELF-REGULATED LEARNING STRATEGIES AND ACHIEVEMENT GOALS AMONG PHYSICAL EDUCATION PRESERVICE TEACHERS

Habitual physical activity (PA) represents an important means to prevent diseases such as overweight, obesity, and diabetes while promoting wellbeing among children (Centers for Disease Control and Prevention [CDC], 2011). Developing a lifelong PA habit entails a degree of self-regulation (Grim et al., 2013). Empirical studies conducted in school physical education (PE) settings show that self-regulated learning (SRL) strategies can facilitate students' motor skill learning as well as increase PA levels that contribute to healthy lifestyles (Kitsantas et al., 2000; Shimon & Petlichkoff, 2009). Thus, it is important to infuse SRL in students through school PE programs.

The quality of school PE programs is largely determined by effective teachers (Ward, 2014). Effective teachers are thoughtful decision makers and reflective practitioners who are ready to bring about increases in student learning. Effective PE teachers are also self-regulated learners (Peeters et al., 2014). They are self-motivated and able to employ adaptive strategies to attain teaching objectives and educational goals (Pintrich, 2000b; Zimmerman, 2002, 2008) as well as promote SRL among their students.

Since teacher education programs are an important training medium, it is crucial to examine how PE preservice teachers self-regulate their learning in the classroom as well as in the gymnasium. The SRL literature, however, has rarely addressed this population. Therefore, the present study examines SRL among a group of PE preservice teachers.

Theoretical Framework

Self-Regulated Learning

Self-regulated learning (SRL) is "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment" (Pintrich, 2000b, p. 453). Pintrich (2000b) proposed a theoretical model that depicts SRL as a process involving four phases and four domains. The four phases include forethought, monitoring, control, and reaction and reflection. The four domains are cognition, motivation, behavior, and context. The phases may not proceed in chronological order because they (e.g., monitoring, control, and reaction) can happen simultaneously.

The forethought phase involves perceptions of context, task analysis, goal setting, and strategic planning. During this phase, learners first identify and analyze requirements of a task and contextual constraints/support. They then activate relevant knowledge about the task and set specific goals in the cognitive domain. In the motivational domain, learners assess the task's difficulty and value as well as their own capability. Behaviorally, they schedule a time and place for study.

The monitoring and control phases require awareness of self and tasks, regulation of effort, and adoptions of cognitive strategies. In the contextual domain, learners are conscious of task requirements and learning environment such as classroom rules. Motivationally, they can monitor and control their self-confidence through positive feedback. Cognitively, learners select strategies for learning and employ metacognitive judgment to monitor their use of strategies. In the behavioral domain, they monitor time management and adjust effort levels according to task requirements.

The reaction and reflection phase refers to when evaluations of task and attributions occur. During this phase, behavioral and contextual reactions and reflections often take place in cognitive and motivational domains. Cognitively, self-regulated learners assess their performance in terms of the task goals and attribute their success or failure to various reasons such as high/low effort, good/poor strategies use, or sufficient/insufficient ability. Motivationally, they may experience happiness or sadness, depending on success or failure. These reactions and reflections, in turn, influence future SRL decisions (Pintrich, 2000b; Zimmerman, 2000).

Self-Regulated Learning Strategies

A key construct of SRL is learning strategies (Pintrich & De Groot, 1990; Zimmerman, 1986) that explain how students acquire knowledge. According to Zimmerman (2000), SRL strategies are “purposive personal processes and actions directed at acquiring or displaying skills” (p. 17). Weinstein and Mayer (1983) identified cognitive learning strategies, such as rehearsal, elaboration, and organization, frequently used in academic contexts. Students use rehearsal strategies to memorize information. Elaboration helps students paraphrase materials under study and connect prior knowledge. Organizational strategies allow students to distinguish key ideas in contrast to general texts. Pintrich (2004) also regarded critical thinking as an important cognitive learning strategy. Critical thinking influences student learning during their application of information, decision-making, and problem solving. Another important category is metacognitive strategies (also called metacognition or metacognitive self-regulation). According to Pintrich (2004), metacognitive strategies involve planning, monitoring, and regulating cognitive strategies use. The use of metacognitive strategies often represents an effective learning means and outcome (Schunk, 2008; Sperling et al., 2004).

The literature (e.g., Biggs, 1993; Winne, 1996; Wolters, Yu, & Pintrich, 1996) categorized the above-mentioned SRL strategies into two levels according to the degree of cognitive processing. Specifically, rehearsal does not involve much cognitive processing, so it falls into the surface learning strategies category. Meanwhile, elaboration, organization, critical thinking, and metacognitive self-regulation engage a comparatively higher level of cognitive processing and thus are categorized as deep learning strategies.

Selection and implementation of SRL strategies distinguish capable self-regulated learners from others (Pintrich, 1995; Winne, 1996). Numerous scholars (e.g., Dannefer & Prayson, 2013; Panadero & Alonso-Tapia, 2014; Turan & Konan, 2012) agree that SRL strategies use is correlated with students' academic performance. In a recent systematic review, Broadbent and Poon (2015) examined studies published from 2004 to 2014 about effects of SRL strategies on academic achievement. They found that use of SRL strategies, particularly metacognitive self-regulation, effort regulation, and critical thinking, were positive predictors of students' academic achievements.

Motivation and Achievement Goals

Motivation is an important component of SRL, and it determines learning strategies use (Paris, Lipson, & Wixson, 1983). Pintrich (1999) contended that only motivated individuals will proactively exercise appropriate strategies. Zimmerman (2000) agreed that SRL strategies “are of little value if people cannot motivate themselves to use them” (p. 17). As a representative of motivation theory, the Achievement Goal Theory (AGT) has received much attention in SRL research. The AGT states that goals play an important role in achievement settings because they serve as reference points that guide learning behaviors (Boekaerts et al., 2000).

Among different achievement goal models, the 2×2 achievement goal model (Elliot, 1999; Elliot & McGregor, 2001) is the most popular and widely used and has extensive validation across settings and disciplines, and it was thus employed in this study. Based on how competence is defined and directed, four achievement goals—mastery-approach goals (MAp), mastery-avoidance goals (MAv), performance-approach (PAp), and performance-avoidance (PAv) goals—are identified in the 2×2 achievement goal model. Based on self-referenced standards, MAp goals orient individuals’ foci on tasks and acquisition of knowledge and skills. Based on normative standards, PAp goals direct people to receive recognition for their competence. MAv goals emphasize intrapersonal competence and the avoidance of failure in learning. Finally, PAv goals center on normative incompetence and the avoidance of being outperformed. The four types of goals have differential roles of in predicting cognitive, affective, and behavioral learning outcomes (e.g., Cellar et al., 2011; Mouratidis et al., 2013).

Relationships between Achievement Goals and SRL Strategies

The relationships between achievement goals and SRL strategies are well documented (e.g., Cellar et al., 2011; Mouratidis et al., 2013). MAp goals tend to promote deep learning strategies such as elaboration and critical thinking (e.g., Liem et al., 2008; Vrugt & Ourt, 2008). Results for the other types of goals, however, have been inconclusive. For instance, Liem et al. (2008) found PAp goals predicted deep learning strategies use, whereas Bernacki et al. (2012) and Vrugt and Ourt (2008) did not. While PAv goals were found to negatively predict deep learning strategies use in Bernacki et al. (2012) and positively predicted rehearsal in Vrugt and Ourt (2008), similar results were not obtained by Liem et al. (2008). Compared to the other goals, MAv goals have received less attention. Two studies (Muis & Franco, 2009; Soltaninejad, 2015) that examined the predictability of MAv goals found that students with goals of this type would use SRL strategies less frequently. Overall, these inconsistencies of performance goals' predictability and the lack of evidence for MAv goals call for further investigation.

Literature Gaps in PE Preservice Teachers' Self-Regulated Learning

While a large body of literature has examined SRL in academic settings, research in PE settings is limited. Earlier studies in the United States revealed that mastery goals and use of SRL strategies (e.g., self-recording, self-talk) tended to bring about better motor skill learning performance and higher levels of interest and satisfaction (e.g., Kitsantas & Zimmerman, 1998; Kitsantas et al., 2000; Zimmerman & Kitsantas, 1997). Later, Greek researchers replicated and extended these studies, and found similar positive effects of SRL strategies on students' motor skill learning and performance (e.g., Kolovelonis et al., 2011; Kolovelonis, Goudas, & Dermitzaki, 2012; Kolovelonis, Goudas, Hassandra, et al., 2012). Other studies (Chatzipanteli et al., 2015; Grim et al., 2013) also found curriculum design and student-centered teaching styles fostered SRL among students. These results indicate that PE teachers can achieve teaching effectiveness through SRL-based instruction, but none of the studies has provided information about PE teachers' SRL knowledge and skills.

Previous research in general education identified that few teachers were able to apply SRL to their teaching practices (Kistner et al., 2010; Zimmerman, 1990, 2002). This is perhaps because teachers themselves had received little instruction about SRL knowledge and skills in their preparation programs. Teachers' understanding and instruction of SRL are important because their experiences decide future teaching practices and student learning. Therefore, teacher education programs should provide preservice teachers with SRL knowledge and skills during the first stage of their professional development.

Although the integration of SRL into teacher education has been advocated (e.g., Buzza & Allinotte, 2013; Michalsky & Schechter, 2013), few, if any, empirical studies have examined SRL from PE preservice teachers' perspectives. Little is known regarding PE preservice teachers' understanding of SRL, motivation, and strategies use in learning and field-based teaching practices. A lack of such information may limit the effectiveness of physical education teacher education (PETE) programs to prepare effective teachers who, in turn, develop physically literate individuals.

The Present Study

The purpose of this study, therefore, is to identify SRL indicators, such as learning strategies use and motivational goal orientations, and their relationships among PE preservice teachers. Specifically, four research questions guide the present study:

1. To what degree do PE preservice teachers apply SRL strategies in their learning?
2. Do PE preservice teachers' achievement goals predict SRL strategies use?
3. How do PE preservice teachers define SRL?
4. How do PE preservice teachers employ SRL strategies during their field-based teaching practices?

This study contributes to the PETE research by first revealing preservice teachers' knowledge and SRL strategies use in their learning and teaching practices. The study also recognizes important motivational goal orientations that drive SRL strategies use. Results of this study can inform PE preservice teachers' understanding and applications of SRL, and assist PETE faculty infuse SRL into their programs.

Method

Participants and Setting

Participants were 419 preservice teachers from five Texas PETE programs. The average enrollment in four programs was approximately 100 preservice teachers, and the other one program had 400 at the time of data collection. Among the participants, 130 participated in 2014 and 289 in 2015. Their average age was 23.05 years (*SD* = 4.28). They consisted of 73 African-Americans (17.4%), 4 Asian-Americans (1.0%), 189

Whites (37.9%), 134 Hispanics (32.0%), and 18 other (4.3%). There were 40 sophomores (9.5%), 155 juniors (37.0%), 214 seniors (51.1%), and 9 other classified types, such as returning students (2.1%). Freshmen were not included because they had not entered professional development phase in their programs. They were not exposed to field teaching experiences, so it was not applicable to ask them to answer the research questions. Among the participants, 11 completed the interviews. Demographic information of the 11 participants is presented in Table 2, in which participants' names were coded into alphabetic letters.

Table 2 Interviewees' demographic information (N = 11)

	Age	Gender	Ethnicity	CLAS	Teaching	Coaching	PT Work
A	23	Female	White	Junior	1	2	5
B	21	Male	Hispanic	Junior	0	4	20
C	26	Male	Hispanic	Senior	0	2	N
D	22	Female	African-American	Senior	2	3	15
E	25	Male	White	Senior	0	4	N
F	20	Male	Hispanic	Junior	0	0	N
G	22	Female	Other	Sophomore	0	4	N
H	24	Female	Other	Junior	2	5	40
J	22	Female	White	Senior	0	.5	30
K	32	Male	Hispanic	Senior	0	1	N
L	25	Male	Hispanic	Senior	0	0	0

Note: CLAS = classification; PT = part-time; N = no response. Units of age, teaching experience, and coaching experience were years. Unit of part-time work was hours.

The 11 participants were from four different PETE programs. At the time of the interview, five were enrolled in a teaching methods course, three were in an assessment and evaluation course, and the other three were in a motor development course. This group aged from 20 to 32 (Mean = 23.81 years). Five of the participants were female, and six male. They included two Whites, five Hispanics, one African-American, and two others. The majority of participants were senior preservice teachers. Participants had little teaching experience but did have one to five years of coaching experience. Six participants responded to the part-time working experience question, and their average working hours per week was 18.33 (SD = 15.05).

Instrumentation

Biographical Data Questionnaires

A biographical questionnaire (see Appendix B) was used to collect participants' demographical data such as age, gender, classification, and teaching and working experiences.

The Achievement Goal Questionnaire

The Achievement Goal Questionnaire (AGQ; Elliot & McGregor, 2001, see Appendix H) was used to assess the four goals depicted in the 2×2 model. The questionnaire includes 12 items, with three items assessing each of the four achievement goal orientations. An example question assessing mastery-approach (MAp) goals is, "I want to learn as much as possible from this course." A question assessing mastery-avoidance (MAv) goals is, "I worry that I may not learn all that I possibly could in this course." A performance-approach (PAp) goals question is "It is important for me to do better than other students." A performance-avoidance (PAv) goals question asks, "My fear of performing poorly in this course is often what motivates me." Participants responded to the questions on a 7-point Likert scale from 1 "*not at all true of me*" to 7 "*very true of me*."

The Cognitive Processing Strategies Scales

The Cognitive Processing Strategies Scales (CPSS; Appendix G) including18 items assessed participants' SRL strategies use. According to the bifactor model in Chapter III, all the items assess general cognitive strategies (GCS), while eight items also measure elaboration (ELA), and at the same time seven other items measure critical thinking (CT). For example, "When studying for this class, I try to relate the material to what I already know" measures GCS and ELA. "I treat the course material as a starting point and try to develop my own ideas about it" measures GCS and CT. Three items only measure GCS, one of which is "If course materials are difficult to understand, I change the way I study the material." Like the AGQ, all 18 items were on a 7-point Likert scale.

An Open-Ended Question

To learn participants' understanding of SRL, an open-ended question asked, "Have you learned the concept of self-regulated learning in any courses that you have taken for your enrolled program? If so, please define this concept in your own words."

Interviews

A semi-structured interview was conducted to collect qualitative data. Five questions on an interview protocol (Appendix I) were: (1) How do you describe self-regulated learning in your own words? (2) Describe the strategies you used for an effective lesson you taught. (3) Were you aware of your thoughts and behaviors during your teaching? What did you do if something went wrong? (4) What would you do if you had a problem in lesson planning or teaching? (5) What did you do and think after you taught a lesson?

Procedure

Prior to the study, permission was obtained from the university Institutional Review Board (IRB). Sixteen PETE programs representing Texas demographically and academically were contacted. Seven programs agreed to facilitate data collection. IRB approvals were then obtained from the seven programs. Due to time allotment however, two programs were unable to take part. Finally, five programs participated in the study.

Quantitative data were collected from paper questionnaires through 2014 and 2015 fall semesters. Upon institutional permission, consent forms (Appendix A) and questionnaires were distributed in the classroom. Participants read the consent form, asked questions, and filled out the consent forms and questionnaires. This procedure took approximately 20 minutes. All participants in the study were automatically entered into a lottery pool. Twenty five randomly selected participants won a $10 gift certificate.

Qualitative data were collected in 2015 through two sources—an open-ended question at the end of the questionnaire and a 20–30 min semi-structured phone interview. The open-ended question asked whether participants had learned the concept of SRL and to provide a definition of SRL. Two hundred sixty-nine participants (M_{age} = 22.79 years, SD = 4.13) completed the open-ended question. Their responses varied from a simple “Yes” or “No” to a few sentences in length. Most responses contained 1–2 sentences that consisted of 28–41 words.

While completing the questionnaires, Participants were asked to leave a contact and specify a time available for an interview if they wanted to volunteer. Initially, 28 participants volunteered for the interview and left their phone numbers. Later, however, 16 of them did not answer phone calls, and one had no teaching experience in the field. As a result, 11 participants completed the interviews via telephone.

At the beginning of each interview, participants were asked whether they were still interested in the interview and if they would like to participate. Next, the purpose of the study was introduced. Interview questions were asked one by one. To elicit more information, the researcher used prompts such as “what else did you do to reflect on your lesson?” At the end of the interviews, the researcher gave a quick overview of interview questions and participants’ answers. Participants were asked if their answers reflected their true thoughts and if they wanted to supplement any information. The interviews lasted 11 min 14s to 31 min 21s (average = 19 min 46s), and each was audio-taped and transcribed verbatim. On average, the transcripts contained 1827 words on five single-spaced pages. All interviewees received a $10 gift certificate afterwards.

Data Analysis

Quantitative Data Analysis

Five steps of analysis were conducted. First, univariate descriptive statistics were computed to see if the data were normally distributed. To reach approximate normality, the absolute values of univariate Skewness and Kurtosis should be smaller than 3 and 10, respectively (Kline, 2005). Second, confirmatory factor analyses (CFAs) were performed to examine the questionnaires' construct validity. Model fit indices used were (1) Chi-Square test (χ^2), (2) Root Mean Square Error of Approximation (RMSEA), (3) Comparative Fit Index (CFI), and (4) Standardized Root Mean Square Residual (SRMR). The χ^2 test examines the discrepancy between a proposed model and data, and a *p* value greater than .05 indicates the model fits the data well (Kline, 2016). For the other three indices, Hu and Bentler (1999) recommend RMSEA $\leq .08$, CFI $< .90$, and SRMR $< .08$ as cut-off values for an acceptable model fit and RMSEA $\leq .05$, CFI $< .95$, and SRMR $< .05$ as cut-off values for a good model fit.

Third, score reliability for each factor was calculated to reflect the precision of estimation. To estimate score reliability, Omega (ω), the proportion of true-score variance to total observed variance, was computed. In a congeneric CFA model where no cross-loadings and correlated residuals exist, ω is analogous to Cronbach's *α*. If a CFA model is not congeneric, ω is a more precise estimate of score reliability than Cronbach's *α*. As mentioned in Chapter III, in a bifactor model, ω represents the ratio between a mixed variance explained by the general factor and group factor(s), and ω_h and ω_s stand for score reliability after removing effects of group factor (s) or the general factor (Reise, 2012). So they were computed for the SRL bifactor constructs. Although Cronbach's *α* is not an accurate estimator for score reliability in latent structures where residuals correlate, it is the most often used in empirical studies, especially for observed variables (e.g., Brown, 2015; Kline, 2016). As such, Cronbach's *α* was also calculated to illustrate how it can misestimate score reliability in this study. Meanwhile, composite scores for each achievement goal and SRL strategy were computed to show observed variable characteristics as well as to answer research question #1.

Then, a measurement model was examined to see correlations between latent variables. Based on the measurement model results, a structural model was tested to address research question #2—how achievement goals predict SRL strategies use. The analyses were conducted using the SPSS (Version 23.0; IBM Corp., 2014) and the Mplus (Version 7.4; Muthén & Muthén, 1998-2015).

Qualitative Data Analysis

Qualitative data were analyzed using content analysis to address research question #4 and #5. Content analysis is a systematic coding process used to identify patterned characteristics in textual data (Hsieh & Shannon, 2005). This process involves breaking texts down to smallest meaningful units (unitizing), grouping similar units into categories (categorizing), and merging relevant categories into themes. Content analysis has been frequently used in qualitative research across disciplines, such as education (e.g., Rock et al., 2016; Stambaugh & Dyson, 2016), psychology (e.g., Bolton, Lehmann, Jordan, & Frank, 2016; Noltemeyer, Proctor, & Dempsey, 2013), and business (e.g., Duan, Yu, Cao, & Levy, 2016; Gallinucci, Golfarelli, & Rizzi, 2015). It is effective in analyzing either rich or thin data (Denzin & Lincoln, 2011). Thus, this approach is appropriate to use here even though responses in this study lacked depth.

To increase the reliability of data analysis, another researcher with expertise in qualitative research helped with the analysis. We read the written responses to the open-ended question and the interview transcriptions, and identified the smallest meaningful units. We compared each other's results, discussed our similarities and differences, and reached an agreement on each unit. All the written responses and transcriptions were unitized using the same procedure. Each unit was printed on an individual index card. In total, 115 cards for the written responses and 244 cards for the interview transcriptions were printed, and each card had about 24 words on it. The two sets of cards were analyzed separately. We read each card carefully and categorized similar ones together. Next, we reviewed the categories and made necessary adjustments until there was a consensus. Finally, themes emerged.

Trustworthiness of qualitative data analysis was established through four strategies (Lincoln & Guba, 1985). First, thick descriptions of setting, participants, and methodology contributed to credibility, transferability, dependability, and conformability. Second, member checks at the end of interviews by the investigator asking participants for clarification and verification enhanced the study's credibility. Third, debriefing data analysis between researchers reinforced the rigor of the study. Finally, conformability was established by an audit trail where a third researcher reviewed data analysis procedures and products.

Results

Quantitative Results

Univariate Descriptive Statistics

Univariate descriptive statistics for the AGQ and the CPSS data were displayed in Appendix J. For the 12 AGQ items, Mean = 3.197–6.389, SD = .919–1.899, Skewness = -1.413–.443, and Kurtosis = -1.069–1.209. For the 18 CPSS items, Mean = 3.157–

5.881, SD = 1.093–1.856, Skewness = -.880–.531, and Kurtosis = -1.022–.147. The Skewness and Kurtosis values indicated that all data were approximately normally distributed.

CFAs

CFA for the AGQ original 4-factor model resulted in a good model fit, $\chi^2_{(48)}$ = 153.310, $p < .001$; RMSEA = .074; CFI = .945; SRMR = .061. All factor loadings were greater than .50, and all indicator variances explained by corresponding factors were significant. Factor correlations ranged from .003–.221. A further check found the largest modification index value was 36.409, caused by item 12. Also, BY statements indicated two items from mastery-avoidance goals would cross-load on performance-avoidance goals. WITH statements showed that the residuals of two items under mastery-approach goals and two under performance-avoidance goals would correlate.

After multiple attempts, a model respecification was made by correlating items G10 and G11 under performance-avoidance goals. The respecified model resulted in a good fit, $\chi^2_{(47)}$ = 99.866, $p < .001$; RMSEA = .055; CFI = .970; SRMR = .045. Factor loadings were all greater than .40. Indicator variances explained ranged from 20.0%–88.8%, all statistically significant.

CFA for the CPSS resulted in a good model fit, $\chi^2_{(120)}$ = 163.440, $p < .001$; RMSEA = .031; CFI = .978; SRMR = .034. Factor loadings on the general factor ranged from .325 to .681, on the two group factors ranged from -.320 to .468. Each item's variance explained was statistically significant, ranging from 23.6%–64.2%. These results showed the two questionnaires used in this study had a good construct validity.

Score Reliability and Descriptive Statistics for Observed Variables

Table 3 presents each observed variable's composite mean scores, standard deviations, Skewness, Kurtosis, Cronbach's α, and ω, as well as ω_h and ω_s. MAp goals scored the highest among the four achievement goals, meaning preservice teachers generally endorsed goals for learning. The second highest score was PAv, indicating the preservice teachers feared of being outperformed or looking inferior to peers. MAv scored the lowest, showing that the preservice teachers had less concern about not being able to learn. Although ELA and CT scores were not necessary to report due to their low ω_s values, they were presented here for the purpose of illustration. The GCS mean scores were 4.508, above the scale mid-point 4 but less than 5, suggesting that for this group of participants, SRL strategies use was at a medium level.

Table 3 Descriptive statistics and score reliability for observed variables (N =370)

	Mean	SD	Skewness	Kurtosis	α	ω	ω_h	ω_s
MAp	6.059	.944	-.999	.235	.800	.817		
MAv	3.514	1.516	.221	-.755	.797	.805		
PAp	4.903	1.564	-.611	-.138	.915	.915		
PAv	5.344	1.447	-.940	.276	.766	.613		
GCS	4.508	.969	-.182	.063	.895	.919	.825	
ELA	4.622	.980	-.102	-.085	.790	.870		.198
CT	4.355	1.057	-.198	.128	.747	.827		.236

Note: MAp = mastery-approach goals, MAv = mastery-avoidance goals, PAp = performance-approach goals, PAv = performance-avoidance goals; GCS = general cognitive strategies, ELA = Elaboration, CT = Critical Thinking.

For MAp, MAv, and PAp, Cronbach's α and ω values were similar. That was because the three constructs were all congeneric (i.e., no item cross-loadings or correlated residuals). For PAv, its ω value was lower than Cronbach's α. This was because Cronbach's α did not take into account the correlated residuals between item10 and item 11.

In the bifactor model, Cronbach's α values were lower than ω. Since ω was based on a blend of variance explained by the general factor (GCS) and group factors (ELA and CT) together, ω_h and ω_s were calculated to reflect a purer variance explained by one factor while controlling for the other factor(s). After removing effects of ELA and CT, ω_h for GCS was still high (.825), meaning its composite score was built on reliable amount of variances. After removing the general factor's effects, however, the group factors ELA and CT resulted in low ω_s values (.198 and .236, respectively). That means their composite scores were less reliable than that of the general factor GCS.

Overall, score reliability for the four achievement goals and GCS was acceptable at .60, while ELA and CT were comparatively lower than .30 after controlling for the variance explained by GCS.

Measurement Modeling

A measurement model was constructed to examine the relationships between latent variables. The measurement model had a good fit, $\chi^2_{(371)} = 534.879$, $p < .001$; RMSEA = .035; CFI = .961; SRMR = .044. As shown in Table 4, GCS, ELA, and CT were not correlated with each other by default. Four achievement goals were either not significantly or moderately correlated with one another (*r*s = .042–.382, *p*s = .001–.434).

MAp was highly correlated with GCS (*r* = .592, *p* < .001) and moderately correlated with ELA (*r* = .279, *p* < .001), PAp correlated with GSC (*r* = .283, *p* < .001) and CT (*r* = .184, *p* < .01), and PAv correlated with GCS (*r* = .275, *p* < .001). MAv had no relationship with the three types of SRL strategies.

Table 4 Correlations between latent achievement goals and learning strategies variables

	MAp	MAv	PAp	PAv	GCS	ELA	CT
MAp	-						
MAv	.045	-					
PAp	.184**	.137*	-				
PAv	.071	.382**	.278**	-			
GCS	.593**	.032	.279**	.270**	-		
ELA	.273**	-.042	.004	-.068	0	-	
CT	.059	.132	.154*	-.033	0	0	-

Note: MAp = mastery-approach goals, MAv = mastery-avoidance goals, PAp = performance-approach goals, PAv = performance-avoidance goals; GCS = General cognitive strategies, ELA = Elaboration, CT = Critical Thinking. **p* < .05; ***p* < .01.

Structural Modeling

A structural model based on the measurement model results was conducted to answer research question #3. The structural model (Figure 6) demonstrated a good model fit, $\chi^2_{(378)} = 544.521$, *p* < .001; RMSEA = .035, CFI = .960, SRMR = .046. In this model, 41.6% of variances (*p* < .001) in GCS was explained by MAp, PAp, and PAv goals, collectively. More specifically, MAp accounted for 31.1% of the variance in GCS alone, while PAp and PAv explained 1.7% and 3.5% of variance in GCS respectively. MAp goals also accounted for 17.8% of variance ($p < .05$) in ELA. Although 4.1% of variance ($p = .180$) in CT was explained by PAp goals, the effect was not significant, so no further explanation was made.

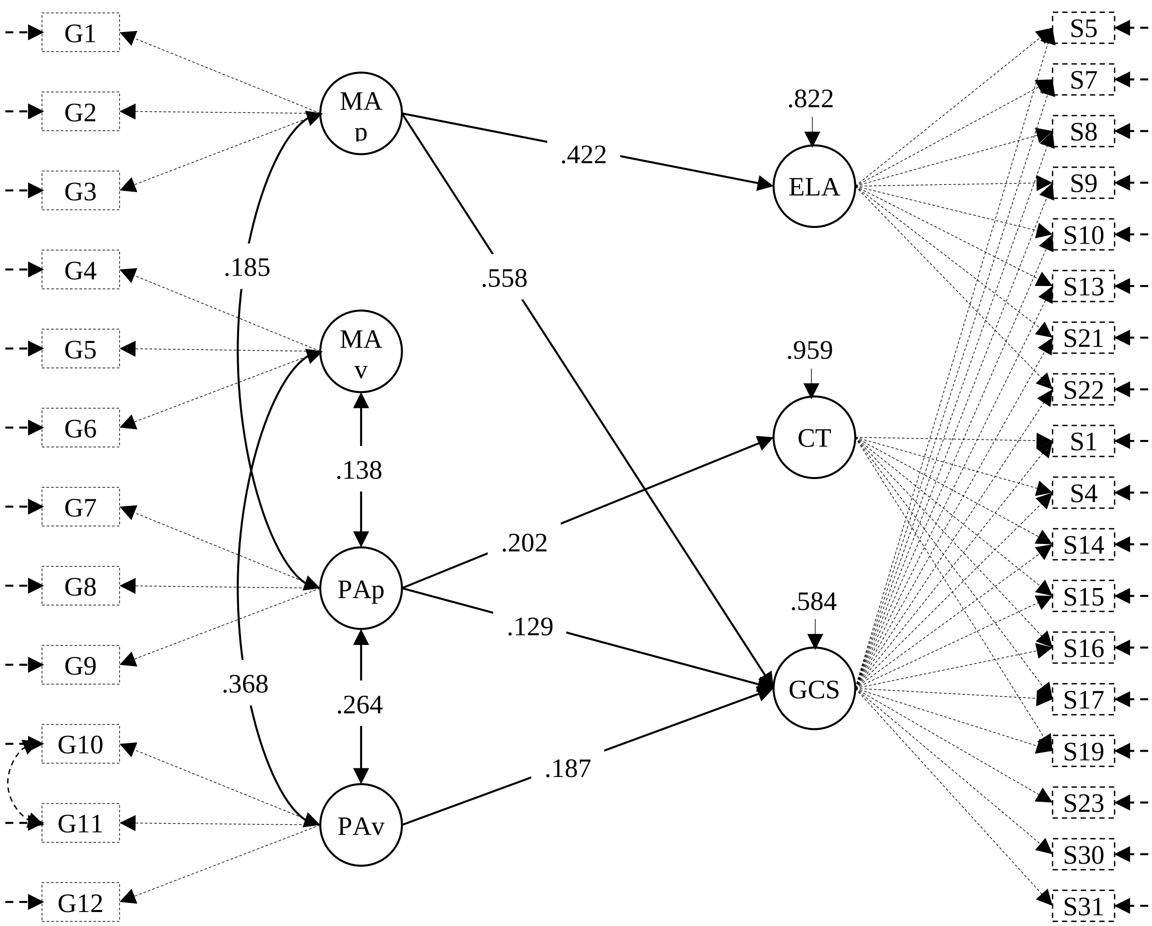

Figure 6. A structural model of achievement goals and learning strategies. To highlight the relationships between achievement goals and SRL strategies, indicators were dashed and their residuals omitted. All solid paths were significant at .05 level. MAp = mastery-approach goals, MAv = mastery-avoidance goals, PAp = performance-approach goals, PAv = performance-avoidance goals; GCS = general cognitive strategies, ELA = elaboration, CT = critical thinking.

Overall, MAp, PAp, and PAv goals all had positive effects on GCS, and among the three predictors MAp goals had the largest effects ($\lambda = .558$). Specifically, one standard deviation of increase in MAp would result in .558 standard deviations of increase in GCS, controlling for PAp and PAv. One standard deviation increase in PAp would result in .129 standard deviations of increase in GCS, controlling for MAp and PAv. One standard deviation increase in PAv would lead to .187 standard deviations of increase in GCS, controlling for MAp and PAp. In addition, MAp goals also had a large effect ($\lambda = .422$, $p < .001$) on the use of elaboration strategies.

Qualitative Results

Participants' responses to the open-ended question and each interview question were analyzed separately. The short responses to all questions showed that the data gathered were not rich or in-depth. Participants' plain descriptions and explanations also indicated their limited understating of SRL. Themes that emerged from the two data sets were described as the following.

Findings from Written Responses

The open-ended question focused on whether participants learned about the concept of SRL in their programs and how they described SRL in their own words. Among the 269 participants who completed the questionnaires, 77 (28.6%) did not respond to the open-ended question, 71 (26.4%) answered "no" without further explanation, 17 (6.3%) answered "no" and defined SRL, 6 (2.2%) answered "yes" without further explanation, 37 (13.8%) answered "yes" and defined SRL, and 61 described SRL without indicating whether they had learned the concept or not.

Overall, 16% of the participants clearly stated (answered “yes”) that they learned the concept of SRL. This small portion may reflect the participants’ low-level exposure to SRL instruction. More than half of the participants did not respond or said they did not learn the concept. One quarter of the participants did not respond, perhaps because the question was not mandatory so they chose not to answer. Another reason might be that they knew little about the concept of SRL.

Nevertheless, nearly half of the participants (115) described SRL in their own words. Their descriptions ranged from a few words to 2–3 sentences and were unitized and printed on 197 index cards, shuffled, and categorized. Finally, four themes emerged from the written responses: (1) self-motivated learning, (2) individualized learning styles and strategies, (3) self-directed study, and (4) time management.

The first theme, self-motivated learning, described SRL as a self-guided learning process involving goal setting and self-motivating. For example, one participant thought of SRL as “a learning process that people use to learn, [in which] you set goals for yourself to try and reach them.” Another participant regarded SRL as, “The motivation of oneself to take control of their [her/his] own learning in order to attain a goal.” Other descriptions of SRL were such as “being able to motivate yourself to learn more,” “motivating myself to get organized to better help me prepare,” and “this concept [SRL] is your own motivation in learning; if you want to succeed in your class.”

The second theme described SRL as studying with different cognitive strategies, in different ways, and at different rates. For example, one participant said, “Studying is SRL. If you don’t study, you won’t be able to learn the information.” Another participant agreed, saying, “To me SRL is studying and figuring out ways that help you understand materials.” Regarding different cognitive strategies, one participant focused on rehearsal that required “repeating concepts and going [that] over times in my head.” Another talked about elaboration: “I have learned to study and relate things to my own life to understand them.” Some relied on self-talk, stating “talking to my self and asking myself questions,” and others preferred note taking, “I’d take excellent notes.”

To some participants, SRL was more about personal ways of learning. They thought, “SRL is how an individual learns. There are many learning styles but it is up to the individual to determine how they learn best.” Therefore, it is important for individuals to “find a way that you can utilize maximum learning for yourself” and “to determine the best way and strategies to help you succeed.”

SRL also involved a particular pace of learning. Participants thought SRL was “self-paced—you pace yourself on how and what you want to learn.” One participant explained, “SRL to me is having the ability to set your own pace with discipline. Having the ability to slow down on topics where needed and excel when you grasp the concept.” Similarly, another participant believed SRL was “learning at the pace/with the style you are most comfortable with.”

The third theme was self-teach, which referred to how participants were able to be self-taught. To these participants, SRL meant “the ability to take the initiative to teach yourself if one is not able to comprehend the concept the first time.” It was “directly in proportion to what you teach yourself” and meant “learning the information on your own." Some participants thought SRL could help them learn "in an online class" or "outside of the classroom." An example one participant gave was,

> "I see the best example for this being when we are expected to read chapters from our book and follow up by taking a quiz that reflects our final grade. We do not discuss the book in class that much so it is up to us to read the book and understand the material thoroughly."

The fourth theme focused on time management. Participants thought SRL was "how one self takes time to learn put aside time for yourself to study and help yourself learn subjects and keywords you don't understand." Participants learned through previous classes that "having scheduled study" was essential. One participant said,

> "I learned about it in a previous freshman class where we learned to set time aside for studying and how well you want to do in the class. We learned that the more you study the better you can do. So if you want to do real well you would need to study more hours."

They equated SRL to "personal time management [that means] being able to manage time in order to keep track of doing different things." More specifically, SRL meant "turning in assignments, exams, quizzes, projects all online at specific due dates that you are to keep up with."

In addition to the four major themes, two responses emphasized SRL as evaluation from a teacher's perspective: "[SRL is] assessing your own teaching and learning how to teach students differently," and "SRL is basically an evaluation from a peer or self. It is about adapting your own skills to different situations in the PE settings."

Findings from the Interview Data

Five research questions were analyzed one by one. Because monitoring and adapting to changes often occurred simultaneously, they were described together. As a result, four categories of finding were: (1) definition of SRL, (2) teaching strategies used in an effective lesson, (3) monitoring and adaptation, (4) reflection. Themes emerged under each question were reported below.

Definition of SRL

Among the 11 interviewees, one said that he had learned about the concept of SRL in one course previously taken, and 10 stated that they had no knowledge about SRL. Two themes emerged from the transcriptions were self-teaching and teacher-directed learning. Self-teaching refers to that participants described SRL as a self-directed learning process whereby they teach themselves. For example, preservice teacher D described SRL as,

> "It [SRL] means like you're taking something, maybe what somebody teaches you, and put in your own way like how you'd like to learn it for yourself. So basically like somebody teaches you something and you make it your own word or own visual, or something you are familiar with, just for you to easier to learn."

Preservice teacher A defined SRL as, "Self-regulating would just be making sure that you not having to be reminded to do things that you just do it yourself, in that given a task you make sure that you completed it on your own." Similarly, preservice teacher K said, “I think it has to do with yourself and how you learn yourself ...” These descriptions reflected how preservice teachers literally interpreted SRL.

SRL was defined as a teacher-directed learning process, in which participants viewed themselves as a teacher rather than a learner. Preservice teacher H said,

> “It [SRL] is giving students information and resources that they can learn on their own time and their own circumstances; I mean, with you give them time as much as they can do it, but they do it on purpose in a way that they can learn information on their own.”

Preservice teacher E shared similar thoughts, “It [SRL] is [a] process set forward by the teacher and they have the responsibility of communicating and assisting either students or whoever is learning the material.” Teacher oriented learning also involved self-evaluation of teaching. As preservice C pointed, “It [SRL] means that as a teacher, one has to evaluate themselves and make corrections the way you teach kids…”

In addition to the two major themes, two preservice teachers mentioned that SRL required help seeking and time management. They said, “If you need help, you get help without a push from the instructor teacher” and “it [SRL] … to study a test a week and to set a time every day or every other day to study for tat class given time on their own.”

Teaching Strategies Used in an Effective Lesson

Five themes emerged from preservice teachers’ responses to teaching strategies used in an effective lesson: (1) lesson preparation, (2) interactive decision making, (3) classroom management, (4) incorporating technology, and (5) post impact.

Lesson preparation. Lesson preparation refers to what preservice teachers usually do before their teaching. During lesson preparation, creating a lesson plan was important because "the lesson plan basically outlines everything you're going to teach." Preservice teacher F suggested teachers should be "being very clear at the objectives of the course" and "laying out a concise schedule of projects, tests, and assignments" on the lesson plan. Preservice teacher H reflected on his lesson planning and said teachers should prepare to "provide students with the equipment that was needed and a variety of tasks that needed to be done."

Most preservice teachers thought preparing "different methods of teaching" was important in lesson planning. They thought that students "are in the process of learning what works best for them—that is going to help them in a long run—because they don't have a particular way of learning things." So students "needed to know multiple ways of doing one thing."

Rehearsal was another way to assist teaching a lesson effectively. Preservice teacher C believed if "you practice before you do it [teach a lesson], it [the lesson] flows fluently and [you are] ready for questions from students and ready to answer all of them." To rehearse a lesson, preservice teacher C would "try to picture all of the scenarios happening during my teaching," and preservice teacher A would "sit there and talk out loud. I won't time myself … But what I will do is to talk, saying out loud and demonstrating as well."

Most preservice teachers were able to recognize the importance of lesson preparation. Preservice teacher B regarded lesson preparation as "the foundation of the education and of being a good teacher." Preservice teacher C thought preparation was the most important part of a lesson because "if I'm very prepared, organized, what I want to teach that I know, it will make a great teaching experience." Preservice teacher A's statement was representative for all participants,

> "I think if I am not prepared, then how can I teach these kids, how can I teach them something that I do not know? So, that comes back to me. I make sure I am prepared. There is going to be mess-ups; that's ok [because] that's part of it, everyone messes up. But if I come with nothing, and I have nothing, no knowledge, nothing, then how am I supposed to teach these kids about physical education. I will not [be] able to, I will not have a job."

Interactive decision making. Interactive decision making means how preservice teachers used specific teaching behaviors (i.e., teaching skills) to generate impacts on student learning. Preservice teachers identified a variety of teaching skills such as demonstration, practicing, and questioning. According to preservice teacher A, a constant demonstration was the key to students' motor skills learning. She described one strategy she used was "I-do-we-do-you-do,"

> "I demonstrated first, then I had the class demonstrate it together as a group, and then I let them do it themselves ... so they were getting the full picture. They were getting practice before they were expected to do it on their own, and that seemed working really well."

Preservice teacher A concerned with younger students' cognitive ability to learn, so she emphasized a particular demonstration technique—break-it-down. This technique requires teacher to separate a complex skill into simpler steps. She said,

> "Their [younger students'] brain is still growing…, they can only learn so much in one time… I had instruction first and demonstration and then I had them do what I did but we did it in steps so there were in sequence: step 1, step 2, step 3 and then I went back and told them to put it all together for a final product."

Preservice teacher H echoed with her by saying,

> "With younger kids, it's more of a breakdown. It's like to teach them A, teach them B, and teach them A and B together; teach them C, and teach them ABC together. Allowing them to process each one at a time though, they figure out how they need to get it done"

Preservice teacher F called this technique "whole-part-whole." He said,

> "Whenever you're trying to teach a complex subject, you can break it—you can show the whole thing together, and then break it down to its components, and then when everything is done, you can put everything back together again once they [students] have mastered the parts. So they can see where everything is going at the beginning, then they can learn the parts and put everything together to make it all work."

Practicing was essential to learning motor skills. Preservice teacher A believed "practice makes perfect." To engage students in practice, preservice teachers created different scenarios. For instance, preservice teacher G used a game-like scenario to teach volleyball. She explained,

> “A scenario would be covering passing of a volley ball. And the coach, me, would throw the ball over the net pretending that I was passing the ball over and they [students] would have to get ready position and pass the ball and get it to the setter, who would just catch the ball, and that would prepare them for knowing where target was the pass at.”

Similarly, preservice teacher L shared his experience in teaching football: “I made a poster… presentation… special shirts, and basically treated it like in a football scenario.”

Questioning was a frequently used teaching strategy. The preservice teachers asked questions to assess students’ understanding from the beginning of a lesson to the end. Preservice teacher L provided an example of asking general questions,

> “During the introduction. I would ask ‘is there any questions?’ If there were questions, I would address them. If there were none, we’d move to the lesson. After the lesson, I’d ask ‘what’ve we learned today?’ People raise their hands and say ‘Oh, we learned this’ or whatever.”

Preservice teacher K shared his experience of questioning when teaching football rules,

> “With the bigger kids…, I asked those questions [such as] ‘do you know what this is? … How many players on offense, how many players are on defense?’ I ask them positions, football positions, who plays this and who plays that. I wanted to see if they knew what they were talking about. Because if they didn’t

> then I was going to make sure I touched on that before I even got to the physical part of kicking a football."

Preservice teacher F liked asking questions such as "personal anecdotes" that are "relevant to the course" so as to "keep them [students] into the lesson." Preservice teacher E agreed that questioning could keep students on the right track of learning,

> "It's a lot better when you have the students talking back to you and not just doing all the talking yourself, because for the students that gets kind of boring and after a while stop listening, so as much as they can get involved and stay engaged in the lesson, the better everything is."

Besides keeping student on track, preservice teacher E also believed questioning could increase student learning,

> "I think this [effective teaching] goes along with the line of asking why ... It's Socratic … Instead of telling the students what you want them to know and giving them a statement, you lead them to the answer [by] asking them a series of questions. Questions that's easy for them to comprehend and easy for them to get and then … you can in a way lead them through your train of thought and how you approach and answer to problem or whatever you're teaching."

On occasion that students might not fully understand instructions, the preservice teachers would re-explain the instruction. Preservice teacher B disclosed that if students did not understand, he would "stay on it, repeat it over and over until the majority of the class can get it and then move on to the next step." Preservice teacher D noticed that "when I do explain the instructions they can get a little organized and pick them up down the road." Preservice teacher E believed explaining "why" was important for student understanding of instructions. He said,

> "I always feel that if somebody know why something is done, they're actually are going to capture the concept and learn it a lot better, because they're going to understand the reason behind it and so they'll be able to acquire, and later if something comes up and they need to apply something. They're going to remember 'Ok, this is why we do it, so I'm going to do it in such and such way.'"

Classroom management. Classroom management was an important factor of effective teaching. Preservice teacher D acknowledged the importance of seating students, "When I'm teaching, every time I'm talking, I try to bring everyone in, sit them down, so they can only focus on me." Preservice teacher E thought following the routine could facilitate teaching. He pointed,

> "It's always the best in my opinion to adhere as much as possible to the style of teaching the children have already seen so that they can continue [learning], so that everything is consistent for them. I just think it would, and especially with procedures and how teachers run their classrooms, if you continue along with the way that has already been done, it makes it a lot easier for you to kind of pick up in the middle of a lesson and be able to teach."

Another managerial strategy was group learning, in which students were paired up or divided into small groups. Preservice teacher A and B mentioned they would pair student up when teaching dance or throwing skills. Preservice teacher H explained why she favored group learning,

> "I prefer group over individual a lot of times because they [students] can help each other out and they don't have to struggle. When they realize that if they are struggling on something, they have someone to count on, or that is not just their struggling, that's something that someone is struggling with."

Incorporating technology. To facilitate student learning, the preservice teachers utilized technology into their teaching such as visual presentations, videos, audio recordings, etc. Preservice teacher A believed that "the majority of kids like some kind of TV" so she "would show a video or something" to help her teach. Preservice teacher D agreed that by incorporating technology in her lesson, students "can better understand what I want from them, so they are more effective when doing for themselves." Similarly, preservice teacher B shared his experience,

> "[If] some students do not understand the power point, I would go back and try to see if there was a video I can find to help explain it in a different way …, [so] the kids can physically see it over and over ..."

Post impact. Post impact occurred when the preservice teachers evaluated the increase in student learning. Preservice teacher D shared how she assessed her own teaching effectiveness, "I think it was effective because students and my peers actually learned what I'm teaching and they were able to tell me in the end of my class what we have learned, everything like that …" She told a specific example of assessing student cognitive learning, "one time I had a poster board. We head count of words and we try everything we put in where the words are supposed to go, so I would know whether I taught effectively on the kids."

Preservice teacher A also commented on her teaching effectiveness of one lesson she taught previously. She noticed student learning occurred in both psychomotor and affective areas, “I thought that went well. In both of them [lessons] I saw what I wanted to see ... the younger and older children move … enjoy and have fun … all participate … demonstrate the skill the correct way.”

Monitoring and Adaptation

Monitoring refers to how preservice teachers were self-aware of their thoughts and behaviors during teaching, and adaptation means what preservice teachers did when their teaching went unexpectedly. The two processes often occurred in a close sequence.

Most preservice teachers were able to monitor their teaching. Preservice teacher A insisted, “You always have to be aware of what you are doing in the gym.” Preservice teacher E admitted, “I’m pretty aware [of myself], I usually keep a pretty clear mind and keep an eye on what I’m doing.” To keep himself aware of his teaching, preservice teacher K would “keep my paper and lesson plan on me.” Preservice teacher G not only monitor herself but also the teaching environment, saying,

> “I would be aware of [myself], I would always constantly keep myself on task, I guess in my head, and I would make sure to stay focus while teaching, knowing what skill I would have to incorporate next, and then I would make myself aware so I could see everyone in my surroundings and that sort of thing.”

Once teaching went unexpectedly, adaptations were assumed. Preservice teachers would get the lesson back to the right track by explaining their instructions again or teach in alternative ways. Preservice teacher K shared a teaching experience, "We were doing [football] kickoffs. I forgot to mention how the football should be angled on the tee. A lot of the kids had the football straight up. So I was like, 'Guys, hold on, I forgot to mention to you guys a little bit ago that we need to choke the ball back a little bit so you would to be able to get under it,' and that's where I went back with them."

Under similar situation, preservice teacher B would "try to stay on and repeat it over and over until the majority of the class can get it," and preservice teacher J would "pull them in and talk to them for a minute or less and remind them to do what I told them." Preservice teacher G talked about what she would do,

"I would generally give the kids a water break [to] collect my thoughts while they were taking a water break and then restart. Other than that I would stop everyone and gather them around explain it more or use other students as examples to see if they understood it."

Preservice teacher J also acknowledged, "If I explained the rules wrong and they were already playing, I would make it shorter and do a different activity instead of taking forever to explain it properly." Preservice teacher A backed up using alternative ways to teach. She gave an example of her teaching experience,

"In part of the obstacle course we had kids… to roll like armadillos. Because they had to act like animals, they were having a hard time grasping that. So I had to change it, you know, just tell them to roll like logs. And that way they understood what I was saying. So like the movement that I was showing them and then they got on a different level than when I said armadillos."

Not all preservice teachers were able to monitor their teaching and make adaptations. Preservice teacher C admitted,

> "During the teaching I guess not really. I don't think [what] I do… Usually I prepare my teaching before and just follow what I planned. If stuff doesn't go one hundred percent how I planned, I just try to follow myself and don't think about what I'm saying… I just do the plan I don't really evaluate myself until after."

Preservice teacher L had similar thoughts,

> "When something went wrong, I just tried to keep going, not let it stumble me. I just tried not to think about it. I'll think about it that I made a mistake, but, I just continue to go, keep moving on. You have a certain time limit for the assignment to teach, so, I want to stay… I just want to make sure it was done clearly."

Help Seeking

Help seeking refers to how preservice teachers found outside sources to assist their lesson planning and teaching when they had problems. Two types of sources identified were human sources and the internet. Among human sources, peers and teachers were frequently consulted. Google search and YouTube were two information sources that preservice teachers often made use of.

Preservice teacher H liked to ask peers and teachers for advice. She said, "If I'm stuck on a lesson plan, I know there are a plenty of other people I can talk to about it. I have a bunch of mentors I can talk to and teachers if I'm stuck." Preservice teacher K shared a similar experience, "I ask my peers and my superiors: How does this look, what do you think, what would you change?" According to preservice teacher B, "Usually the more people I ask, the more likely I am able to get different answers and responses…, the more variety I have and [am] able to teach," and he was more likely to "find my own method" to teach a lesson.

"The internet is a good source to get information," preservice teacher A disclosed. Taking advantage of the internet, preservice teacher C said, "If I had difficulty planning a lesson, usually what I do is go online and find something how to do something." Preservice teacher D also liked finding ideas online, "I try to use Google and go online like YouTube to find some creative things they did, just to try to give me ideas like what I'm supposed to do."

Finding outside sources was helpful, especially when preservice teachers were not familiar with the content they were going to teach. Preservice teacher C manifested,

> "If I have no idea, for example we were teaching basketball right now, and I'm not a basketball player, I don't know anything about drills. So, I have to rely on my peers and go online and look for stuff and information. That way I can build the classroom, and that's the way I do it."

Similarly, preservice teacher G would "go online to a Volleyball Coaches website and see if there were plans that I can follow or modify" when teaching volleyball.

Reflection

Reflection refers to what preservice teachers thought and did after teaching a lesson. Overall, the preservice teachers concurred reflection as a way to improve teaching effectiveness. Preservice teacher L thought reflection was "the most important part" of teaching because "it puts everything together, and I [am able to] learn what is good and what is bad.” Preservice teacher G believed through reflection she could assess effective teaching,

> “Honestly reflection [is important] because after you teach the material you don't know if it's effective unless you reflect over it and see if they [students] actually understand what you were teaching. So to me you don't find out any results unless you reflect over it.”

Comparing to other parts of a lesson, preservice teacher E believed reflection could improve one’s teaching ability. He pointed out,

> “I would say as long as you’re reflecting on how things went, then you should, and as long as you are putting a lot of time in doing refection and how to improve things, then I believe you’ll always be able to improve. If everything just puts on to either preparation or instruction, then you are not really doing anything in terms of improvement in the lesson. It’s just going to stay the way it is. If you don’t reflect on anything, that’s not really going to get better than it already is.”

In terms of how to reflect, preservice teachers often ask themselves questions and make critiques about their teaching. Preservice teacher B talked about what questions he routinely asked himself,

> “After I teach it I go back and ask great questions for myself, like did the students learn what they need to learn? Did I get through the major points that I needed to go through in my presentation? What is the most common section that my students didn’t understand?”

Like preservice teacher B, other preservice teachers tended to think what went well, what did not go well, why, and how they could change for the next teaching. Preservice teacher E's thoughts on reflection were representative. He said,

> "That was basically what I had. I usually just spend rest of the time after the lesson, just trying to think about what I did really well and what I could have done better, and how I might have done it better … Taking a little bit of the time to kind of critique how it went, like how I thought it could've gone and how it actually did go, and then thinking about why something worked really well and why something didn't work as well. I just like to … do a quick run-down through my head of how I think everything went."

To improve reflective practices, preservice teachers showed their interests and enthusiasm in receiving feedback from cooperative teachers and students. They thought that teachers' feedback could help them recognize where they could improve. As preservice teacher D mentioned,

> "I have a cooperative teacher during my elementary teaching. She gave me some feedback [on my teaching]. During my secondary teaching, my [another] cooperative teacher gave me some feedback on what I can improve on. The things they tell me like something I realize, 'Oh, I've got to make it better.'"

They also valued student feedback. Preservice teacher H liked student feedback because it gave her "more of open-mindedness on how to teach." After teaching a lesson, she would "talk to students about how they liked it and what they liked about it, what they didn’t like about it,” so she “can get feedback on how it would affect them and how they thought about me teaching it.”

Preservice teacher C shared his experience with student feedback, saying, “When I've done the teaching here in school, I talk to other students and see what they're doing, what works for them, and what didn't feed off; so that way I can make my teach better.” He also acknowledged that asking students “helps me a lot… It's when you get students say you could've done better… it's everybody sees a different perspective so you pick up all the stuff that you didn't think about yourself.”

Besides feedback form cooperative teachers and students, technology could be another way to facilitate reflection. Preservice teacher C also commented on how one could reflect via using technology. He said,

> “That's when I realize some things I could've done better, how I could ask for something like for one of my classes I'm taking a semester, I have somebody recording you while you teach, and I guess me out after I looked at the video and saw some stuff I really wasn't paying attention to.”

In summary, the PE preservice teachers defined SRL in various versions such as self-teaching and managing time. That might be due to a lack of exposure to formal SRL instruction in their programs. To conduct an effective PE lesson, the preservice teachers emphasized lesson preparation such as making detailed lesson plans and rehearsing before teaching. During the instruction, they utilized skills of teaching, such as skill modeling and questioning, as well as technological assistance while monitoring the class and making necessary adjustments. They also assessed student learning in the end of the lesson. After the lesson, they picked up thoughts and reflected what had gone well and what improvement might be made for the next lesson. These behaviors indicated that the preservice teachers followed a self-regulatory process; however, not all of them operated at the same level. As said previously, some preservice teachers would not do any modifications even though problematic scenarios occurred.

Discussion

Considering the dearth of self-regulated learning (SRL) research in physical education teacher education (PETE), the present study examined PE preservice teachers' use of SRL strategies and how their strategies use was affected by achievement goals. Meanwhile, this study explored their understanding of SRL and how they self-regulated during their field practices. The following sections discuss results for the four research questions asked in this study.

Research Question #1: To What Degree Do PE Preservice Teachers Apply SRL Strategies in Their Learning?

Preservice teachers' general cognitive strategies use scored 4.508 on a 7-point Likert scale, above the scale's midpoint 4 but lower than 5 (see Table 3). This means that their degree of SRL strategies use was at a medium level. The result is similar to the degree of SRL strategies use among college students of other disciplines in the United States (e.g., Bartels, Magun-Jackson, & Ryan, 2010; Hilpert, Stempien, van der, Kraft, & Husman, 2013; Muis & Franco, 2009). For example, using the 7-point Likert scale, Bartels et al. (2010) found 146 undergraduate students majoring in Education scored 4.57 on average. Similarly, Muis and Franco (2009) examined SRL strategies use in 201

Education Psychology undergraduate students, and these students scored 4.48 on the 7-point Likert scale.

This result is also comparable to college students' learning strategies use in other countries (e.g., Hashemyolia, Asmuni, Ayub, Daud, & Shah, 2014; Turan & Konan, 2012; Vrugt & Ourt, 2008). For instance, Buzza and Allinotte (2013) reported that 108 Canadian Education teacher candidates scored 4.82 on average on SRL strategies scales. Turan and Konan (2012) surveyed 309 fourth-year Turkish undergraduate students during their surgery clerkship. They found that students used SRL strategies at a medium level, with a mean score of 4.20. The medium level of strategies use might reflect a lack of purposeful SRL instruction in PETE as well as in higher education overall. Therefore, designing meaningful SRL instructions for college students, including PE preservice teachers, seems to be imperative.

Research Question #2: Do PE Preservice Teachers' Achievement Goals Predict SRL Strategies Use?

According to Elliot and McGregor (2001), different achievement goals have differential effects on cognitive, motivational, and behavioral outcomes. In the literature, mastery-approach (MAp) goal orientation has consistently demonstrated its adaptive consequences. This study provided additional evidence that preservice teachers oriented by MAp goals tended to employ cognitive and metacognitive strategies more often than other goals. Compared to other types of goal orientation, the effect of MAp goals on general cognitive and elaboration strategies were predominant (see Figure 4). Conforming to previous SRL studies among college students (e.g., Bernacki et al., 2012;

Cellar et al., 2011; Muis & Franco, 2009) and secondary students (e.g., Fadlelmula, Cakiroglu, & Sungur, 2014; Mouratidis et al., 2013; Soltaninejad, 2015), the present study shows that aiming at one's own improvement in learning and increase in competence profits SRL strategies use.

Compared to other goal orientations, mastery-avoidance (MAv) goals have received less research attention. One reason might be that instead of using the 2×2 achievement goal model to examine associations between achievement goals and SRL learning strategies, most previous studies relied on the trichotomous model that did not include MAv goals. Among a few previous studies, two (i.e., Muis & Franco, 2009; Soltaninejad, 2015) found similar results—MAv goals negatively predicted use of SRL strategies such as elaboration. The present study, however, revealed that MAv goals did not have effects on SRL strategies use. This might be due to the fact that fear of failure underlying MAv goals (Moller & Elliot, 2006) led to the disassociation between MAv goals and SRL strategies. This assumption needs further empirical support, however.

Consequences of performance-approach (PAp) goals are inconclusive in the literature. PAp goals may positively (e.g., Mouratidis et al., 2013; Vrugt & Ourt, 2008), negatively (e.g., Muis & Franco, 2009; Soltaninejad, 2015), or not (e.g., Bernacki et al., 2012; Fadlelmula et al., 2014) predict different SRL strategies use. In this study, PAp goals positively predicted general cognitive strategies use. This might be because preservice teachers with PAp goals tried to outperform peers so that they had more cognitive engagement and reflective thoughts in their learning. This association nevertheless needs further investigation.

In the literature, performance-avoidance (PAv) goals tend to negatively (e.g., Dupeyrat & Mariné, 2005; Liem et al., 2008) or not (e.g., Fadlelmula et al., 2014; Vrugt & Ourt, 2008) predict deep SRL strategies use such as elaboration and critical thinking, and positively predict surface SRL strategies use such as rehearsal (e.g., Liem et al., 2008; Soltaninejad, 2015). The current study revealed that preservice teachers with PAv goals would be likely to use general cognitive strategies. This might be because these preservice teachers did not want to feel humiliated compared to peers with higher competence, so they had a certain level of general cognitive strategies use.

Note that the constructs of SRL strategies in this study differ from those of previous studies. In previous studies (e.g., Bartels et al., 2010; Sadi & Uyar, 2013; Turan & Konan, 2012), SRL strategies used to include five distinct constructs (i.e., rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulation). Some studies (i.e., Dela Rosa & Bernardo, 2013; Diseth & Kobbeltvedt, 2010; Vrugt & Ourt, 2008) categorized the five constructs into two categories (i.e., surface strategies and deep strategies). In the present study, all five constructs merged into one general cognitive processing strategies while two distinct strategies emerged. This unique construct may have led to dissimilarities between results of this study and those of previous studies. In spite of the differences, given the solid theoretical premises (all strategies are sorted by the degree of cognitive processing) and rigorous statistical procedures (bifactor EFA and bifactor CFA modeling in Chapter III), the present study may represent the most appropriate solution for exhibiting relationships between achievement goals and SRL strategies use.

Research Question #3: How Do PE Preservice Teachers Define SRL?

The definition of SRL, in its simplest form, is "skills and will" (e.g., Garcia & Pintrich, 1996; Zusho et al., 2003). According to Pintrich (2000b) and Zimmerman (2000), SRL entails activation and regulation of cognition, motivation, behavior, and environment. Findings from the written responses and the interviews show that the majority of preservice teachers in this study did not learn the concept of SRL in any courses offered during their professional development stages. Their definitions of SRL thus varied considerably and seemed to be presumptive and superficial.

In their written responses, preservice teachers first identified SRL as a self-motivated learning process. They pointed out that goal setting was the reason and self-motivation was the drive for them to learn. This is in accordance to the SRL theory (e.g., Pintrich, 2000b; Pintrich, 2004) that motivation is an important component of self-regulatory processes. Self-regulated learners set goals to initiate effort, make plans, monitor, and evaluate their learning. Generally, goals can be oriented to learning that focuses on self-improvement or interpersonal comparison. The former type of goals is conducive to student success, while the latter is often disadvantageous (e.g., Pintrich, 2000b; Zimmerman, 2013). This group of preservice teachers, however, did not specify which type of goals they referred to. Since the written responses were not rich, it is challenging to assume what the participants meant. Future research may take steps to address this question.

Learning styles and strategies are another important component of SRL. This component has been a focus of education, and it has immediate impacts on student learning outcomes (Zimmerman, 2000). Similar to Ewijk and Werf (2012) who found that learning strategies were important to student learning, preservice teachers of this study thought self-regulated learners would use different learning styles for academic success. But, they did not explain what specific styles they used. Even though they mentioned some specific strategies such as repeating information to oneself and connecting prior knowledge, the preservice teachers failed to term these processes as rehearsal and elaboration as they appeared in the SRL literature. These findings, again, revealed how limited exposure to SRL these preservice teachers had.

Preservice teachers in this study identified time management as an indicator of SRL. This identification is consistent with what the SRL theory (e.g., Pintrich, 2000b; Pintrich, 2004) as well as empirical studies (Randi, Corno, & Johnson, 2011) emphasized. Previous research among college students often found that proper time management could lead to academic success (e.g., MacCann, Fogarty, & Roberts, 2012; Renzulli, 2015) and reduced stress (Häfner, Stock, Pinneker, & Ströhle, 2014). Probably because time management is “a classic aspect of most learning and study skills courses” (Pintrich, 2004, p. 398), the preservice teachers were able to recognize its importance. Moreover, these preservice teachers were usually required to take 12–15 credit hours per semester. Many of them also had to spare time for part-time jobs and socializations. Good time management was certainly helpful to their learning and lives.

Findings from the written responses and the interviews had overlaps. One common theme was self-teaching. Many preservice teachers viewed SRL as a process whereby they learned on their own. These respondents, however, did not explain how specifically they would learn by themselves. Another overlap was teacher-directed learning. Some preservice teachers regarded SRL as initiated and controlled by the teacher. This was especially apparent when the interviewees talked about how to teach young students from a teacher's perspective.

Overall, the preservice teachers' definitions captured certain characteristics but also reflected their limited understanding of SRL. This is probably because they were not well exposed to formal SRL instruction in their preparation programs. This finding may also support why their learning strategies use was not at high level. Previous research (e.g., Buzza & Allinotte, 2013; Kistner et al., 2010) discussed that teacher preparation programs often failed to create an environment to foster SRL. It is not surprising that few teachers were able to apply SRL to their teaching (Kistner et al., 2010; Zimmerman, 2002). Physical educators thus need to carry the responsibility to instill SRL in their teacher education programs.

Research Question #4: How Do PE Preservice Teachers Employ SRL Strategies during Their Field-Based Teaching Practices?

Although the preservice teachers' understanding of SRL was primitive, their descriptions of effective teaching experiences contained indicators of a self-regulatory process. In PE, a lesson can be divided into three sequential sections: preparation, instruction, and reflection. These sections resemble the three phases of SRL: forethought, monitoring and control, and reflection, as described by Pintrich (2000b). It was during the three phases that the preservice teachers demonstrated their use of SRL strategies.

During the forethought phase, the preservice teachers focused on the preparation of a lesson. They knew that the objective was to bring about an increase in student learning; they thus did goal setting. They incorporated different methods of teaching, management, and assessment into their lesson plans; this process assembles strategic planning. Goal setting and strategic planning are key components of task analysis in the forethought phase. Individuals who are proficient in goal setting and strategic planning tend to achieve greater academic performance than those who are not (Zimmerman, 2002).

In addition, they asked peers and teachers and went online to find out helpful information for their lessons; these behaviors associate with help seeking strategies. Help seeking is an important indicator of SRL and academic success (Pintrich, 2004). For example, White (2011) found that help seeking strategies could assist preservice teachers to succeed in certification exams. Randi et al. (2011) reported that many preservice teachers identified help seeking adaptive to professional development during field-based teaching practices. By looking for information from outside sources, the preservice teachers in this study demonstrated certain characteristics of SRL.

Before teaching, some preservice teachers rehearsed to make sure their lessons went smoothly. Although rehearsal has been labeled as a low-level cognitive processing strategy, it is effective in putting information into memory, especially with a definite purpose (Weinstein, Acee, & Jung, 2011). Focusing on effective teaching, Ward, Smith, and Makasci (1997) conducted an intervention and found that using directed rehearsal improved PE preservice teachers' teaching skills. To teach effectively, the preservice teachers of this study actively went over their lesson plans before entering the gym. This process might have helped identify what elements in their lesson plans should be modified and how they could use verbal or body language to engage students in the lesson.

During the monitor and control phases, the preservice teachers were able to monitor their own behavior, thoughts, and context. They were also able to make adjustments accordingly if the lesson did not go as expected. For example, preservice teacher D knew that "sometimes when I'm teaching, I'm not very vocal" and "found myself with my back turned to the kids." Thus in the next class, she became "very loud and stern when I talk" and "stood in the middle, [so] I can face, I can be with kids with them each side with me." Preservice teacher G would "generally just give the kids a water break to collect my thoughts" when her lesson went as unplanned. Self-monitoring and immediate modifications are essential to engage students in learning. These deliberate practices are appropriate instructional strategies that allow teachers to teach effectively (SHAPE America, 2015). Still, there were a few preservice teachers who were unable to monitor and make adaptations. Rather, when problems presented, they just kept the lesson going and reflected on their teaching until after the class.

In the reaction and reflection phase, the preservice teachers used to self-evaluate and make attributions as well as plan for the next teaching. Typically, they reflected on what went well and what did not during their teaching and why. They also asked themselves whether students learned in the lesson and why. Later, they would write down their reflective thoughts on paper or make changes to the lesson plan for the next time use. Self-reflection is an important aspect of SRL. Self-regulated learners usually develop their learning experiences through reflections (Zimmerman, 2008). Reflective practices are also a focus in teacher education and effective teaching (Giovannelli, 2003). Dervent (2015) examined the effect of reflective practices on PE preservice teachers' development. He found that after gaining reflective experiences, preservice teachers were able to improve their instructions and also became more open to critiques from others. Jung (2012) reported that experienced PE teachers focused on students, instruction, context, and critical incidents during reflection. The preservice teachers in this study did not go in such depth but only described their reflective process in general. As Dervent (2015) mentioned, this might be because they were at the early stage of professional training so their reflective thinking was still under development.

Overall, the strategies preservice teachers employed during their field-based practices indicate that PETE programs did afford opportunities to foster SRL. This finding is similar to Randi (2004), who also found preservice teachers were able to self-regulate to a certain level during teacher preparation phases. It should be noted, however, that although these preservice teachers demonstrated the use of some SRL strategies, their focus was still on instruction. To become a true self-regulated learner, preservice teachers need to learn to teach but also learn from teaching (Dembo, 2001). Therefore, integrating SRL into PETE program requires immediate actions.

Limitations & Implications

Although the present study revealed important relationships between SRL strategies and achievement goal orientations among PE preservice teachers, it should be cautioned that results of this study may not be applicable to preservice teachers in other disciplines. Also, the present study focused on PE preservice teachers' strategies use but did not examine how strategies use predicted academic achievement. Therefore, future research can include student academic learning performance as a dependent variable and examine the impact of SRL strategies use to academic achievement. Also interesting is to examine how SRL strategies use mediates the relationship between achievement goals and academic performance. Doing so may inform physical educators about PETE program design and instruction, thus better preparing prospective effective teachers.

Based on the quantitative data results, one practical implication can be made. Due to its predominant effects on SRL strategies, mastery-approach goals should be emphasized during preservice teachers' training. To facilitate the use of SRL strategies, PE teacher educators can encourage the endorsement of mastery-approach goals among preservice teachers—specifically, focus preservice teachers on their own learning progresses, avoid comparing them to peers, and provide positive feedback.

Provided PE preservice teachers' shallow understanding of SRL and medium-level of strategies use, effort in fostering SRL among them is needed. Zimmerman (2000) delineated four phases of SRL development: (1) observation, (2) emulation, (3) self-control, and (4) self-regulation. PETE programs can design purposeful instruction based on these four phases. The first step can be explicit instructions (e.g., Kistner et al., 2010; Kramarski & Michalsky, 2009; Vrieling, Bastiaens, & Stijnen, 2012). PE teacher educators need to explain what SRL is, its importance, components and specific learning strategies. Teacher educators can also let preservice teachers read professional articles for a better understanding of SRL (Randi, 2004). With an intellectual understanding, preservice teachers may be motivated to learn about and use SRL strategies in their own learning and future teaching.

Second, teacher educators should demonstrate when and how to use SRL strategies. In the classroom, for example, teacher educators can show preservice teachers how to use elaboration strategies by summarizing a paragraph or paraphrasing a text and how to use the internet to find useful sources for their assignments. During field practices, teacher educators can guide preservice teachers to rehearse before teaching a lesson, to monitor themselves during teaching, and reflect after teaching, as well as look for mentor teachers' advice and feedback (Randi, 2004). These direct instructions may help preservice teachers master specific strategies and use them in a certain context.

Third, provide opportunities for preservice teachers to practice SRL. After demonstrating strategies use, teacher educators can empower and encourage preservice teachers to use strategies such as mentioned in the previous paragraph. The SRL literature also presents a repertoire of instructional methods. For example, questioning can promote preservice teachers' critical thinking and self-evaluation (Kramarski & Michalsky, 2009). Keeping diaries or writing reflective journals is conducive to self-monitoring and reflective capability (e.g., Arsal, 2010; Güvenç, 2010). Assigning preservice teachers challenging tasks such as teaching an unfamiliar topic can enhance their experiences of SRL strategies use (Randi, 2004).

Fourth, create a supportive learning environment to develop self-regulated learners. A supportive learning environment should support preservice teachers' autonomy. That is, they can make their own choices to, for example, decide a topic for a written project and how to write it (Zimmerman & Kitsantas, 2002), or choose a specific level of curriculum unit plan (Randi, 2004). Building a good relationship with preservice teachers and promoting interactions among them can motivate them to self-regulate (Ewijk & Werf, 2012; Perry, VandeKamp, Mercer, & Nordby, 2002). In the field, cooperative teachers and university supervisors can develop preservice teachers as self-regulated learners by allowing them to design and implement lesson plans and unit plans, and debrief them about their teaching (e.g., Perry, Hutchinson, & Thauberger, 2008; Perry, Phillips, & Hutchinson, 2006).

In addition, technology-based learning approaches have shown effectiveness in promoting SRL (Kitsantas, 2013). For instance, Kramarski and Michalsky (2010) trialed a metacognitive instruction in their web-based learning module and found an increase in preservice teachers' self-reflection and self-regulation. Through two experiments using note taking and self-monitoring in an online course, Kauffman, Zhao, and Yang (2011) recorded a positive change in preservice teachers' SRL. After teaching self-observation and self-evaluation to an online course for a semester, Chang (2005) found students were more intrinsically motivated and experienced a higher level of self-efficacy in learning. Teacher educators can refer to these studies for designing their own SRL-based programs.

To teach students to self-regulate, teachers must have knowledge and skills of SRL. This principle also applies to teacher educators. To train preservice teachers to self-regulate, teacher educators should know SRL themselves. Teacher educators' behavior affects preservice teachers' learning (Gordon, Dembo, & Hocevar, 2007). Therefore, those teacher educators who are unfamiliar with SRL need to embrace, invest time and energy, and accord their ways of instruction with SRL principles (Ewijk & Werf, 2012). For this purpose, Randi (2004) recommended teacher educators to learn and develop SRL from their own teaching practices, by conducting teacher-as-research projects, and engaging in collegial network.

Overall, empirical studies have shown the effectiveness of SRL in student learning across disciplines; but research in teacher education has not found positive evidence that teacher educators and preservice teachers are capable of self-regulating their own learning. This fact may reflect a lack of SRL instruction among teacher education programs. The cause might be due to the complexity and difficulty of SRL theory. To bridge theory and practice, this study has elaborated on how SRL can be promoted among preservice teachers as well as teacher educators.

CHAPTER V

CONCLUSION

The primary goal of this dissertation was to investigate self-regulated learning (SRL) among physical education (PE) preservice teachers. To reach this goal, the dissertation started with a comprehensive review of literature in PE and physical education teacher education (PETE) (Chapter II). To establish the precision of quantitative data analysis, Chapter III addressed psychometric properties of the Cognitive and Metacognitive Learning Strategies Scales (CMLSS) through bifactor analysis. Chapter IV revealed differential effects of achievement goals on SRL strategies use via structural equation modeling. Meanwhile, content analysis of responses to an open-ended question and a semi-structured interview revealed PE preservice teachers' definition of SRL and their self-regulation during field practices. This chapter is concluding findings and results from previous chapters as well as discussing implications for future research and practice.

Research Findings and Results

A comprehensive literature review in Chapter II found that although SRL is an important concept, its research in PE has not been extensively conducted. Among a limited number of SRL studies in PE, strategies such as goal setting and self-recording were found conducive to student motor skill learning, performance, and motivation (e.g., Cleary et al., 2006; Kolovelonis et al., 2011). Scholars concurred that teachers play a key role in developing self-regulated students, but few previous studies have examined PE teachers' SRL. PE preservice teacher training is an essential phase to receive SRL instruction; however, little empirical evidence of their SRL knowledge and skills exists.

Chapter III addressed the prerequisite research question about psychometric properties of the CMLSS among PE preservice teachers. Confirmatory factor analysis (CFA) of the original 5-factor first-order model proposed by Pintrich et al. (1991) resulted in a poor fit. Specifically in this study, latent factors were highly correlated, and modification indices presented indicators' cross-loadings and correlated residuals. Through an exploratory factor analysis (EFA) parallel analysis and a bifactor EFA, a general factor together with two group factors emerged. A bifactor CFA resulted an acceptable model fit and verified the bifactor nature of the CMLSS. Further, 11 indicators that had cross-loadings and/or residual correlations were removed. The final 18-item bifactor model had a good fit to the data. Score reliability for the general factor was good; but after controlling the general factor's effects, the two group factors' scale reliability was relatively low.

In Chapter IV, both quantitative and qualitative methodologies were used to examine PE preservice teachers' SRL. Descriptive statistics found that PE preservice teachers' use of SRL strategies was at a medium degree. Structural equation modeling discovered that achievement goals positive predicted on SRL strategies use. Specifically, mastery-approach (MAp) goals positively predicted general cognitive strategies and elaboration. Mastery-avoidance (MAv) goals had no statistically significant association with SRL strategies. Performance-approach (PAp) and performance-avoidance (PAv) goals positive predicted general cognitive strategies use, but their effects were relatively weak.

Content analysis of qualitative data explored PE preservice teachers' definition of SRL and their self-regulation during field practices. The preservice teachers described SRL from various perspectives and in limited words. That might be due to their limited exposure to formal SRL instruction, and it may also explain why their use of learning strategies was at a medium level. Nevertheless, four themes emerged from written responses to an open-ended question were control of learning, learning strategies and styles, self-teach, and time management. Interviews with 11 preservice teachers found that they thought SRL was self-teaching or teacher oriented learning.

Eleven PE preservice teachers also disclosed their self-regulation during field practices. To carry out an effective lesson, they focused on lesson preparation, teaching strategies, classroom management, using technology, and evaluating student learning. For preparing a lesson, the preservice teachers relied on their own knowledge base. In case of need, they sought help from peers, professors, cooperative teachers, and university supervisors. During their teaching, the majority of them were aware of their own thoughts and behaviors. Once problematic situations occurred, they were able to figure out immediate solutions. After teaching, they usually reflected on the lesson: what has been done well or not well, why, and how to do better for future teaching.

Implications for Future Research and Practice

Results and findings of this dissertation have important implications for future research and practice in PETE. In Chapter II, it was found out the effectiveness of SRL in promoting students' motor skills acquisition and performance as well as motivational outcomes in PE. Therefore, PE teachers can adopt these strategies to foster student SRL. This chapter also spotted a vacancy of SRL research in PE preservice teachers and thus urged more studies to fill the gap.

Chapter III provided solid evidence for the superiority of bifactor analysis over first-order factorial analysis. Particularly for questionnaires structured hierarchically such as the CMLSS, the bifactor approach is a better choice to identify their complex multidimensionality. Future research can follow the procedure demonstrated in this chapter (i.e., EFA parallel analysis and bifactor EFA to determine the possibility of a bifactor structure, bifactor CFA to verify the bifactor structure) to conduct a bifactor analysis. To calculate model-based specific score reliability for the general factor and group factor(s), researchers should compute ω_h and ω_s rather than Cronbach's α and ω. Studies with large samples can go directly with bifactor modeling. For studies with a small sample that cannot satisfy latent modeling requirements, it is wise to compute a single composite score using all items. To keep research economically efficient, the CPSS (Appendix G) is recommended to use.

In Chapter IV, SRL among PE preservice teachers was investigated in more depth. Although the preservice teachers demonstrated some indicators of SRL in field practices, they were unable to articulate what SRL means. Their unspecific and superficial definitions, coupled with a medium level of SRL strategies use identified in the quantitative data, indicated a lack of SRL instruction among PE preservice teachers. As such, PETE programs should initiate explicit SRL instruction and create opportunities for preservice teachers to practice SRL strategies. The associations between achievement goals and SRL strategies implied the endorsement of MAp goals could promote SRL strategies use. That is, PE teacher educators can create a mastery oriented learning environment where preservice teachers focus on their own learning and improvement instead of comparing to peers.

In conclusion, as one of the first attempts to addressing SRL among PE preservice teachers, this dissertation (1) provided evidence for the CMLSS' construct validity and score reliability using bifactor analysis, (2) examined the predictability of achievement goal orientations to SRL strategies use, and (3) explored PE preservice teachers' understanding and utilization of SRL in field practices. Utilizing both quantitative and qualitative methodologies, this dissertation presented a fuller picture of PE preservice teachers' SRL.

REFERENCES

Al-Harthy, I. S., Was, C. A., & Isaacson, R. M. (2010). Goals, efficacy and metacognitive self-regulation: A path analysis. *International Journal of Education, 2*(1), 1–20. Advance online publication.

Alkharusi, H., Neisler, O., Al-Barwani, T., Clayton, D., Al-Sulaimani, H., Khan, M., . . . Al-Kalbani, M. (2012). Psychometric properties of the Motivated Strategies for Learning Questionnaire for Sultan Qaboos University students. *College Student Journal, 46*(3), 567–580.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*(3), 261–271. doi:10.1037/0022-0663.84.3.261

Arsal, Z. (2010). The effects of diaries on self-regulation strategies of preservice science teachers. *International Journal of Environmental & Science Education, 5*(1), 85–103.

Artino, A. R., Dong, T., DeZee, K. J., Gilliland, W. R., Waechter, D. M., Cruess, D., & Durning, S. J. (2012). Achievement goal structures and self-regulated learning: Relationships and changes in medical school. *Academic Medicine, 87*(10), 1375–1381. doi:10.1097/ACM.0b013e3182676b55

Bandura, A. (1986). *Social foundations of thought and action: A social cogntive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Baranik, L. E., Stanley, L. J., Bynum, B. H., & Lance, C. E. (2010). Examining the construct validity of master-avoidance achievement goals: A meta-analysis. *Human Performance*, *23*, 265–282. doi:10.1080/08959285.2010.488463

Bartels, J. M., Magun-Jackson, S., & Ryan, J. J. (2010). Dispositional approach-avoidance achievement motivation and cognitive self-regulated learning: The mediation of achievement goals. *Individual Differences Research, 8*(2), 97–110.

Bembenutty, H., White, M. C., & Vélez, M. R. (2015). *Developing self-regulation of learning and teaching skills among teacher candidates*. New York, NY: Springer.

Bernacki, M. L., Byrnes, J. P., & Cromley, J. G. (2012). The effects of achievement goals and self-regulated learning behaviors on reading comprehension in technology-enhanced learning environments. *Contemporary Educational Psychology, 37*(2), 148–161. doi:10.1016/j.cedpsych.2011.12.001

Biggs, J. (1993). What do inventories of students' learning processes really measure? A theoretical review and clarification. *British Journal of Educational Psychology, 63*(1), 3–19.

Boekaerts, M., Pintrich, P. R., & Zeidner, M. (2000). *Handbook of self-regulation*. San Diego, CA: Academic.

Bolton, K. W., Lehmann, P., Jordan, C., & Frank, L. (2016). Self-determined goals in a solution-focused batterer intervention program: Application for building client strengths and solutions. *Journal of Human Behavior in the Social Environment, 26*(6), 541–548. doi:10.1080/10911359.2016.1172996

Borkowski, J. G., Chan, L. K. S., & Muthukrishna, N. (2000). A process-oriented model of metacognition: Links between motivation and executive functioning. In G. Schraw & J. Impara (Eds.), *Issues in the Measurement of Metacognition*. Lincoln, NE: Buros Institute of Mental Measurements, University of Nebraska.

Bowen, N. K., & Guo, S. (2011). *Strctural equation modeling*. New York, NY: Oxford.

Broadbent, J., & Poon, W. L. (2015). Self-regulated learning strategies and academic achievement in online higher education learning environments: A systematic review. *The Internet and Higher Education*, *27*, 1–13. doi:10.1016/j.iheduc.2015.04.007

Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). New York: Guilford.

Butler, D. L., & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis. *Review of Educational Research, 65*(3), 245–281. doi:10.3102/00346543065003245

Büyüköztürk, Ş., Akgün, Ö. E., Özkahveci, Ö., & Demirel, F. (2004). Güdülenme ve Öğrenme Stratejileri Ölçeği’nin Türkçe formunun geçerlik ve güvenirlik çalışması. *Kuram Ve Uygulamada Eğitim Bilimleri, 4*(2), 207–239.

Buzza, D., & Allinotte, T. (2013). Pre-service teachers' self-regulated learning and their developing concepts of SRL. *Brock Education*, *23*(1), 58–76.

Cao, L., & Nietfeld, J. L. (2007). Examining relationships between achievement goals, study strategies, and class performance in educational psychology. *Teaching Educational Psychology, 2*(1), 1–20.

Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research, 1*(2), 245–276. doi:10.1207/s15327906mbr0102_10

Cellar, D. F., Stuhlmacher, A. F., Young, S. K., Fisher, D. M., & et al. (2011). Trait goal orientation, self-regulation, and performance: A meta-analysis. *Journal of Business and Psychology*, *26*(4), 467–483. doi:10.1007/s10869-010-9201-6

Centers for Disease Control and Prevention. (2011). *Physical activity and health—the benefits of physical activity*. Retrieved from http://www.cdc.gov/physicalactivity/everyone/health/index.html

Chang, M.-M. (2005). Applying self-regulated learning strategies in a web-based instruction—an investigation of motivation perception. *Computer Assisted Language Learning, 18*(3), 217–230. doi:10.1080/09588220500178939

Chatzipanteli, A., Digelidis, N., & Papaioannou, A. G. (2015). Self-regulation, motivation and teaching styles in physical education classes: An intervention study. *Journal of Teaching in Physical Education*, *34*(2), 333–344. doi:10.1123/jtpe.2013-0024

Chen, F. F., Hayes, A., Carver, C. S., Laurenceau, J.-P., & Zhang, Z. (2012). Modeling general and specific variance in multifaceted constructs: A comparison of the bifactor model to other approaches. *Journal of Personality, 80*(1), 219–251. doi:10.1111/j.1467-6494.2011.00739.x

Chiang, Y.-T., Yeh, Y.-C., Lin, S. S. J., & Hwang, F.-M. (2011). Factor structure and predictive utility of the 2x2 achievement goal model in a sample of Taiwan students. *Learning and Individual Differences, 21*(4), 432–437. doi:10.1016/j.lindif.2011.02.011

Chiu, W., & Won, D. (2016). Relationship between sport website quality and consumption intentions: Application of a bifactor model. *Psychological Reports, 118*(1), 90–106. doi:10.1177/0033294115625269

Cho, M.-H., & Shen, D. (2013). Self-regulation in online learning. *Distance Education, 34*(3), 290–301. doi:10.1080/01587919.2013.835770

Cho, M.-H., & Summers, J. (2012). Factor validity of the Motivated Strategies for Learning Questionnaire (MSLQ) in asynchronous online learning environments. *Journal of Interactive Learning Research*, *23*(1), 5–28.

Chung, C., Liao, X., Song, H., & Lee, T. (2016). Bifactor approach to modeling multidimensionality of physical self-perception profile. *Measurement in Physical Education and Exercise Science, 20*(1), 1–15. doi:10.1080/1091367X.2015.1081594

Cleary, T. J., Zimmerman, B. J., & Keating, T. (2006). Training physical education students to self-regulate during basketball free throw practice. *Research Quarterly for Exercise and Sport, 77*(2), 251–262.

Cook, D. A., Thompson, W. G., & Thomas, K. G. (2011). The Motivated Strategies for Learning Questionnaire: Score validity among medicine residents. *Medical Education, 45*(12), 1230–1240. doi:10.1111/j.1365-2923.2011.04077.x

Credé, M., & Phillips, L. A. (2011). A meta-analytic review of the Motivated Strategies for Learning Questionnaire. *Learning and Individual Differences, 21*(4), 337–346. doi:10.1016/j.lindif.2011.03.002

Dahl, T. I., Bals, M., & Turi, A. L. (2005). Are students' beliefs about knowledge and learning associated with their reported use of learning strategies? *British Journal of Educational Psychology, 75*, 257–273.

Dannefer, E. F., & Prayson, R. A. (2013). Supporting students in self-regulation: Use of formative feedback and portfolios in a problem-based learning setting. *Medical Teacher, 35*(8), 655–660. doi:10.3109/0142159X.2013.785630

Dela Rosa, E. D., & Bernardo, A. B. I. (2013). Are two achievement goals better than one? Filipino students' achievement goals, deep learning strategies and affect. *Learning and Individual Differences, 27*, 97–101. doi:10.1016/j.lindif.2013.07.005

Dembo, M. H. (2001). Learning to teach is not enough—future teachers also need to learn how to learn. *Teacher Education Quarterly, 4*, 23–35.

Denzin, N. K., & Lincoln, Y. S. (2011). *The SAGE handbook of qualitative research* (4th ed.). Thousand Oaks, CA: Sage.

Dervent, F. (2015). The effect of reflective thinking on the teaching practices of preservice physical education teachers. *Issues in Educational Research, 25*(3), 260–275.

Diseth, Å., & Kobbeltvedt, T. (2010). A mediation analysis of achievement motives, goals, learning strategies, and academic achievement. *British Journal of Educational Psychology, 80*(4), 671–687. doi:10.1348/000709910X492432

Duan, W., Yu, Y., Cao, Q., & Levy, S. (2016). Exploring the impact of social media on hotel service performance: A sentimental analysis approach. *Cornell Hospitality Quarterly, 57*(3), 282–296. doi:10.1177/1938965515620483

Dunn, K. E., Lo, W.-J., Mulvenon, S. W., & Sutcliffe, R. (2012). Revisiting the Motivated Strategies for Learning Questionnaire: A theoretical and statistical reevaluation of the metacognitive self-regulation and effort regulation subscales. *Educational and Psychological Measurement*, *72*(2), 312–331. doi:10.1177/0013164411413461

Dupeyrat, C., & Mariné, C. (2005). Implicit theories of intelligence, goal orientation, cognitive engagement, and achievement: A test of Dweck's model with returning to school adults. *Contemporary Educational Psychology, 30*(1), 43–59. doi:10.1016/j.cedpsych.2004.01.007

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, *95*(2), 256–273.

Elliot, A. J. (1997). Integrating the "classic" and "contemporary" approaches to achievement motivation: A hierarchical model of approach and avoidance achievement motivation. In M. L. Maehr & P. R. Pintrich (Eds.), *Advances in motivation and achievement* (Vol. 10, pp. 143–179). Greenwich, CT: JAI.

Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals. *Educational Psychologist, 34*(3), 169–189. doi:10.1207/s15326985ep3403_3

Elliot, A. J., & Church, M. A. (1997). A hierarchical model of approach and avoidance achievement motivation. *Journal of Personality and Social Psychology, 72*(1), 218–232. doi:10.1037/0022-3514.72.1.218

Elliot, A. J., & Dweck, C. S. (2005). *Handbook of competence and motivation*. New York, NY: Guilford.

Elliot, A. J., & Harackiewicz, J. M. (1996). Approach and avoidance achievement goals and intrinsic motivation: A mediational analysis. *Journal of Personality and Social Psychology, 70*(3), 461–475. doi:10.1037/0022-3514.70.3.461

Elliot, A. J., & McGregor, H. A. (2001). A 2×2 achievement goal framework. *Journal of Personality and Social Psychology*, *80*(3), 501–519. doi:10.1037//0022-3514.80.3.501

Elliot, A. J., Murayama, K., & Pekrun, R. (2011). A 3×2 achievement goal model. *Journal of Educational Psychology, 103*(3), 632–648. doi:10.1037/a0023952

Embretson, S. E., & Reise, S. P. (2000). *Item response theory for psychologists*. Mahwah, N.J: Erlbaum Associates.

Ericsson, K. A., & Simon, H. A. (1984). *Protocol analysis : Verbal reports as data*. Cambridge, MA: MIT.

Ewijk, C. D., & Werf, G. (2012). What teachers think about self-regulated learning: Investigating teacher beliefs and teacher behavior of enhancing students' self-regulation. *Education Research International*, *2012*(Article ID 741713), 1–10. Advance online publication. doi:10.1155/2012/741713

Fadlelmula, F. K., Cakiroglu, E., & Sungur, S. (2014). Developing a structural model on the relationship among motivational beliefs, self-regulated learning strategies, and achievement in mathematics. *International Journal of Science and Mathematics Education*. doi:10.1007/s10763-013-9499-4

Feiz, P., Hooman, H. A., & kooshki, S. (2013). Assessing the Motivated Strategies for Learning Questionnaire (MSLQ) in Iranian Students: Construct validity and reliability. *Procedia - Social and Behavioral Sciences, 84,* 1820–1825. doi:10.1016/j.sbspro.2013.07.041

Gallinucci, E., Golfarelli, M., & Rizzi, S. (2015). Advanced topic modeling for social business intelligence. *Information Systems*, *53,* 87–106. doi:10.1016/j.is.2015.04.005

Garcia, T., & Pintrich, P. R. (1994). Regulating motivation and cognition in the classroom: The role of self-schemas and self-regulatory strategies. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational applications* (pp. 127-153). Hillsdale, NJ: Erlbaum.

Garcia, T., & Pintrich, P. R. (1996). Assessing students' motivation and learning strategies in the classroom context: The Motivated Strategies for Learning Questionnaire. In M. Birenbaum & F. J. R. C. Dochy (Eds.), *Alternatives in assessment of achievements, learning processes and prior knowledge* (pp. 319–339). New York, NY: Springer.

Gardner, J. W. (1963). *Self-renewal: The individual and the innovative society*. New York, NY: Harper & Row.

Ghanizadeh, A. (2011). An investigation into the relationship between self-regulation and critical thinking among Iranian EFL teachers. *Journal of Technology & Education, 5*(3), 213–221.

Giovannelli, M. (2003). Relationship between reflective disposition toward teaching and effective teaching. *Journal of Educational Research, 96*(5), 293–309.

Gordon, S. C., Dembo, M. H., & Hocevar, D. (2007). Do teachers' own learning behaviors influence their classroom goal orientation and control ideology? *Teaching and Teacher Education, 23*(1), 36–46. doi:10.1016/j.tate.2004.08.002

Greene, B. A., Miller, R. B., Crowson, H. M., Duke, B. L., & Akey, K. L. (2004). Predicting high school students' cognitive engagement and achievement: Contributions of classroom perceptions and motivation. *Contemporary Educational Psychology, 29*(4), 462–482. doi:10.1016/j.cedpsych.2004.01.006

Grim, M., Petosa, R., Hortz, B., & Hunt, L. (2013). Formative evaluation of MyFit: A curriculum to promote self-regulation of physical activity among middle school students. *American Journal of Health Education, 44*(2), 81–87. doi:10.1080119325037.2013.764238

Guan, J., McBride, R., & Xiang, P. (2007). Reliability and validity evidence for achievement goal models in high school physical education settings. *Measurement in Physical Education and Exercise Science, 11*(2), 103–129.

Güvenç, H. (2010). The effects of cooperative learning and learning journals on teacher candidates' self-regulated learning. *Kuram ve Uygulamada Egitim Bilimleri/ Educational Sciences: Theory & Practice, 10*(3), 1477–1487.

Häfner, A., Stock, A., Pinneker, L., & Ströhle, S. (2014). Stress prevention through a time management training intervention: An experimental study. *Educational Psychology, 34*(3), 403-416. doi:10.1080/01443410.2013.785065

Hashemyolia, S., Asmuni, A., Ayub, A. F. M., Daud, S. M., & Shah, J. A. (2014). Motivation to use self-regulated learning strategies in learning management system amongst science and social science undergraduates. *Asian Social Science, 11*(3), 49–56. doi:10.5539/ass.v11n3p

Hilpert, J. C., Stempien, J., van der, K. J., Kraft, H., & Husman, J. (2013). Evidence for the latent factor structure of the MSLQ: A new conceptualization of an established questionnaire. *Sage Open, 3*(4), 1–10. Advance online publication. doi:10.1177/2158244013510305

Holzinger, K. J., & Swineford, F. (1937). The bi-factor method. *Psychometrika, 2*(1), 41–54.

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika, 30*(2), 179–185.

Howard-Rose, D., & Winne, P. H. (1993). Measuring component and sets of cognitive processes in self-regulated learning. *Journal of Educational Psychology, 85*(4), 591–604. doi:10.1037/0022-0663.85.4.591

Hsieh, H.-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*(9), 1277–1288. doi:10.1177/1049732305276687

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1–55. doi:10.1080/10705519909540118

IBM Corp. (2014). IBM SPSS Statistics for Windows (Version 23.0) [Computer software]. Armonk, NY: IBM Corp.

Ismail, N. M., & Sharma, A. (2012). Goal orientation and self-regulated learningstrategies as predictors of EFL students' GPA. *Journal of Educational Review, 5*(1), 111–125.

Jöreskog, K. G., & Sörbom, D. (1984). LISREL VI [Computer software]. Chicago, IL: Scientific Software International, Inc.

Jung, J. (2012). The focus, role, and meaning of experienced teachers' reflection in physical education. *Physical Education & Sport Pedagogy, 17*(2), 157–175.

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement, 20*(1), 141–151.

Kauffman, D. F., Zhao, R., & Yang, Y.-S. (2011). Effects of online note taking formats and self-monitoring prompts on learning from online text: Using technology to enhance self-regulated learning. *Contemporary Educational Psychology, 36*(4), 313–322. doi:10.1016/j.cedpsych.2011.04.001

Keller-Schneider, M. (2014). Self-regulated learning in teacher education - The significance of individual resources and learning behaviour. *Australian Journal of Educational & Developmental Psychology*, *14*, 144–158.

Kermarrec, G., Todorovich, J. R., & Fleming, D. S. (2004). An investigation of the self-regulation components students employ in the physical education setting. *Journal of Teaching in Physical Education*, *23*(2), 123–142.

Kistner, S., Rakoczy, K., Otto, B., Dignath-van Ewijk, C., Büttner, G., & Klieme, E. (2010). Promotion of self-regulated learning in classrooms: Investigating frequency, quality, and consequences for student performance. *Metacognition and Learning*, *5*(2), 157–171. doi:10.1007/s11409-010-9055-3

Kitsantas, A. (2013). Fostering college students' selfregulated learning with learning technologies. *Hellenic Journal of Psychology*, *10*, 235–252.

Kitsantas, A., & Zimmerman, B. J. (1998). Self-regulation of motoric learning: A strategic cycle view. *Journal of Applied Sport Psychology*, *10*(2), 220–239.

Kitsantas, A., Zimmerman, B. J., & Cleary, T. (2000). The role of observation and emulation in the development of athletic self-regulation. *Journal of Educational Psychology*, *92*(4), 811–817. doi:10.1037/0022-0663.92.4.811

Kline, R. B. (2005). *Principles and practice of structural equation modeling*. New York, NY: Guilford.

Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th ed.). New York, NY: Guilford.

Kolovelonis, A., Goudas, M., & Dermitzaki, I. (2010). Self-regulated learning of a motor skill through emulation and self-control levels in a physical education setting. *Journal of Applied Sport Psychology*, *22*(2), 198–212. doi:10.1080/10413201003664681

Kolovelonis, A., Goudas, M., & Dermitzaki, I. (2011). The effect of different goals and self-recording on self-regulation of learning a motor skill in a physical education setting. *Learning and Instruction, 21*(3), 355–364. doi:10.1016/j.learninstruc.2010.04.001

Kolovelonis, A., Goudas, M., & Dermitzaki, I. (2012). The effects of self-talk and goal setting on self-regulation of learning a new motor skill in physical education. *International Journal of Sport & Exercise Psychology, 10*(3), 221–235. doi:10.1080/1612197X.2012.671592

Kolovelonis, A., Goudas, M., Hassandra, M., & Dermitzaki, I. (2012). Self-regulated learning in physical education: Examining the effects of emulative and self-control practice. *Psychology of Sport and Exercise*, *13*(4), 383–389. doi:10.1016/j.psychsport.2012.01.005

Kramarski, B., & Michalsky, T. (2009). Investigating preservice teachers' professional growth in self-regulated learning environments. *Journal of Educational Psychology*, *101*(1), 161–175. doi:10.1037/a0013101

Kramarski, B., & Michalsky, T. (2010). Preparing preservice teachers for self-regulated learning in the context of technological pedagogical content knowledge.

Learning and Instruction, 20(5), 434–447. doi:10.1016/j.learninstruc.2009.05.003

Kranzler, J. H., Benson, N., & Floyd, R. G. (2015). Using estimated factor scores from a bifactor analysis to examine the unique effects of the latent variables measured by the WAIS-IV on academic achievement. *Psychological Assessment, 27*(4), 1402–1416. doi:10.1037/pas0000119

Liem, A. D., Lau, S., & Nie, Y. (2008). The role of self-efficacy, task value, and achievement goals in predicting learning strategies, task disengagement, peer relationship, and achievement outcome. *Contemporary Educational Psychology, 33*(4), 486–512. doi:10.1016/j.cedpsych.2007.08.001

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Thousand Oaks, CA: Sage.

Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association, 83*(404), 1198–1202. doi:10.2307/2290157

Little, R. J. A., & Rubin, D. B. (2002). *Statistical analysis with missing data* (2nd ed.). Hoboken, NJ: Wiley.

MacCann, C., Fogarty, G. J., & Roberts, R. D. (2012). Strategies for success in education: Time management is more important for part-time than full-time community college students. *Learning and Individual Differences, 22*(5), 618–623. doi:10.1016/j.lindif.2011.09.015

Maehr, M. L. (1989). Thoughts about motivation. In C. Ames & R. Ames (Eds.), *Research on motivation in education* (Vol. 3, pp. 299–315). New York, NY: Academic.

Meece, J. L. (1994). The role of motivation in self-regulated learning. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational applications* (pp. 25–44). Hillsdale, NJ: Erlbaum.

Michalsky, T., & Schechter, C. (2013). Preservice teachers' capacity to teach self-regulated learning: Integrating learning from problems and learning from successes. *Teaching and Teacher Education, 30*, 60–73. doi:10.1016/j.tate.2012.10.009

Moller, A. C., & Elliot, A. J. (2006). The 2×2 achievement goal framework: An overview of empirical research. In A. V. Mitel (Ed.), *Focus on Educational Psychology* (pp. 307–326). New York, NY: Nova Science.

Mouratidis, A., Vansteenkiste, M., Michou, A., & Lens, W. (2013). Perceived structure and achievement goals as predictors of students' self-regulated learning and affect and the mediating role of competence need satisfaction. *Learning and Individual Differences*, *23*, 179–186. doi:10.1016/j.lindif.2012.09.001

Muis, K. R., & Franco, G. M. (2009). Epistemic beliefs: Setting the standards for self-regulated learning. *Contemporary Educational Psychology, 34*(4), 306–318. doi:10.1016/j.cedpsych.2009.06.005

Muthén, L. K., & Muthén, B. O. (1998-2015). Mplus (Version 7.4) [Computer software]. Los Angeles, CA: Muthén & Muthén.

Nicholls, J. (1989). *The competitive ethos and democratic education*. Cambridge, MA: Harvard University Press.

Noltemeyer, A. a. m. e., Proctor, S., & Dempsey, A. (2013). Race and ethnicity in school psychology publications: A content analysis and comparison to publications in related disciplines. *Contemporary School Psychology, 17*(1), 129–142. doi:10.1007/BF03340994

Olaussen, B. S., & Bråten, I. (1999). Students' use of strategies for self-regulated learning: Cross-cultural perspectives. *Scandinavian Journal of Educational Research, 43*(4), 409–432. doi:10.1080/0031383990430405

Ommundsen, Y. (2003). Implicit theories of ability and self-regulation strategies in physical education classes. *Educational Psychology, 23*(2), 141–157. doi:10.1080/01443410303224

Panadero, E., & Alonso-Tapia, J. (2014). How do students self-regulate? Review of Zimmerman's cyclical model of self-regulated learning. *Anales de Psicología, 30*(2), 450–462. doi:10.6018/analesps.30.2.167221

Paris, S. G., Lipson, M. Y., & Wixson, K. K. (1983). Becoming a strategic reader. *Contemporary Educational Psychology, 8*(3), 293–316. doi:10.1016/0361-476X(83)90018-8

Paris, S. G., & Winograd, P. (2003). The role of self-regulated learning in contextual teaching: Principles and practices for teacher preparation. Washington, DC: Office of Educational Research and Improvemnt.

Pearce, J. M. (2001). The use of self-directed learning to promote active citizenship in STS classes. *Bulletin of Science, Technology & Society, 21*(4), 312–321. doi:10.1177/027046760102100409

Peeters, J., De Backer, F., Reina, V. R., Kindekens, A., Buffel, T., & Lombaerts, K. (2014). The role of teachers' self-regulatory capacities in the implementation of self-regulated learning practices. *Procedia - Social and Behavioral Sciences, 116*(2014), 1963–1970. doi:10.1016/j.sbspro.2014.01.504

Perry, N. E. (1998). Young children's self-regulated learning and contexts that support it. *Journal of Educational Psychology, 90*(4), 715–729. doi:10.1037/0022-0663.90.4.715

Perry, N. E., Hutchinson, L., & Thauberger, C. (2008). Talking about teaching self-regulated learning: Scaffolding student teachers' development and use of practices that promote self-regulated learning. *International Journal of Educational Research, 47*(2), 97–108. doi:10.1016/j.ijer.2007.11.010

Perry, Nancy E., Phillips, L., & Hutchinson, L. (2006). Mentoring student teachers to support self-regulated learning. *The Elementary School Journal, 106*(3), 237–254. doi:10.1086/501485

Perry, N. E., VandeKamp, K. O., Mercer, L. K., & Nordby, C. J. (2002). Investigating teacher-student interactions that foster self-regulated learning. *Educational Psychologist, 37*(1), 5–15. doi:10.1207/S15326985EP3701_2

Phan, H. P. (2010). Critical thinking as a self-regulatory process component in teaching and learning. *Psicothema, 22*(2), 284–292.

Pintrich, P. R. (1988a). A process-oriented view of student motivation and cognition. *New directions for institutional research, 1988*(57), 65–79.

Pintrich, P. R. (1988b). Student learning and college teaching. *New Directions for Teaching and Learning, 1988*(33), 71–86. doi:10.1002/tl.37219883308

Pintrich, P. R. (1995). Understanding self-regulated learning. In P. R. Pintrich (Ed.), *Understanding self-regulated learning* (Vol. 1995, pp. 3–12). San Francisco, CA: Jossey-Bass.

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International Journal of Educational Research, 31*(6), 459–470. doi:10.1016/S0883-0355(99)00015-4

Pintrich, P. R. (2000a). An achievement goal theory perspective on issues in motivation terminology, theory, and research. *Contemporary Educational Psychology, 25*(1), 92–104. doi:10.1006/ceps.1999.1017

Pintrich, P. R. (2000b). The role of goal orientationin self-regulated learning. In M. Boekaerts, P. R. Pintrich & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 451–502). San Diego, CA: Academic.

Pintrich, P. R. (2004). A conceptual framework for assessing motivation and self-regulated learning in college students. *Educational Psychology Review, 16*(4), 385–407. doi:10.1007/s10648-004-0006-x

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82*(1), 33–40. doi:10.1037/0022-0663.82.1.33

Pintrich, P. R., & Schrauben, B. (1992). Students' motivational beliefs and their cognitive engagement in classroom academic tasks. In D. H. Schunk & J. L. Meece (Eds.), *Student perceptions in the classroom* (pp. 149–183). Hillsdale, NJ: Erlbaum.

Pintrich, P. R., & Schunk, D. H. (1996). *Motivation in education: Theory, research and applications*. Engleook Cliffs, NJ: Prentice Hall Merill.

Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1991). A manual for the use of the Motivational Strategies for Learning Questionnaire (MSLQ). Ann Arbor, MI: Univeristy of Michigan, National Center for Research to Improve Postesecondary Teaching and Learning.

Pintrich, P. R., Smith, D. A. F., Garcia, T., & Mckeachie, W. J. (1993). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ). *Educational and Psychological Measurement, 53*(3), 801–813. doi:10.1177/0013164493053003024

Pintrich, P. R., & Zusho, A. (2007). Student motivation and self-regulated learning in the college classroom. In R. P. Perry & J. C. Smart (Eds.), *The scholarship of teaching and learning in higher education: An evidence-based perspective* (pp. 731-810). Dordrecht, The Netherlands: Springer.

Randi, J. (2004). Teachers as self-regulated learners. *Teachers College Record, 106*(9), 1825–1853.

Randi, J., Corno, L., & Johnson, E. (2011). Transitioning from college classroom to teaching career: Self-regulation in prospective teachers. *New Directions for Teaching & Learning, 2011*(126), 89–98. doi:10.1002/tl.447

Reise, S. P. (2012). The rediscovery of bifactor measurement models. *Multivariate Behavioral Research, 47*(5), 667–696. doi:10.1080/00273171.2012.715555

Renzulli, S. J. (2015). Using learning strategies to improve the academic performance of university students on academic probation. *NACADA Journal, 35*(1), 29–41. doi:10.12930/NACADA-13-043

Roces, C., Tourón, J., & Gonzalez, M. C. (1995). Validación preliminar del CEAM III (Cuestionario de Estrategias de Aprendizaje y Motivación II). *Psicológia, 16*(3), 347–366.

Rock, M. L., Cheek, A. E., Sullivan, M. E., Jones, J. L., Holden, K. B., & Kang, J. (2016). Looking back and moving ahead: A content analysis of two teacher education journals. *Teacher Education and Special Education: The Journal of the Teacher Education Division of the Council for Exceptional Children, 39*(1), 7–27. doi:10.1177/0888406415622031

Sadi, O., & Uyar, M. (2013). The relationship between self-efficacy, self-regulated learning strategies and achievement: A path model. *Journal of Baltic Science Education, 12*(1), 21–33.

Saks, K., Leijen, Ä., Edovald, T., & Õun, K. (2015). Cross-cultural adaptation and psychometric properties of the Estonian version of MSLQ. *Procedia - Social and Behavioral Sciences, 191*, 597–604. doi:10.1016/j.sbspro.2015.04.278

Schunk, D. (2008). Metacognition, self-regulation, and self-regulated learning: Research recommendations. *Educational Psychology Review, 20*(4), 463–467. doi:10.1007/s10648-008-9086-3

SHAPE America. (2013). *National standards for K-12 physical education*. Reston, VA: Author. Retrieved from http://www.shapeamerica.org/standards/upload/National-Standards-Flyer.pdf

SHAPE America. (2014). *National standards & grade-level outcomes for K-12 physical education*. Champaign, IL: Human Kinetics.

SHAPE America. (2015). *The essential components of physical education*. Retrieved from http://www.shapeamerica.org/upload/theessentialcomponentsofphysicaleducation.pdf

Sharma, S., Mukherjee, S., Kumar, A., & Dillon, W. R. (2005). A simulation study to investigate the use of cutoff values for assessing model fit in covariance structure models. *Journal of Business Research, 58*(7), 935–943. doi:10.1016/j.jbusres.2003.10.007

Shimon, J. M., & Petlichkoff, L. M. (2009). Impact of pedometer use and self-regulation strategies on junior high school physical education students' daily step counts. *Journal of Physical Activity & Health, 6*(2), 178–184.

Shoemaker, P. J., Tankard, J. W. J., & Lasorsa, D. L. (2004). 7 theoretical models. In P. J. Shoemaker, J. W. J. Tankard & D. L. Lasorsa (Eds.), *How to build social science theories* (pp. 107–145). Thousand Oaks, CA: Sage.

Sitzmann, T., & Ely, K. (2011). A meta-analysis of self-regulated learning in work-related training and educational attainment: What we know and where we need to go. *Psychological Bulletin, 137*(3), 421–442. doi:10.1037/a0022777

Soltaninejad, M. (2015). Investigating predictive role of 2x2 achievement goal orientations on learning strategies with structural equation modeling. *The Malaysian Online Journal of Educational Science, 3*(3), 21–30.

Somuncuoglu, Y., & Yildirim, A. (1999). Relationship between achievement goal orientations and use of learning strategies. *Journal of Educational Research, 92*(5), 267–277.

Sperling, R. A., Howard, B. C., Staley, R., & DuBois, N. (2004). Metacognition and self-regulated learning constructs. *Educational Research and Evaluation, 10*(2), 117–139. doi:10.1076/edre.10.2.117.27905

Stambaugh, L. A. l. g. e., & Dyson, B. E. (2016). A comparative content analysis of music educators journal and philosophy of music education review (1993–2012). *Journal of Research in Music Education, 64*(2), 238–254. doi:10.1177/0022429416646997

Turan, S., & Konan, A. (2012). Self-regulated learning strategies used in surgical clerkship and the relationship with clinical achievement. *Journal of Surgical Education, 69*(2), 218–225. doi:10.1016/j.jsurg.2011.09.003

Turner, J. C. (1995). The influence of classroom contexts on young children's motivation for literacy. *Reading Research Quarterly, 30*(3), 410–441. doi:10.2307/747624

UzuntİRyakİ-KondakÇI, E., & ÇApa-Aydin, Y. (2013). Predicting critical thinking skills of university students through metacognitive self-regulation skills and chemistry self-efficacy. *Educational Sciences: Theory & Practice, 13*(1), 666–670.

Vancouver, J. B. (2000). Self-regulation in organizational settings: A tale of two paradigms. In M. Boekaerts, P. R. Pintrich & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 303–341). New York, NY: Academic.

Vrieling, E., Bastiaens, T., & Stijnen, S. (2012). Effects of increased self-regulated learning opportunities on student teachers' motivation and use of metacognitive skills. *Australian Journal of Teacher Education, 37*(8), 102–117. doi:10.14221/ajte.2012v37n8.6

Vrugt, A., & Ourt, F. J. (2008). Metacognition, achievement goals, study strategies and academic achievement: Pathways to achievement. *Metacognition & Learning, 3*(2), 123–146. doi:10.1007/s11409-008-9022-4

Ward, P. (2014). A response to the conversations on effective teaching in physical education. *Research Quarterly for Exercise and Sport, 85*(3), 293–296. doi:10.1080/02701367.2014.933653

Ward, P., Smith, S., & Makasci, K. (1997). Teacher training: Effects of directed rehearsal on the teaching skills of physical education majors. *Journal of Behavioral Education, 7*(4), 505–517.

Weinstein, C. E., Acee, T. W., & Jung, J. (2011). Self-regulation and learning strategies. In H. Bembenutty (Ed.), *Self-Regulated Learning* (pp. 45–54). San Francisco, CA: Wiley.

Weinstein, C. E., & Mayer, R. E. (1983). The teaching of learning strategies. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 315–327). New York, NY: MacMillan.

Weinstein, C. E., Schulte, A. C., & Palmer, D. R. (1987). *LASSI: Learning and Study Strategies Inventory*. Clearwater, FL: H&H.

Weiss, H. M. (1990). learning theory in industrial and organizational psychology. In M. D. Dunnette & L. M. Hough (Eds.), *Handbook of industrial and organizational psychology* (Vol. 1, pp. 171–222). Palo Alto, CA: Consulting Psychologists.

White, M. C. (2011). Predicting success in teacher certification testing: The role of academic help seeking. *International Journal of Educational and Psychological Assessment, 7*(1), 24–44.

Winne, P. H. (1996). A metacognitive view of individual differences in self-regulated learning. *Learning and Individual Differences, 8*(4), 327–353. doi:10.1016/S1041-6080(96)90022-9

Winne, P. H., & Hadwin, A. F. (1998). Studying as self-regulated learning. In D. J. Hacker, J. Dunlosky & A. C. Graesser (Eds.), *Metacognition in educational theory and practice* (pp. 272–304). Hillsdale, NJ: Erlbaum.

Wolters, C. A. (2004). Advancing achievement goal theory: Using goal structures and goal orientations to predict students' motivation, cognition, and achievement.

Journal of Educational Psychology, 96(2), 236–250. doi:10.1037/0022-0663.96.2.236

Wolters, C. A., Yu, S. L., & Pintrich, P. R. (1996). The relation between goal orientation and students' motivational beliefs and self-regulated learning. *Learning and Individual Differences, 8*(3), 211–238. doi:10.1016/S1041-6080(96)90015-1

Żemojtel-Piotrowska, M., Czarna, A. Z., Piotrowski, J., Baran, T., & Maltby, J. (2016). Structural validity of the Communal Narcissism Inventory (CNI): The bifactor model. *Personality and Individual Differences, 90*, 315–320. doi:10.1016/j.paid.2015.11.036

Zimmerman, B. J. (1986). Development of self-regulated learning: Which are the key subprocesses? *Contemporary Educational Psychology, 16*(2), 307–313.

Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology, 81*(3), 329-339. doi:10.1037/0022-0663.81.3.329

Zimmerman, B. J. (1990). Self-regulated learning and academic achievement: An overview. *Educational Psychologist, 25*(1), 3–17.

Zimmerman, B. J. (1998). Academic studying and the development of personal skill: A self-regulatory perspective. *Educational Psychologist, 33*(2/3), 73–86. doi:10.1080/00461520.1998.9653292

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13–39). San Diego, CA: Academic.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice, 41*(2), 64–70. doi:10.2307/1477457

Zimmerman, B. J. (2008). Theories of self-regulated learning and academic achievement: An overview and analysis. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theoretical perspectives* (2nd ed., pp. 1–37). New York, NY: Erlbaum.

Zimmerman, B. J. (2013). From cognitive modeling to self-regulation: A social cognitive career path. *Educational Psychologist, 48*(3), 135–147. doi:10.1080/00461520.2013.794676

Zimmerman, B. J., & Kitsantas, A. (1996). Self-regulated learning of a motoric skill: The role of goal setting and self-monitoring. *Journal of Applied Sport Psychology, 8*(1), 60–75.

Zimmerman, B. J., & Kitsantas, A. (1997). Developmental phase in self-regulation: Shifting from process goals to outcome goals. *Journal of Educational Psychology, 89*(1), 29–39.

Zimmerman, B. J., & Kitsantas, A. (2002). Acquiring writing revision and self-regulatory skill through observation and emulation. *Journal of Educational Psychology, 94*(4), 660–668. doi:10.1037/0022-0663.94.4.660

Zimmerman, B. J., & Martinez-Pons, M. (1986). Development of a structured interview for assessing student use of self-regulated learning strategies. *American Educational Research Journal, 23*(4), 614–628. doi:10.2307/1163093

Zimmerman, B. J., & Martinez-Pons, M. (1988). Construct validation of a strategy model of student self-regulated learning. *Journal of Educational Psychology, 80*(3), 284–290. doi:10.1037/0022-0663.80.3.284

Zusho, A., Pintrich, P. R., & Coppola, B. (2003). Skill and will: The role of motivation and cognition in the learning of college chemistry. *International Journal of Science Education, 25*(9), 1081–1094. doi:10.1080/0950069032000052207

APPENDIX A

CONSENT FORM

TEXAS A&M UNIVERSITY HUMAN SUBJECTS PROTECTION PROGRAM

Consent Form

Project Title: Self-Regulated Learning in Physical Education Preservice Teachers

You are invited to take part in this study being conducted by Jiling Liu, a doctoral student from Sport Pedagogy Program in Health & Kinesiology Department, Texas A&M University. The information in this form is provided to help you decide whether or not to participate. If you decide to participate in the study, you will be asked to sign this consent form. If you decide not to participate, there will be no consequence to you.

Why Is This Study Being Done?

The purpose of this study is to learn about what self-regulated learning strategies that students in physical education teacher education (PETE) program use and how the strategies use is determined by motivational orientations. With such knowledge, PETE program instructors might be able to improve future students' self-regulated learning ability.

Why Am I Being Asked To Be In This Study?

You are being asked to be in this study because you are enrolled in this PETE program and thus you are considered a physical education preservice teacher.

How Many People Will Be Asked To Be In This Study?

All students enrolled in this program are invited to participate in this study.

What Are the Alternatives to being in this study?

No. The alternative is not to participate.

What Will I Be Asked To Do In This Study?

Your participation will involve completing a questionnaire that consists of three parts (either on paper or online). The first part is Achievement Goals survey that includes 12 questions, the second part is Cognitive and Metacognitive Strategies including 31 questions, and the third is Resource Management Strategies consisting of 19 questions. There are also an information sheet in the beginning and two open-ended questions in the end of the questionnaire. The questionnaire should take about 15 minutes to complete. You are also invited for an individual interview that will last for about 20 minutes. If you agree to be interviewed, you will be asked to answer questions related to your self-regulated learning experiences.

Will Photos, Video or Audio Recordings Be Made Of Me during the Study?

The researchers will take an audio recording during the interview so that the interview data can be transcribed verbatim. Only if you agree to be audio-typed can you participate in the interview.

________ I want to participate in completing the MSLQ and the interview in this research study.

________ I want to participate in completing the MSLQ but not the interview in this research study.

________ I do not want to participate in this research study.

Are There Any Risks To Me?

The risks involved in this study are minimal. Your participation is voluntary and requires no legal, financial, physical, social, psychological obligation or any greater involvement than what one might experience in normal daily activities. Your decision to participate or not will not benefit or harm your performance in class.

Will There Be Any Costs To Me?

Aside from your time, there are no costs for taking part in the study.

Will I Be Paid To Be In This Study?

Your participation in this study automatically enables you to enter a lottery pool. If you win, you will get a $10 certificate. The lottery will have 100 winners in total. For participating in the interview, a $10 certificate will be granted.

Will Information From This Study Be Kept Private?

The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely and only the involved researchers have access to the records.

Information about you will be stored in locked file cabinet; computer files protected with a password. This consent form will be filed securely in an official area.

People who have access to your information include the Principal Investigator and research study personnel. Representatives of regulatory agencies such as the Office of Human Research Protections (OHRP) and entities such as the Texas A&M University Human Subjects Protection Program may access your records to make sure the study is being run correctly and that information is collected properly.

Who may I Contact for More Information?

You may contact the Principal Investigator, Ron McBride, to tell him about a concern or complaint about this research at 979-845-8788 or rmac@tamu.edu.

For questions about your rights as a research participant, to provide input regarding research, or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office by phone at 1-979-458-4067, toll free at 1-855-795-8636, or by email at irb@tamu.edu.

What if I Change My Mind About Participating?

This research is voluntary and you have the choice whether or not to be in this research study. You may decide to not begin or to stop participating at any time. If you choose not to be in this study or stop being in the study, there will be no effect on your student status, medical care, employment, evaluation, relationship with Texas A&M University, etc. Any new information discovered about the research will be provided to you. This information could affect your willingness to continue your participation.

Statement of Consent

I agree to be in this study and know that I am not giving up any legal rights by signing this form. The procedures, risks, and benefits have been explained to me, and my questions have been answered. I know that new information about this research study will be provided to me as it becomes available and that the researcher will tell me if I must be removed from the study. I can ask more questions if I want. A copy of this entire consent form will be given to me.

____________________________ ____________________________
Participant's Signature Date

____________________________ ____________________________
Printed Name Date

INVESTIGATOR'S AFFIDAVIT:
Either I have or my agent has carefully explained to the participant the nature of the above project. I hereby certify that to the best of my knowledge the person who signed this consent form was informed of the nature, demands, benefits, and risks involved in his/her participation.

____________________________ ____________________________
Signature of Presenter Date

____________________________ ____________________________
Printed Name Date

APPENDIX B

BIOGRAPHICAL DATA QUESTIONNAIRE

1. Please print your name: ____________________
2. Please specify your year of birth: _____
3. Please specify your gender: (1) Male ___ (2) Female ___
4. You consider yourself to be:

   (1) Caucasian ___ (2) Hispanic ___ (3) African-American ___
   (4) Asian-American ___ (5) Other ___
5. Please specify your classification:

   (1) Freshman ___ (2) Sophomore ___ (3) Junior ___ (4) Senior ___
   (5) Other (please specify) _________
6. Please name the course in which you are doing the survey: ______________
7. How many hours a week approximately do you study for this course? __________
8. How many years of teaching experience in K-12 schools did you have before entering this program? ______
9. How many years of coaching experience did you have before entering this program? ____
10. How many hours per week do you work for pay? ____ or Not applicable______

APPENDIX C

THE COGNITIVE AND METACOGNITIVE STRATEGIES SCALES

The following questions ask about your learning strategies and study skills for this class.

There are no right or wrong answers. Answer the questions about how you study in this class as accurately as possible. Use the same scale to answer the remaining questions. If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes you.

	Not at all true			→			Very true of me
1. During class time I often miss important points because I'm thinking of other things.	1	2	3	4	5	6	7
2. When I study for this class, I practice saying the material to myself over and over.	1	2	3	4	5	6	7
3. When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions.	1	2	3	4	5	6	7
4. When studying for this course, I make up questions to help focus on learning materials.	1	2	3	4	5	6	7
5. When I study for this course, I outline the material to help me organize my thoughts.	1	2	3	4	5	6	7
6. I often find myself questioning things I hear or read in this course to decide if I find them convincing.	1	2	3	4	5	6	7
7. When I become confused about something I'm studying for this class, I go back and try to figure it out.	1	2	3	4	5	6	7
8. I try to relate ideas in this subject to those in other courses whenever possible.	1	2	3	4	5	6	7
9. When studying for this course, I review my class notes and the course materials over and over again.	1	2	3	4	5	6	7
10. If course materials are difficult to understand, I change the way I study the material.	1	2	3	4	5	6	7
11. When a theory, interpretation, or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence.	1	2	3	4	5	6	7

12. When studying for this class, I try to relate the material to what I already know.	1	2	3	4	5	6	7
13. Before I study new course material thoroughly, I often skim it to see how it is organized.	1	2	3	4	5	6	7
14. I treat the course material as a starting point and try to develop my own ideas about it.	1	2	3	4	5	6	7
15. When I study for this course, I go through the materials and my class notes and try to find the most important ideas.	1	2	3	4	5	6	7
16. I ask myself questions to make sure I understand the material I have been studying in this class.	1	2	3	4	5	6	7
17. When I study for this course, I write brief summaries of the main ideas from the materials and my class notes.	1	2	3	4	5	6	7
18. I memorize key words to remind me of important concepts in this class.	1	2	3	4	5	6	7
19. I try to change the way I study in order to fit the course requirements and the instructor's teaching style.	1	2	3	4	5	6	7
20. I make simple charts, diagrams, or tables to help me organize course material.	1	2	3	4	5	6	7
21. I often find that I have been studying for this class but don't know what it was all about.	1	2	3	4	5	6	7
22. I try to understand the material in this class by making connections between the readings and the concepts from the lectures.	1	2	3	4	5	6	7
23. 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 for this course.	1	2	3	4	5	6	7
24. I try to play around with ideas of my own related to what I am learning in this course.	1	2	3	4	5	6	7
25. When studying for this course I try to determine which concepts I don't understand well.	1	2	3	4	5	6	7
26. I make lists of important items for this course and memorize the lists.	1	2	3	4	5	6	7

27. I try to apply ideas from other class activities such as lecture and discussion.	1	2	3	4	5	6	7
28. When I study for this class, I set goals for myself in order to direct my activities in each study period.	1	2	3	4	5	6	7
29. Whenever I read or hear an assertion or conclusion in this class, I think about possible alternatives.	1	2	3	4	5	6	7
30. When I study for this course, I go over my class notes and make an outline of important concepts.	1	2	3	4	5	6	7
31. If I get confused taking notes in class, I make sure I sort it out afterwards.	1	2	3	4	5	6	7

Open-ended questions:

1. Have you learned the concept of self-regulated learning in any courses that you have taken for your enrolled program? If so, please define this concept in your own words.

2. If you have any thoughts, comments, or suggestions about this survey, please feel free to write down below.

THANK YOU!

APPENDIX D

THE CMLSS UNIVARIATE DESCRIPTIVE STATISTICS

	N	Min	Max	Mean	SD	Skewness	Kurtosis
S1	380	1	7	4.634	1.607	-.323	-.739
S2	380	1	7	4.639	1.733	-.394	-.762
S3	379	1	7	5.119	1.623	-.869	.122
S4	380	1	7	3.400	1.761	.374	-.744
S5	379	1	7	4.612	1.764	-.398	-.820
S6	380	1	7	3.618	1.764	.161	-.893
S7	380	2	7	5.379	1.329	-.727	-.055
S8	380	1	7	5.316	1.464	-.859	.324
S9	380	2	7	5.587	1.394	-.874	-.012
S10	380	1	7	4.553	1.576	-.223	-.591
S11	380	1	7	4.374	1.554	-.257	-.455
S12	380	3	7	5.895	1.089	-.836	.083
S13	379	1	7	4.665	1.664	-.393	-.610
S14	380	1	7	4.426	1.652	-.185	-.618
S15	380	2	7	5.389	1.312	-.670	.082
S16	380	1	7	4.729	1.606	-.340	-.736
S17	380	1	7	3.563	1.869	.263	-1.030
S18	380	2	7	5.779	1.211	-1.031	.786
S19	379	1	7	4.570	1.658	-.346	-.589
S20	380	1	7	3.179	1.855	.525	-.807
S21	378	1	7	5.262	1.598	-.763	-.252
S22	380	1	7	5.179	1.382	-.608	-.001
S23	380	1	7	4.613	1.478	-.343	-.341
S24	380	1	7	4.603	1.566	-.455	-.367
S25	379	1	7	4.908	1.421	-.564	-.125
S26	380	1	7	4.287	1.779	-.193	-.959
S27	380	2	7	5.305	1.298	-.647	.006
S28	380	1	7	4.771	1.614	-.503	-.533
S29	380	1	7	4.284	1.542	-.102	-.610
S30	378	1	7	4.836	1.790	-.561	-.669
S31	380	1	7	4.342	1.839	-.272	-.971

APPENDIX E

THE ORIGINAL 5-FACTOR MODEL CFA RESULTS

THE MODEL ESTIMATION TERMINATED NORMALLY

MODEL FIT INFORMATION

Number of Free Parameters	97
Loglikelihood	
H0 Value	-18432.212
H0 Scaling Correction Factor for MLR	1.0994
H1 Value	-17900.429
H1 Scaling Correction Factor for MLR	1.1326
Information Criteria	
Akaike (AIC)	37058.424
Bayesian (BIC)	37440.621
Sample-Size Adjusted BIC	37132.859
(n* = (n + 2) / 24)	
Chi-Square Test of Model Fit	
Value	931.830*
Degrees of Freedom	367
P-Value	0.0000
Scaling Correction Factor for MLR	1.1414

* The chi-square value for MLM, MLMV, MLR, ULSMV, WLSM and WLSMV cannot be used for chi-square difference testing in the regular way. MLM, MLR and WLSM chi-square difference testing is described on the Mplus website. MLMV, WLSMV, and ULSMV difference testing is done using the DIFFTEST option.

RMSEA (Root Mean Square Error Of Approximation)	
Estimate	0.064
90 Percent C.I.	0.059 0.069
Probability RMSEA <= .05	0.000
CFI/TLI	
CFI	0.861
TLI	0.846

Chi-Square Test of Model Fit for the Baseline Model

Value	4471.805
Degrees of Freedom	406
P-Value	0.0000

SRMR (Standardized Root Mean Square Residual)

Value	0.062

MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
REH BY				
S1	1.000	0.000	999.000	999.000
S2	1.015	0.096	10.621	0.000
S3	0.803	0.100	8.036	0.000
S4	0.979	0.123	7.967	0.000
ELA BY				
S5	1.000	0.000	999.000	999.000
S6	1.032	0.128	8.077	0.000
S7	0.823	0.102	8.064	0.000
S8	0.878	0.150	5.857	0.000
S9	1.206	0.113	10.710	0.000
S10	1.112	0.113	9.848	0.000
ORG BY				
S11	1.000	0.000	999.000	999.000
S12	0.739	0.085	8.666	0.000
S13	0.726	0.083	8.707	0.000
S14	1.102	0.073	15.120	0.000
CT BY				
S15	1.000	0.000	999.000	999.000
S16	1.364	0.162	8.396	0.000
S17	1.498	0.173	8.654	0.000
S18	1.219	0.158	7.718	0.000
S19	1.302	0.167	7.803	0.000
MSR BY				
S21	1.000	0.000	999.000	999.000
S22	0.823	0.098	8.437	0.000
S23	1.019	0.097	10.470	0.000
S24	1.019	0.104	9.775	0.000
S25	1.181	0.098	12.001	0.000

S26	0.915	0.111	8.243	0.000
S28	0.926	0.100	9.258	0.000
S29	0.867	0.098	8.829	0.000
S30	1.071	0.104	10.283	0.000
S31	1.139	0.114	9.994	0.000
ELA WITH				
REH	0.642	0.097	6.600	0.000
ORG WITH				
REH	1.026	0.133	7.705	0.000
ELA	0.830	0.110	7.510	0.000
CT WITH				
REH	0.336	0.076	4.430	0.000
ELA	0.546	0.081	6.775	0.000
ORG	0.587	0.095	6.156	0.000
MSR WITH				
REH	0.796	0.120	6.624	0.000
ELA	0.772	0.115	6.718	0.000
ORG	1.071	0.140	7.630	0.000
CT	0.722	0.110	6.576	0.000
Intercepts				
S1	4.639	0.089	52.270	0.000
S2	5.587	0.071	78.248	0.000
S3	5.779	0.062	93.179	0.000
S4	4.287	0.091	47.030	0.000
S5	5.124	0.083	61.595	0.000
S6	5.316	0.075	70.884	0.000
S7	5.895	0.056	105.619	0.000
S8	3.563	0.096	37.219	0.000
S9	5.179	0.071	73.149	0.000
S10	5.305	0.067	79.777	0.000
S11	4.613	0.090	51.116	0.000
S12	5.389	0.067	80.184	0.000
S13	3.179	0.095	33.455	0.000
S14	4.829	0.092	52.712	0.000
S15	3.618	0.090	40.033	0.000
S16	4.374	0.080	54.946	0.000
S17	4.426	0.085	52.284	0.000
S18	4.603	0.080	57.383	0.000
S19	4.284	0.079	54.227	0.000

S21	3.400	0.090	37.688	0.000
S22	5.379	0.068	79.000	0.000
S23	4.553	0.081	56.368	0.000
S24	4.663	0.085	54.766	0.000
S25	4.729	0.082	57.489	0.000
S26	4.568	0.085	53.851	0.000
S28	4.613	0.076	60.916	0.000
S29	4.905	0.073	67.411	0.000
S30	4.771	0.083	57.706	0.000
S31	4.342	0.094	46.091	0.000
Variances				
REH	0.924	0.180	5.131	0.000
ELA	0.765	0.140	5.442	0.000
ORG	1.507	0.213	7.060	0.000
CT	0.725	0.172	4.204	0.000
MSR	1.034	0.179	5.790	0.000
Residual Variances				
S1	2.070	0.168	12.327	0.000
S2	0.986	0.099	9.966	0.000
S3	0.867	0.099	8.733	0.000
S4	2.272	0.165	13.800	0.000
S5	1.865	0.190	9.829	0.000
S6	1.322	0.130	10.180	0.000
S7	0.666	0.065	10.272	0.000
S8	2.893	0.182	15.869	0.000
S9	0.793	0.095	8.305	0.000
S10	0.736	0.082	8.922	0.000
S11	1.588	0.182	8.713	0.000
S12	0.894	0.093	9.583	0.000
S13	2.637	0.166	15.927	0.000
S14	1.359	0.159	8.561	0.000
S15	2.380	0.188	12.686	0.000
S16	1.060	0.109	9.736	0.000
S17	1.097	0.124	8.864	0.000
S18	1.368	0.129	10.622	0.000
S19	1.142	0.112	10.199	0.000
S21	2.058	0.163	12.663	0.000
S22	1.061	0.097	10.882	0.000
S23	1.405	0.130	10.795	0.000
S24	1.681	0.131	12.786	0.000
S25	1.129	0.102	11.113	0.000
S26	1.869	0.154	12.138	0.000

S28	1.292	0.116	11.148	0.000
S29	1.235	0.107	11.593	0.000
S30	1.411	0.125	11.278	0.000
S31	2.032	0.152	13.341	0.000

STANDARDIZED MODEL RESULTS

STDYX Standardization

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
REH BY				
S1	0.555	0.047	11.705	0.000
S2	0.701	0.036	19.355	0.000
S3	0.638	0.044	14.380	0.000
S4	0.529	0.044	12.068	0.000
ELA BY				
S5	0.539	0.045	11.881	0.000
S6	0.618	0.043	14.327	0.000
S7	0.661	0.039	16.905	0.000
S8	0.412	0.055	7.526	0.000
S9	0.764	0.030	25.688	0.000
S10	0.750	0.032	23.247	0.000
ORG BY				
S11	0.698	0.041	16.815	0.000
S12	0.692	0.041	17.086	0.000
S13	0.481	0.047	10.185	0.000
S14	0.758	0.033	22.696	0.000
CT BY				
S15	0.483	0.054	8.991	0.000
S16	0.748	0.029	25.945	0.000
S17	0.773	0.030	25.920	0.000
S18	0.664	0.040	16.717	0.000
S19	0.720	0.033	21.707	0.000
MSR BY				
S21	0.578	0.042	13.620	0.000
S22	0.631	0.042	15.081	0.000
S23	0.658	0.038	17.383	0.000
S24	0.624	0.036	17.191	0.000
S25	0.749	0.026	29.061	0.000

S26	0.563	0.043	12.948	0.000
S28	0.638	0.038	16.722	0.000
S29	0.621	0.039	15.789	0.000
S30	0.676	0.035	19.368	0.000
S31	0.631	0.035	18.051	0.000
ELA WITH				
REH	0.764	0.052	14.574	0.000
ORG WITH				
REH	0.870	0.049	17.644	0.000
ELA	0.773	0.046	16.682	0.000
CT WITH				
REH	0.410	0.064	6.403	0.000
ELA	0.733	0.044	16.806	0.000
ORG	0.562	0.061	9.157	0.000
MSR WITH				
REH	0.814	0.038	21.554	0.000
ELA	0.868	0.034	25.308	0.000
ORG	0.858	0.037	22.896	0.000
CT	0.834	0.031	26.528	0.000
Intercepts				
S1	2.681	0.106	25.300	0.000
S2	4.014	0.181	22.188	0.000
S3	4.780	0.239	20.015	0.000
S4	2.413	0.088	27.268	0.000
S5	3.160	0.154	20.537	0.000
S6	3.636	0.176	20.699	0.000
S7	5.418	0.233	23.228	0.000
S8	1.909	0.060	31.651	0.000
S9	3.752	0.164	22.844	0.000
S10	4.093	0.178	23.056	0.000
S11	2.622	0.104	25.321	0.000
S12	4.113	0.181	22.697	0.000
S13	1.716	0.051	33.835	0.000
S14	2.704	0.113	23.846	0.000
S15	2.054	0.069	29.562	0.000
S16	2.819	0.112	25.154	0.000
S17	2.682	0.102	26.253	0.000
S18	2.944	0.124	23.734	0.000
S19	2.782	0.102	27.259	0.000

S21	1.933	0.062	31.312	0.000
S22	4.053	0.177	22.940	0.000
S23	2.892	0.110	26.365	0.000
S24	2.809	0.113	24.933	0.000
S25	2.949	0.112	26.421	0.000
S26	2.763	0.110	25.029	0.000
S28	3.125	0.127	24.683	0.000
S29	3.458	0.149	23.144	0.000
S30	2.960	0.122	24.221	0.000
S31	2.364	0.090	26.291	0.000

Variances

REH	1.000	0.000	999.000	999.000
ELA	1.000	0.000	999.000	999.000
ORG	1.000	0.000	999.000	999.000
CT	1.000	0.000	999.000	999.000
MSR	1.000	0.000	999.000	999.000

Residual Variances

S1	0.692	0.053	13.119	0.000
S2	0.509	0.051	10.027	0.000
S3	0.593	0.057	10.473	0.000
S4	0.720	0.046	15.492	0.000
S5	0.709	0.049	14.491	0.000
S6	0.619	0.053	11.621	0.000
S7	0.563	0.052	10.872	0.000
S8	0.831	0.045	18.450	0.000
S9	0.416	0.045	9.163	0.000
S10	0.438	0.048	9.048	0.000
S11	0.513	0.058	8.864	0.000
S12	0.521	0.056	9.281	0.000
S13	0.769	0.045	16.908	0.000
S14	0.426	0.051	8.426	0.000
S15	0.767	0.052	14.758	0.000
S16	0.440	0.043	10.199	0.000
S17	0.403	0.046	8.744	0.000
S18	0.559	0.053	10.612	0.000
S19	0.482	0.048	10.080	0.000
S21	0.666	0.049	13.553	0.000
S22	0.602	0.053	11.415	0.000
S23	0.567	0.050	11.379	0.000
S24	0.610	0.045	13.455	0.000
S25	0.439	0.039	11.370	0.000
S26	0.684	0.049	13.982	0.000

S28	0.593	0.049	12.175	0.000
S29	0.614	0.049	12.546	0.000
S30	0.543	0.047	11.516	0.000
S31	0.602	0.044	13.678	0.000

Variances

REH	1.000	0.000	999.000	999.000
ELA	1.000	0.000	999.000	999.000
ORG	1.000	0.000	999.000	999.000
CT	1.000	0.000	999.000	999.000
MSR	1.000	0.000	999.000	999.000

Residual Variances

S1	0.692	0.053	13.119	0.000
S2	0.509	0.051	10.027	0.000
S3	0.593	0.057	10.473	0.000
S4	0.720	0.046	15.492	0.000
S5	0.709	0.049	14.491	0.000
S6	0.619	0.053	11.621	0.000
S7	0.563	0.052	10.872	0.000
S8	0.831	0.045	18.450	0.000
S9	0.416	0.045	9.163	0.000
S10	0.438	0.048	9.048	0.000
S11	0.513	0.058	8.864	0.000
S12	0.521	0.056	9.281	0.000
S13	0.769	0.045	16.908	0.000
S14	0.426	0.051	8.426	0.000
S15	0.767	0.052	14.758	0.000
S16	0.440	0.043	10.199	0.000
S17	0.403	0.046	8.744	0.000
S18	0.559	0.053	10.612	0.000
S19	0.482	0.048	10.080	0.000
S21	0.666	0.049	13.553	0.000
S22	0.602	0.053	11.415	0.000
S23	0.567	0.050	11.379	0.000
S24	0.610	0.045	13.455	0.000
S25	0.439	0.039	11.370	0.000
S26	0.684	0.049	13.982	0.000
S28	0.593	0.049	12.175	0.000
S29	0.614	0.049	12.546	0.000
S30	0.543	0.047	11.516	0.000
S31	0.602	0.044	13.678	0.000

R-SQUARE

Observed Variable	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
S1	0.308	0.053	5.852	0.000
S2	0.491	0.051	9.677	0.000
S3	0.407	0.057	7.190	0.000
S4	0.280	0.046	6.034	0.000
S5	0.291	0.049	5.941	0.000
S6	0.381	0.053	7.163	0.000
S7	0.437	0.052	8.453	0.000
S8	0.169	0.045	3.763	0.000
S9	0.584	0.045	12.844	0.000
S10	0.562	0.048	11.624	0.000
S11	0.487	0.058	8.408	0.000
S12	0.479	0.056	8.543	0.000
S13	0.231	0.045	5.093	0.000
S14	0.574	0.051	11.348	0.000
S15	0.233	0.052	4.496	0.000
S16	0.560	0.043	12.972	0.000
S17	0.597	0.046	12.960	0.000
S18	0.441	0.053	8.358	0.000
S19	0.518	0.048	10.853	0.000
S21	0.334	0.049	6.810	0.000
S22	0.398	0.053	7.541	0.000
S23	0.433	0.050	8.691	0.000
S24	0.390	0.045	8.595	0.000
S25	0.561	0.039	14.531	0.000
S26	0.316	0.049	6.474	0.000
S28	0.407	0.049	8.361	0.000
S29	0.386	0.049	7.895	0.000
S30	0.457	0.047	9.684	0.000
S31	0.398	0.044	9.026	0.000

MODEL MODIFICATION INDICES

Minimum M.I. value for printing the modification index 10.000

		M.I.	E.P.C.	Std E.P.C.	StdYX E.P.C.
BY Statements					
REH	BY S8	12.333	0.711	0.683	0.366
REH	BY S12	17.984	0.998	0.959	0.732

REH	BY S28	22.268	-0.694	-0.666	-0.451
ELA	BY S3	10.167	0.452	0.395	0.327
ELA	BY S12	11.166	0.530	0.463	0.353
ELA	BY S22	33.397	1.181	1.033	0.778
ORG	BY S8	49.368	1.188	1.458	0.781
ORG	BY S28	20.727	-0.658	-0.808	-0.547
CT	BY S8	12.974	0.739	0.629	0.337
CT	BY S13	11.645	0.530	0.451	0.243
CT	BY S28	27.684	0.899	0.765	0.518
CT	BY S31	10.995	-0.709	-0.603	-0.329
MSR	BY S8	56.067	2.076	2.111	1.131
MSR	BY S12	11.453	0.573	0.583	0.445

WITH Statements

S6	WITH S4	11.487	-0.346	-0.346	-0.200
S7	WITH S3	13.778	0.173	0.173	0.228
S7	WITH S6	31.949	0.328	0.328	0.350
S8	WITH S4	19.855	0.654	0.654	0.255
S8	WITH S7	12.456	-0.290	-0.290	-0.209
S9	WITH S8	10.886	-0.313	-0.313	-0.207
S10	WITH S2	12.612	-0.200	-0.200	-0.235
S11	WITH S8	12.533	0.452	0.452	0.211
S12	WITH S3	14.219	0.211	0.211	0.240
S13	WITH S8	32.475	0.892	0.892	0.323
S13	WITH S12	19.186	-0.417	-0.417	-0.272
S14	WITH S11	15.309	0.450	0.450	0.306
S21	WITH S8	15.786	0.548	0.548	0.224
S21	WITH S11	22.330	0.514	0.514	0.284
S21	WITH S13	13.841	0.494	0.494	0.212
S22	WITH S8	12.154	-0.347	-0.347	-0.198
S22	WITH S9	14.621	0.217	0.217	0.236
S22	WITH S13	12.117	-0.334	-0.334	-0.200
S24	WITH S17	25.025	0.426	0.426	0.313
S25	WITH S12	10.455	0.202	0.202	0.201
S25	WITH S21	14.532	0.344	0.344	0.226
S26	WITH S13	10.122	0.402	0.402	0.181
S26	WITH S23	21.946	0.438	0.438	0.270
S28	WITH S18	16.843	0.324	0.324	0.244
S29	WITH S18	15.935	0.308	0.308	0.237
S29	WITH S28	18.649	0.316	0.316	0.250

APPENDIX F

THE BIFACTOR MODEL CFA RESULTS

THE MODEL ESTIMATION TERMINATED NORMALLY

MODEL FIT INFORMATION

Number of Free Parameters	111
Loglikelihood	
H0 Value	-18317.921
H0 Scaling Correction Factor for MLR	1.1036
H1 Value	-17900.429
H1 Scaling Correction Factor for MLR	1.1326
Information Criteria	
Akaike (AIC)	36857.843
Bayesian (BIC)	37295.202
Sample-Size Adjusted BIC	36943.021
(n* = (n + 2) / 24)	
Chi-Square Test of Model Fit	
Value	731.327*
Degrees of Freedom	353
P-Value	0.0000
Scaling Correction Factor for MLR	1.1417

* The chi-square value for MLM, MLMV, MLR, ULSMV, WLSM and WLSMV cannot be used for chi-square difference testing in the regular way. MLM, MLR and WLSM chi-square difference testing is described on the Mplus website. MLMV, WLSMV, and ULSMV difference testing is done using the DIFFTEST option.

RMSEA (Root Mean Square Error Of Approximation)	
Estimate	0.053
90 Percent C.I.	0.048 0.059
Probability RMSEA <= .05	0.171
CFI/TLI	
CFI	0.907
TLI	0.893

Chi-Square Test of Model Fit for the Baseline Model

Value	4471.805
Degrees of Freedom	406
P-Value	0.0000

SRMR (Standardized Root Mean Square Residual)

Value	0.047

MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
ELA BY				
S3	0.378	0.066	5.743	0.000
S5	0.292	0.105	2.772	0.006
S6	0.545	0.105	5.190	0.000
S7	0.510	0.067	7.604	0.000
S8	-0.644	0.136	-4.728	0.000
S9	0.524	0.069	7.563	0.000
S10	0.458	0.072	6.342	0.000
S13	-0.587	0.124	-4.716	0.000
S21	-0.347	0.103	-3.364	0.001
S22	0.486	0.069	7.095	0.000
S29	0.235	0.078	3.007	0.003
CT BY				
S1	-0.391	0.118	-3.330	0.001
S2	-0.498	0.074	-6.719	0.000
S4	-0.442	0.103	-4.305	0.000
S11	-0.535	0.089	-5.978	0.000
S12	-0.225	0.074	-3.021	0.003
S14	-0.545	0.094	-5.778	0.000
S15	0.676	0.101	6.680	0.000
S16	0.591	0.080	7.393	0.000
S17	0.739	0.089	8.264	0.000
S18	0.715	0.088	8.132	0.000
S19	0.531	0.080	6.611	0.000
S28	0.441	0.080	5.519	0.000
S31	-0.241	0.091	-2.649	0.008
GCS BY				
S1	0.828	0.092	9.038	0.000
S2	0.766	0.073	10.499	0.000
S3	0.617	0.066	9.306	0.000
S4	0.850	0.090	9.412	0.000
S5	0.794	0.078	10.237	0.000

S6	0.733	0.082	8.906	0.000
S7	0.586	0.059	9.907	0.000
S8	1.027	0.088	11.721	0.000
S9	0.917	0.062	14.832	0.000
S10	0.833	0.065	12.897	0.000
S11	1.090	0.078	13.924	0.000
S12	0.842	0.067	12.538	0.000
S13	0.967	0.090	10.796	0.000
S14	1.190	0.077	15.398	0.000
S15	0.586	0.103	5.710	0.000
S16	0.970	0.072	13.456	0.000
S17	1.045	0.079	13.291	0.000
S18	0.828	0.085	9.687	0.000
S19	0.941	0.078	12.111	0.000
S21	1.069	0.085	12.531	0.000
S22	0.799	0.072	11.125	0.000
S23	1.022	0.074	13.733	0.000
S24	1.024	0.076	13.463	0.000
S25	1.201	0.061	19.592	0.000
S26	0.923	0.082	11.309	0.000
S28	0.909	0.072	12.594	0.000
S29	0.844	0.072	11.688	0.000
S30	1.088	0.073	14.896	0.000
S31	1.166	0.077	15.061	0.000
ELA WITH				
GCS	0.000	0.000	999.000	999.000
CT	0.000	0.000	999.000	999.000
CT WITH				
GCS	0.000	0.000	999.000	999.000
Intercepts				
S1	4.639	0.089	52.270	0.000
S2	5.587	0.071	78.248	0.000
S3	5.779	0.062	93.179	0.000
S4	4.287	0.091	47.030	0.000
S5	5.124	0.083	61.595	0.000
S6	5.316	0.075	70.884	0.000
S7	5.895	0.056	105.619	0.000
S8	3.563	0.096	37.219	0.000
S9	5.179	0.071	73.149	0.000
S10	5.305	0.067	79.777	0.000
S11	4.613	0.090	51.116	0.000

S12	5.389	0.067	80.184	0.000
S13	3.179	0.095	33.455	0.000
S14	4.829	0.092	52.712	0.000
S15	3.618	0.090	40.033	0.000
S16	4.374	0.080	54.946	0.000
S17	4.426	0.085	52.284	0.000
S18	4.603	0.080	57.383	0.000
S19	4.284	0.079	54.227	0.000
S21	3.400	0.090	37.688	0.000
S22	5.379	0.068	79.000	0.000
S23	4.553	0.081	56.368	0.000
S24	4.663	0.085	54.766	0.000
S25	4.729	0.082	57.489	0.000
S26	4.568	0.085	53.851	0.000
S28	4.613	0.076	60.916	0.000
S29	4.905	0.073	67.411	0.000
S30	4.771	0.083	57.706	0.000
S31	4.342	0.094	46.091	0.000
Variances				
ELA	1.000	0.000	999.000	999.000
CT	1.000	0.000	999.000	999.000
GCS	1.000	0.000	999.000	999.000
Residual Variances				
S1	2.155	0.165	13.023	0.000
S2	1.103	0.096	11.552	0.000
S3	0.938	0.102	9.173	0.000
S4	2.238	0.161	13.942	0.000
S5	1.914	0.187	10.220	0.000
S6	1.302	0.146	8.891	0.000
S7	0.579	0.071	8.150	0.000
S8	2.013	0.254	7.914	0.000
S9	0.788	0.088	8.997	0.000
S10	0.777	0.082	9.461	0.000
S11	1.621	0.165	9.827	0.000
S12	0.958	0.083	11.561	0.000
S13	2.152	0.198	10.864	0.000
S14	1.477	0.142	10.428	0.000
S15	2.305	0.191	12.061	0.000
S16	1.118	0.113	9.915	0.000
S17	1.086	0.125	8.693	0.000
S18	1.248	0.123	10.174	0.000
S19	1.204	0.113	10.648	0.000

S21	1.829	0.166	11.024	0.000
S22	0.887	0.090	9.900	0.000
S23	1.435	0.131	10.973	0.000
S24	1.707	0.128	13.318	0.000
S25	1.129	0.104	10.907	0.000
S26	1.883	0.148	12.744	0.000
S28	1.158	0.108	10.730	0.000
S29	1.244	0.112	11.122	0.000
S30	1.414	0.119	11.877	0.000
S31	1.954	0.147	13.263	0.000

STANDARDIZED MODEL RESULTS

STDYX Standardization

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
ELA BY				
S3	0.313	0.056	5.620	0.000
S5	0.180	0.065	2.782	0.005
S6	0.373	0.072	5.175	0.000
S7	0.469	0.061	7.736	0.000
S8	-0.345	0.073	-4.702	0.000
S9	0.380	0.050	7.635	0.000
S10	0.353	0.056	6.339	0.000
S13	-0.317	0.067	-4.741	0.000
S21	-0.197	0.059	-3.371	0.001
S22	0.366	0.051	7.234	0.000
S29	0.166	0.056	2.981	0.003
CT BY				
S1	-0.226	0.067	-3.353	0.001
S2	-0.358	0.051	-7.070	0.000
S4	-0.249	0.057	-4.341	0.000
S11	-0.304	0.049	-6.146	0.000
S12	-0.172	0.057	-3.017	0.003
S14	-0.305	0.052	-5.844	0.000
S15	0.384	0.056	6.828	0.000
S16	0.381	0.051	7.462	0.000
S17	0.448	0.052	8.532	0.000
S18	0.457	0.052	8.840	0.000
S19	0.345	0.052	6.682	0.000
S28	0.299	0.053	5.621	0.000
S31	-0.131	0.049	-2.653	0.008

GCS BY				
S1	0.479	0.047	10.185	0.000
S2	0.550	0.041	13.325	0.000
S3	0.510	0.044	11.552	0.000
S4	0.479	0.046	10.379	0.000
S5	0.489	0.044	11.036	0.000
S6	0.502	0.047	10.687	0.000
S7	0.539	0.044	12.231	0.000
S8	0.550	0.041	13.340	0.000
S9	0.665	0.032	20.599	0.000
S10	0.643	0.036	17.700	0.000
S11	0.620	0.039	15.856	0.000
S12	0.642	0.036	18.069	0.000
S13	0.522	0.041	12.751	0.000
S14	0.666	0.034	19.852	0.000
S15	0.332	0.056	5.937	0.000
S16	0.625	0.036	17.294	0.000
S17	0.633	0.038	16.447	0.000
S18	0.529	0.048	11.061	0.000
S19	0.611	0.041	14.931	0.000
S21	0.608	0.040	15.140	0.000
S22	0.602	0.043	14.014	0.000
S23	0.649	0.038	17.010	0.000
S24	0.617	0.036	17.259	0.000
S25	0.749	0.026	28.643	0.000
S26	0.558	0.042	13.266	0.000
S28	0.616	0.039	15.617	0.000
S29	0.595	0.040	14.906	0.000
S30	0.675	0.033	20.161	0.000
S31	0.635	0.034	18.820	0.000
ELA WITH				
GCS	0.000	0.000	999.000	999.000
CT	0.000	0.000	999.000	999.000
CT WITH				
GCS	0.000	0.000	999.000	999.000
Intercepts				
S1	2.681	0.106	25.301	0.000
S2	4.014	0.181	22.188	0.000
S3	4.780	0.239	20.015	0.000
S4	2.413	0.088	27.268	0.000
S5	3.160	0.154	20.537	0.000

S6	3.636	0.176	20.699	0.000
S7	5.418	0.233	23.228	0.000
S8	1.909	0.060	31.651	0.000
S9	3.752	0.164	22.844	0.000
S10	4.092	0.178	23.056	0.000
S11	2.622	0.104	25.321	0.000
S12	4.113	0.181	22.697	0.000
S13	1.716	0.051	33.835	0.000
S14	2.704	0.113	23.846	0.000
S15	2.054	0.069	29.562	0.000
S16	2.819	0.112	25.154	0.000
S17	2.682	0.102	26.253	0.000
S18	2.944	0.124	23.734	0.000
S19	2.782	0.102	27.259	0.000
S21	1.933	0.062	31.313	0.000
S22	4.053	0.177	22.940	0.000
S23	2.892	0.110	26.365	0.000
S24	2.809	0.113	24.933	0.000
S25	2.949	0.112	26.421	0.000
S26	2.763	0.110	25.029	0.000
S28	3.125	0.127	24.683	0.000
S29	3.458	0.149	23.144	0.000
S30	2.960	0.122	24.221	0.000
S31	2.364	0.090	26.291	0.000
Variances				
ELA	1.000	0.000	999.000	999.000
CT	1.000	0.000	999.000	999.000
GCS	1.000	0.000	999.000	999.000
Residual Variances				
S1	0.720	0.051	14.060	0.000
S2	0.570	0.050	11.454	0.000
S3	0.642	0.051	12.569	0.000
S4	0.709	0.046	15.445	0.000
S5	0.728	0.045	16.056	0.000
S6	0.609	0.057	10.625	0.000
S7	0.489	0.056	8.667	0.000
S8	0.578	0.070	8.267	0.000
S9	0.414	0.040	10.235	0.000
S10	0.462	0.046	10.057	0.000
S11	0.524	0.050	10.575	0.000
S12	0.558	0.048	11.605	0.000
S13	0.627	0.056	11.174	0.000

S14	0.463	0.043	10.717	0.000
S15	0.742	0.053	14.003	0.000
S16	0.464	0.045	10.413	0.000
S17	0.399	0.047	8.487	0.000
S18	0.511	0.052	9.727	0.000
S19	0.508	0.048	10.563	0.000
S21	0.591	0.052	11.339	0.000
S22	0.503	0.049	10.246	0.000
S23	0.579	0.049	11.698	0.000
S24	0.620	0.044	14.058	0.000
S25	0.439	0.039	11.216	0.000
S26	0.689	0.047	14.670	0.000
S28	0.531	0.046	11.461	0.000
S29	0.618	0.049	12.615	0.000
S30	0.544	0.045	12.046	0.000
S31	0.580	0.043	13.492	0.000

R-SQUARE

Observed Variable	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
S1	0.280	0.051	5.473	0.000
S2	0.430	0.050	8.657	0.000
S3	0.358	0.051	7.017	0.000
S4	0.291	0.046	6.340	0.000
S5	0.272	0.045	5.997	0.000
S6	0.391	0.057	6.813	0.000
S7	0.511	0.056	9.040	0.000
S8	0.422	0.070	6.035	0.000
S9	0.586	0.040	14.496	0.000
S10	0.538	0.046	11.692	0.000
S11	0.476	0.050	9.614	0.000
S12	0.442	0.048	9.193	0.000
S13	0.373	0.056	6.639	0.000
S14	0.537	0.043	12.427	0.000
S15	0.258	0.053	4.859	0.000
S16	0.536	0.045	12.007	0.000
S17	0.601	0.047	12.804	0.000
S18	0.489	0.052	9.323	0.000
S19	0.492	0.048	10.238	0.000
S21	0.409	0.052	7.833	0.000
S22	0.497	0.049	10.108	0.000
S23	0.421	0.049	8.505	0.000

S24	0.380	0.044	8.629	0.000
S25	0.561	0.039	14.322	0.000
S26	0.311	0.047	6.633	0.000
S28	0.469	0.046	10.103	0.000
S29	0.382	0.049	7.789	0.000
S30	0.456	0.045	10.080	0.000
S31	0.420	0.043	9.790	0.000

MODEL MODIFICATION INDICES

Minimum M.I. value for printing the modification index 10.000

	M.I.	E.P.C.	Std E.P.C.	StdYX E.P.C.
BY Statements				
ELA BY S2	22.806	0.360	0.360	0.259
ELA BY S12	15.718	0.273	0.273	0.208
CT BY S3	25.107	-0.323	-0.323	-0.267
WITH Statements				
S2 WITH S1	12.382	0.331	0.331	0.215
S7 WITH S6	26.938	0.307	0.307	0.354
S10 WITH S2	12.647	-0.202	-0.202	-0.218
S12 WITH S3	11.470	0.187	0.187	0.198
S13 WITH S12	11.651	-0.294	-0.294	-0.205
S14 WITH S11	17.276	0.424	0.424	0.274
S21 WITH S11	10.552	0.339	0.339	0.197
S24 WITH S17	25.761	0.427	0.427	0.314
S25 WITH S12	11.055	0.205	0.205	0.197
S25 WITH S13	12.104	-0.329	-0.329	-0.211
S25 WITH S21	10.560	0.279	0.279	0.194
S26 WITH S23	23.035	0.449	0.449	0.273
S29 WITH S4	10.748	0.313	0.313	0.188
S29 WITH S18	11.812	0.257	0.257	0.206
S29 WITH S28	19.592	0.310	0.310	0.258

APPENDIX G

THE COGNITIVE PROCESSING STRATEGIES SCALES

Based on the bifactor CFA model respecification, 18 items were retained and listed below. For readers to conveniently locate these items, listed below were the number in Figure 5, the number in Appendix C, and the number in the original MSLQ, as well as their corresponding categories. REH = rehearsal, ELA = elaboration, CT = critical thinking, ORG = organization, MSR = metacognitive self-regulation, and GCS = general cognitive strategies.

	# in Fig. 5	Bifactor Category	# in the CMLSS	# in the Original MSLQ	Original Category
1. When I study for this class, I practice saying the material to myself over and over.	S1	CT & GCS	2	39	REH
2. I make lists of important items for this course and memorize the lists.	S4	CT & GCS	26	72	REH
3. When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions.	S5	ELA & GCS	3	53	ELA
4. When studying for this class, I try to relate the material to what I already know.	S7	ELA & GCS	12	64	ELA
5. When I study for this course, I write brief summaries of the main ideas from the materials and my class notes.	S8	ELA & GCS	17	67	ELA
6. I try to understand the material in this class by making connections between the readings and the concepts from the lectures.	S9	ELA & GCS	22	69	ELA
7. I try to apply ideas from other class activities such as lecture and discussion.	S10	ELA & GCS	27	81	ELA

8. I make simple charts, diagrams, or tables to help me organize course material.	S13	ELA & GCS	20	49	ORG
9. When I study for this course, I go over my class notes and make an outline of important concepts.	S14	CT & GCS	30	63	ORG
10. I often find myself questioning things I hear or read in this course to decide if I find them convincing.	S15	CT & GCS	6	38	CT
11. When a theory, interpretation, or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence.	S16	CT & GCS	11	47	CT
12. I treat the course material as a starting point and try to develop my own ideas about it.	S17	CT & GCS	14	51	CT
13. Whenever I read or hear an assertion or conclusion in this class, I think about possible alternatives.	S19	CT & GCS	29	71	CT
14. When studying for this course, I make up questions to help focus on learning materials.	S21	ELA & GCS	4	36	MSR
15. When I become confused about something I'm studying for this class, I go back and try to figure it out.	S22	ELA & GCS	7	41	MSR
16. If course materials are difficult to understand, I change the way I study the material.	S23	GCS	10	44	MSR
17. When I study for this class, I set goals for myself in order to direct my activities in each study period.	S30	GCS	28	78	MSR
18. If I get confused taking notes in class, I make sure I sort it out afterwards.	S31	GCS	31	79	MSR

APPENDIX H

ACHIEVEMENT GOAL QUESTIONNAIRE

The following questions ask about your motivation for and attitudes about this class. There are no right or wrong answers, just answer as accurately as possible. Use the scale below to answer the questions. If you think the statement is very true of you, circle 7; if a statement is not at all true of you, circle 1. If the statement is more or less true of you, find the number between 1 and 7 that best describes you.

	Not at all true	→					Very true of me
1. I want to learn as much as possible from this course.	1	2	3	4	5	6	7
2. I worry that I may not learn all that I possibly could in this course.	1	2	3	4	5	6	7
3. It is important for me to do better than other students.	1	2	3	4	5	6	7
4. Sometimes I'm afraid that I may not understand the content of this course as thoroughly as I'd like.	1	2	3	4	5	6	7
5. It is important for me to do well compared to others in this course.	1	2	3	4	5	6	7
6. My goal in this course is to get a better grade than most of the other students.	1	2	3	4	5	6	7
7. It is important for me to understand the content of this course as thoroughly as possible.	1	2	3	4	5	6	7
8. I just want to avoid doing poorly in this course.	1	2	3	4	5	6	7
9. I desire to completely master the material presented in this course.	1	2	3	4	5	6	7
10. My goal in this course is to avoid performing poorly.	1	2	3	4	5	6	7
11. I am often concerned that I may not learn all that there is to learn in this course.	1	2	3	4	5	6	7
12. My fear of performing poorly in this course is often what motivates me.	1	2	3	4	5	6	7

APPENDIX I

INTERVIEW PROTOCOL

My name is _____, today I am with ____. We are talking about his/her experience with self-regulated learning during field-based practices.

1. Have you learned the concept of self-regulated learning in any courses that you have taken for your Physical Education Teacher Certification program? If so, could you please define self-regulated learning in your own words?
2. Have you taught a lesson since you enrolled in our program? If so, please describe the strategies you sued for a lesson?
3. Were you aware of your thoughts and behaviors during your teaching? What did you do if something went wrong?
4. What would you do if you had a problem in lesson planning or teaching?
5. What did you do and think after you taught a lesson?

Ok. We talked about self-regulated learning during your field-based practices, particularly _____. Is there anything you would like to add or elaborate?

Thank you for participating this interview! If you have any question, please feel free to contact me.

APPENDIX J

UNIVARIATE DESCRIPTIVE STATISTICS FOR THE AGQ AND THE CPSS

	N	Min	Max	Mean	SD	Skewness	Kurtosis
G1	370	4	7	6.389	.919	-1.332	.612
G2	370	1	7	3.197	1.822	.443	-.919
G3	370	1	7	5.035	1.632	-.802	.128
G4	370	1	7	3.835	1.772	-.019	-1.069
G5	370	1	7	5.065	1.628	-.737	-.101
G6	370	1	7	4.608	1.808	-.368	-.777
G7	370	3	7	6.130	1.104	-1.170	.495
G8	370	1	7	5.651	1.750	-1.211	.405
G9	370	2	7	5.659	1.295	-.776	-.058
G10	370	1	7	5.800	1.600	-1.413	1.209
G11	370	1	7	3.508	1.801	.216	-.998
G12	370	1	7	4.581	1.899	-.422	-.973
S1	370	1	7	4.643	1.716	-.389	-.754
S2	370	1	7	4.303	1.761	-.201	-.930
S3	370	1	7	5.114	1.621	-.880	.147
S4	370	3	7	5.881	1.093	-.827	.064
S5	370	1	7	3.573	1.856	.250	-1.022
S6	370	1	7	5.176	1.385	-.626	.020
S7	370	2	7	5.303	1.279	-.651	.068
S8	370	1	7	3.157	1.834	.531	-.791
S9	370	1	7	4.824	1.779	-.549	-.671
S10	370	1	7	3.608	1.742	.164	-.862
S11	370	1	7	4.381	1.554	-.260	-.470
S12	370	1	7	4.438	1.637	-.185	-.600
S13	370	1	7	4.286	1.532	-.104	-.604
S14	370	1	7	3.392	1.747	.376	-.732
S15	370	2	7	5.378	1.322	-.722	-.054
S16	370	1	7	4.557	1.570	-.209	-.594
S17	370	1	7	4.789	1.584	-.502	-.505
S18	370	1	7	4.341	1.832	-.264	-.975

Note: Initial G represents items of the AGQ. Initial S represents items of the CPSS.