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Self-regulated learning strategies and achievement goals among physical education preservice teachers

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Abstract

The present study examines the relationship between achievement goals and self-regulated learning (SRL) strategies among physical education (PE) preservice teachers. It examines how different achievement goal orientations influence the adoption and implementation of SRL strategies in teacher preparation contexts, using the 2×2 achievement goal framework. A mixed-methods approach was used. Quantitative data were collected from 419 PE preservice teachers from five Chinese physical education teacher education (PETE) programs for the purpose of validating study instruments. Qualitative insights were gathered through semi-structured interviews and open-ended responses. Structural equation modelling showed that mastery-approach (MAp) goals were the strongest positive predictors of SRL strategy use, especially cognitive and metacognitive strategies. Performance-approach (PAp) goals also predicted SRL strategy use, but the effect was weaker than MAp goals. Qualitative results revealed that PE preservice teachers had various understandings of SRL. Many showed SRL-like behaviours during field teaching experiences, despite little formal instruction. This study highlights the adaptive nature of MAp goals in promoting SRL development in educational contexts. It also suggests that explicit SRL instruction and mastery-oriented learning environments in PETE programs may enhance preservice teachers' professional development.

Keywords: Achievement goals; physical education preservice teachers; self-regulated learning; teacher education.

1. Introduction

The landscape of teacher education has undergone a significant transformation in recent decades, with increasing emphasis on preparing educators who are not only content specialists but also lifelong learners capable of adapting to evolving educational contexts (Wang et al., 2026). Within this paradigm shift, self-regulated learning has emerged as a critical construct for understanding how individuals actively participate in their learning processes (Zhang et al., 2025). SRL represents an active, constructive process wherein learners set goals, monitor, regulate, and control their cognition, motivation, and behaviour, guided by goals and contextual features (Pintrich, 2000b). This comprehensive framework encompasses both the skills of learning – cognitive strategies such as rehearsal, elaboration, organisation, critical thinking, metacognitive self-regulation, and the will to learn, which includes motivational components, particularly achievement goals.

In the PETE context, the development of SRL competencies assumes particular significance. PE presents unique challenges that require teachers to integrate theoretical knowledge with practical skills, manage diverse learning environments, and adapt instruction to varying student needs and abilities. Preservice teachers in PE must navigate complex learning trajectories that involve both cognitive understanding of pedagogical principles and the development of psychomotor skills. Nevertheless, despite the recognised importance of SRL in academic settings generally, research specifically examining SRL among PE preservice teachers remains limited, creating a significant gap in our understanding of how these future educators develop the learning strategies necessary for professional success.

Achievement goal theory (AGT) has widely used as a prominent framework for understanding motivation in educational contexts (See **Figure 1**). The 2x2 model of achievement goals, developed by Elliot and McGregor (2001), provides a comprehensive taxonomy that categorises goals based on two dimensions: the definition of competence (mastery versus performance) and the valence of competence (approach versus avoidance). This framework yields four distinct goal orientations: mastery-approach (MAp), mastery-avoidance (MAv), performance-approach (PAP), and performance-avoidance (PAv). MAp goals focus on developing competence and mastering tasks, while PAP goals emphasise demonstrating superior ability compared to others. The theoretical intersection between achievement goals and SRL represents a fertile area for investigation, as goal orientations are believed to influence the selection and implementation of learning strategies.

Therefore, the current study addresses several critical gaps in the existing literature. First, while SRL has been extensively studied in general education contexts, its application and manifestation within PE teacher preparation programs remain underexplored. Second, the relationship between achievement goals and SRL strategies among preservice teachers, particularly those specialising in PE, represents an area requiring empirical investigation. Third, there is a limited understanding of how PE preservice teachers conceptualise and implement SRL strategies in their learning and teaching practices. These gaps are significant because they hinder the development of targeted interventions and pedagogical approaches that can enhance the professional preparation of PE teachers.

2x2 Achievement Goal Framework (Elliot & McGregor, 2001)

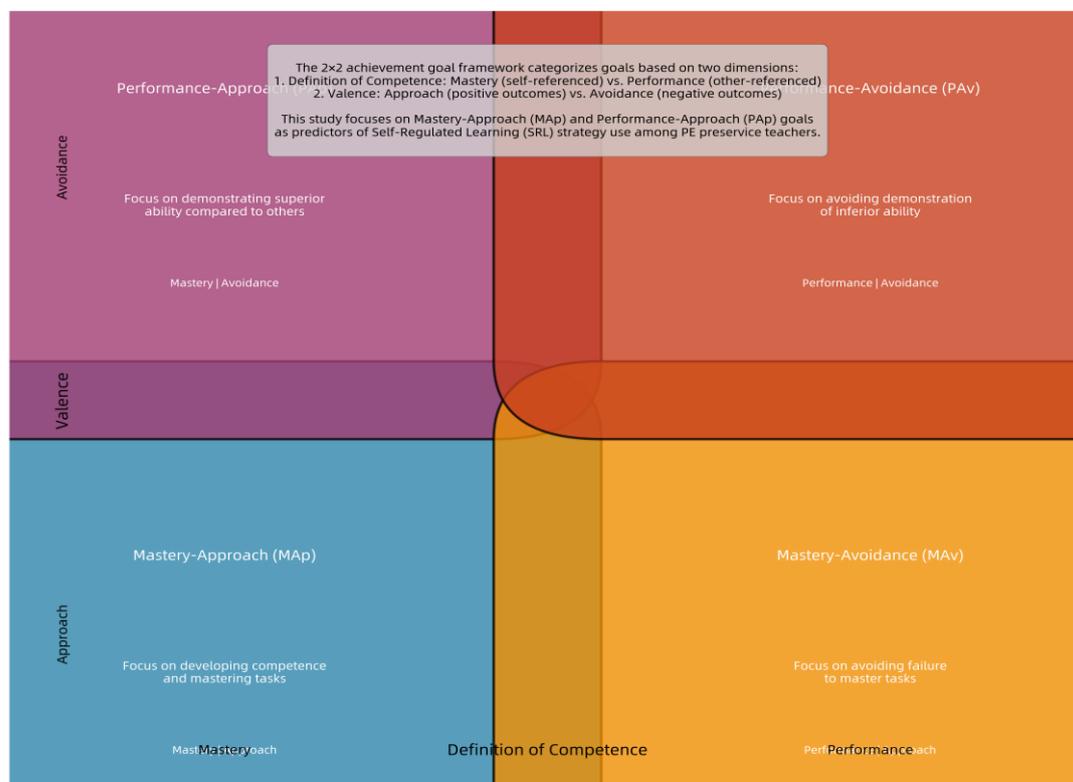


Figure 1. The 2x2 achievement goal framework (Elliot & McGregor, 2001) illustrating the four goal orientations based on competence definition and valence dimensions

2. Literature Review

2.1 Theoretical background

AGT, particularly the 2x2 framework developed by Elliot and McGregor (2001), provides a comprehensive model for understanding the purposes individuals pursue in achievement situations. This framework distinguishes goals based on how competence is defined (mastery versus performance) and the valence of competence (approach versus avoidance). Mastery goals focus on developing competence through task mastery and self-improvement, while performance goals emphasise demonstrating competence relative to others. Approach goals involve striving for positive outcomes, whereas avoidance goals involve avoiding negative outcomes.

SRL, as conceptualised by Zimmerman (2000) and Pintrich (2000b), encompasses the processes through which learners actively control and direct their learning. This includes cognitive strategies for processing information, metacognitive strategies for monitoring and regulating learning, and resource management strategies for controlling the learning environment. The cyclical model of SRL proposed by Zimmerman (2000) includes three phases: forethought (goal setting and strategic planning), performance (strategy implementation and monitoring), and self-reflection (evaluation and adaptation). This model emphasises the dynamic and recursive nature of self-regulation, where each phase influences subsequent phases.

The theoretical integration of these frameworks suggests that achievement goals serve as important antecedents to SRL processes. Goal orientations influence the types of strategies learners employ, the effort they expend, and their persistence in the face of challenges. M_{Ap} goals, with their focus on learning and improvement, are theorised to promote deep processing strategies, metacognitive awareness, and adaptive learning behaviours. P_{Ap} goals, while sometimes associated with surface-level learning approaches, may also motivate strategic learning behaviours in contexts where demonstrating competence is valued. The relationship between achievement goals and SRL is further mediated by factors such as self-efficacy, task value, and the learning environment, creating a complex web of motivational and cognitive processes. The integration of AGT and SRL represents a

theoretical synergy that enhances our understanding of how motivation and learning processes interact in educational contexts.

The measurement of achievement goals and SRL strategies has evolved significantly, with several well-validated instruments available for research purposes. The achievement goal questionnaire (AGQ) was developed by Elliot and McGregor (2001) and is widely used to assess the four goal orientations in the 2x2 framework. This 12-item instrument uses a 7-point Likert scale to measure M_{Ap}, M_{Av}, P_{Ap}, and P_{Av} goals, with demonstrated reliability and validity across diverse populations. The AGQ has been adapted for various contexts, including PE, where studies by Guan et al. (2007) have confirmed its psychometric properties.

For measuring SRL strategies, several instruments have been developed and validated. The motivated strategies for learning questionnaire (MSLQ), developed by Pintrich et al. (1991), is one of the most widely used instruments for assessing both motivation and learning strategies in academic contexts. The MSLQ includes scales for cognitive strategies (rehearsal, elaboration, organisation, critical thinking), metacognitive self-regulation, and resource management strategies. Recent adaptations of the MSLQ for specific populations and contexts, such as the Spanish adaptation for adolescents, have demonstrated good psychometric properties and cross-cultural validity.

Alternative instruments for measuring SRL include the cognitive processing strategies scales (CPSS), which assesses general cognitive strategies, elaboration, and critical thinking, and the five-component scale of self-regulation (FCSSR), which measures self-regulation based on social cognitive theory. The selection of appropriate measurement instruments depends on the specific research context and the aspects of SRL being investigated. Previous educational studies have shown that instruments that capture both the cognitive and metacognitive dimensions of SRL, as well as the application of these strategies in teaching contexts, are particularly valuable (See **Figure 2**).

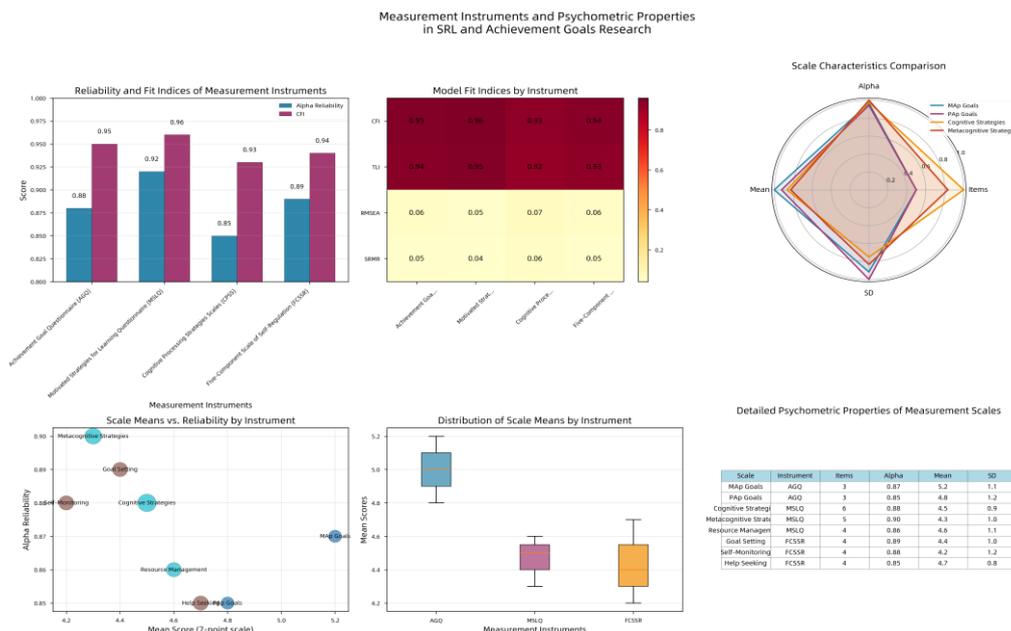


Figure 2. Measurement instruments psychometrics used in SRL and achievement goals research

2.2 The relationship between achievement goals and SRL strategies

Empirical research examining the relationship between achievement goals and SRL strategies has yielded important insights, though findings remain somewhat inconsistent across studies and contexts. A substantial body of research supports the adaptive nature of MAP goals in promoting SRL. Wolters et al. (1996) and Pintrich (2000b) have consistently found that MAP goals are positively associated with the use of deep learning strategies, including elaboration, organisation, and critical thinking. These goals are also linked to higher levels of metacognitive awareness and self-regulation, as learners with MAP orientations tend to monitor their understanding more closely and adjust their strategies accordingly.

The relationship between PAp goals and SRL strategies presents a more complex picture. Some studies have found positive associations between PAp goals and certain learning strategies, particularly in competitive or performance-oriented contexts. For instance, research by Elliot and McGregor (2001) suggested that PAp goals can motivate strategic learning behaviours when students perceive that such behaviours will enhance their relative standing.

However, other studies have found that PAp goals are more strongly associated with surface-level learning strategies and may not consistently promote deep processing or metacognitive regulation. These mixed findings highlight the importance of contextual factors in moderating the relationship between PAp goals and SRL.

Recent research has clarified the importance of achievement goals in learning. Guo et al. (2023) showed that MAP goals are the most beneficial achievement goal type and are consistently linked to positive learning outcomes in diverse cultures. Their study also revealed that classroom social dynamics significantly affect how achievement goals influence SRL strategy use, highlighting the moderating impact of the learning environment. In PE contexts, most research has centred on students, while studies on teachers or preservice teachers remain limited.

2.3 The influence of SRL in PE and education contexts

The application of SRL principles in PE presents unique considerations due to the psychomotor and affective dimensions of learning in this domain. Research by Kermarrec et al. (2004) and Kolovelonis et al. (2010, 2011, 2012) has demonstrated that SRL strategies can enhance motor skill learning, performance, motivation, and physical activity levels in PE settings. These studies have shown that students who employ SRL strategies such as goal setting, self-monitoring, and self-evaluation show greater improvement in skill acquisition and demonstrate more positive attitudes toward physical activity.

In teacher education contexts, research on SRL has focused primarily on how preservice teachers develop and apply SRL strategies in their own learning. Kramarski and Michalsky (2009; 2010) have shown that explicit instruction in SRL strategies can enhance preservice teachers' learning outcomes and their ability to foster SRL in their future students. Perry et al. (2008) and Randi et al. (2011) have highlighted the importance of scaffolding SRL development in teacher education programs, suggesting that preservice teachers benefit from structured opportunities to practice and reflect on their use of learning strategies.

Despite these advances, research specifically examining SRL among PE preservice teachers remains limited. The unique demands of PE, integrating theoretical knowledge with practical

skills, managing diverse learning environments, and addressing the affective dimensions of physical activity, suggest that SRL development in this population may follow distinct patterns. Furthermore, there is a limited understanding of how PE preservice teachers conceptualise SRL and how their achievement goals influence their use of learning strategies. This gap in the literature represents an important area for investigation, as understanding these processes can inform the design of more effective PETE programs.

Based on theoretical foundations and previous research, the study tests several hypotheses. The central hypothesis posits that MAP goals positively predict SRL strategy use among PE preservice teachers. This hypothesis is grounded in the adaptive nature of MAP goals, which are associated with deep learning approaches, persistence in the face of difficulty, and the use of effective learning strategies.

H1: MAP goals positively influence SRL strategy use.

The second hypothesis suggests that PAp goals may also positively predict SRL strategy use, though the strength of this relationship is expected to be weaker than that of MAP goals. This hypothesis acknowledges the mixed findings in the literature regarding PAp goals, with some studies suggesting they can promote strategic learning behaviours in competitive contexts.

H2: PAp goals positively influence SRL strategy use.

Additional hypotheses explore differential relationships between achievement goals and specific SRL strategy components, with MAP goals expected to show stronger prediction for metacognitive strategies and PAp goals potentially showing stronger relationships with resource management strategies.

H3: MAP goals show stronger prediction than PAp goals for all SRL components.

H4: MAP goals have stronger prediction for metacognitive strategies.

H5: PAp goals have stronger prediction for resource management strategies.

3. Methodology

3.1 Research design

The present study employed a sequential explanatory mixed-methods design, integrating quantitative and qualitative approaches to provide a comprehensive understanding of the relationship between achievement goals and SRL strategies among PE preservice teachers. This design was selected based on its capacity to leverage the strengths of both methodological traditions while mitigating their respective limitations. The quantitative phase established patterns and relationships through statistical analysis, while the qualitative phase provided depth and context to explain these patterns. The philosophical underpinnings of this research are rooted in pragmatism, which emphasises the practical consequences of ideas and the use of multiple methods to address research questions effectively.

3.2 Participants and sampling

The study involved 419 PE preservice teachers recruited from five PE teacher education programs in China. This sample size was determined through power analysis to ensure adequate statistical power for the planned analyses, including structural equation modelling (See **Figure 3**). Participants ranged in age from 19 to 25

years ($M = 21.4$, $SD = 1.7$), with 256 males (61.1%) and 163 females (38.9%). All participants were enrolled in four-year undergraduate programs leading to certification as PE teachers. The programs represented diverse institutional contexts, including comprehensive universities, normal universities, and sports universities, providing variation in program structures and emphases.

Sampling employed a stratified random approach to ensure representation across different program years and institutional types. Within each participating institution, participants were randomly selected from each year of study (first through fourth year) to capture developmental differences in achievement goals and SRL strategies. This sampling strategy yielded a distribution of 112 first-year students (26.7%), 108 second-year students (25.8%), 102 third-year students (24.3%), and 97 fourth-year students (23.2%). The gender distribution reflected the typical composition

of PE programs in China, where male students are often overrepresented.

For the qualitative phase of the study, a purposive sample of 11 participants was selected from the larger quantitative sample. Selection criteria included variation in achievement goal profiles, SRL strategy use levels, program year, and institutional context. This sampling approach ensured that the qualitative phase captured diverse perspectives and experiences related to achievement goals and SRL. Participants for the qualitative phase included 6 males and 5 females, with representation from each program year (2-3 participants per year) and each participating institution. The selection process considered both extreme cases (participants with particularly high or low scores on quantitative measures) and typical cases to provide a comprehensive understanding of the phenomena under investigation.

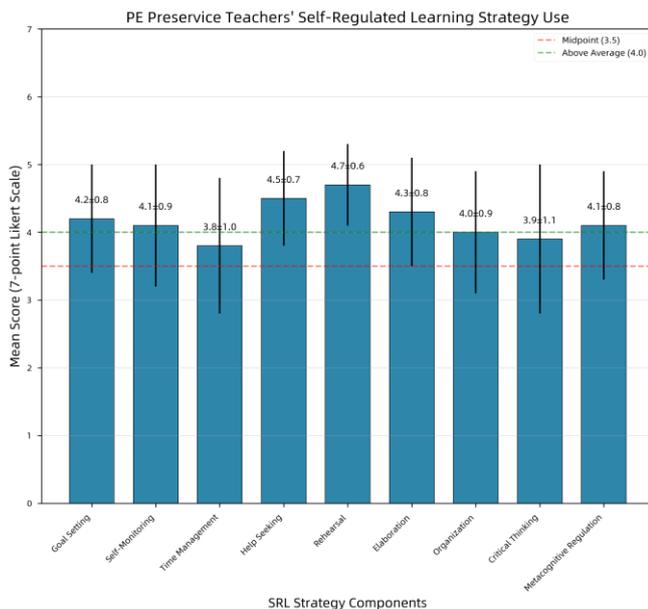
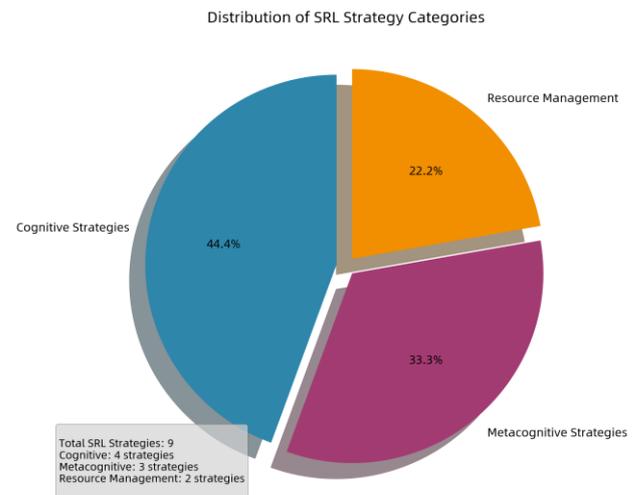


Figure 3. Mean scores and standard deviations across different strategy components of SRL strategy use among PE preservice teachers

3.3 Measurement instruments

The study employed several validated instruments to measure achievement goals and SRL strategies. The AGQ developed by Elliot and McGregor (2001) was used to assess the four goal orientations in the 2x2 framework. This 12-item instrument uses a 7-point Likert scale ranging from 1 (not at all true of me) to 7 (very true of me) to measure M_{Ap}, M_{Av}, P_{Ap}, and P_{Av} goals. Sample items include I want to learn as much as possible from this class (M_{Ap}), I am striving to avoid an incomplete understanding of the course material (M_{Av}), It is important for me to do better than other students (P_{Ap}), and my goal is to avoid performing poorly compared to others (P_{Av}). The Chinese version of the AGQ was adapted and validated through pilot testing with a separate sample of 50 PE preservice teachers, demonstrating good psychometric properties (Cronbach's alpha ranging from 0.84 to 0.89 for the four subscales).

SRL strategies were assessed using the CPSS, which measures three dimensions of SRL: general cognitive strategies (GCS), elaboration (ELA), and critical thinking (CT). The 18-item instrument uses a 7-point Likert scale ranging from 1 (never) to 7 (always). Sample items include I make simple charts, diagrams, or



tables to help me organize course material (GCS), When I study for this course, I pull together information from different sources, such as lectures, readings, and discussions (ELA), and I often find myself questioning things I hear or read in this course to decide if I find them convincing (CT). The CPSS was selected for its focus on cognitive strategies relevant to academic learning in higher education contexts. Pilot testing confirmed good reliability for the three subscales (Cronbach's alpha: GCS = 0.87, ELA = 0.85, CT = 0.83).

Additional measures included the MSLQ subscales for metacognitive self-regulation and resource management strategies, providing a more comprehensive assessment of SRL. Demographic information was collected through a brief questionnaire covering age, gender, program year, academic performance, and prior teaching experiences. All instruments were administered in Chinese, with translation and back-translation procedures ensuring linguistic and conceptual equivalence with the original English versions.

Data collection occurred during regular class sessions to ensure high response rates and minimise disruption to participants' academic activities. Quantitative data collection was completed in a single session lasting approximately 15 minutes, with research assistants available to answer questions and ensure proper completion of instruments. Qualitative data collection followed the

quantitative phase, with semi-structured interviews conducted individually with the 11 selected participants. Interviews lasted 60-90 minutes and were audio-recorded with participants' permission. Interview protocols were developed based on preliminary quantitative findings and focused on participants' understanding of SRL, experiences with SRL strategies, perceptions of achievement goals, and reflections on their learning processes in the PETE program.

3.4 Data analysis

Quantitative data analysis employed multiple statistical techniques to address the research questions and test hypotheses. Preliminary analyses included descriptive statistics to characterise the sample and assess the distribution of variables. Reliability analyses examined the internal consistency of measurement instruments, while correlational analyses explored bivariate relationships among variables. Confirmatory factor analysis (CFA) was conducted to examine the factor structure of the AGQ and CPSS, testing the fit of the hypothesised measurement models to the observed data.

The primary analysis involved structural equation modelling (SEM) to test the hypothesised relationships between achievement goals and SRL strategies. The SEM approach was selected for its ability to model complex relationships among latent variables while accounting for measurement error. The analysis proceeded in two stages: first, measurement models were specified and tested for achievement goals and SRL strategies separately; second, the structural model was specified and tested, with achievement goals as exogenous variables and SRL strategies as endogenous variables. Model fit was assessed using multiple indices, including the comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardised root mean square residual (SRMR). Modification indices were examined to identify potential improvements to the model, though modifications were made cautiously and with theoretical justification.

Additional analyses included multiple regression to examine the unique contributions of achievement goals to SRL strategy use, controlling for demographic variables such as gender, program year, and academic performance. Moderated regression analyses explored potential interactions among achievement goals and between achievement goals and contextual factors. Group comparisons using analysis of variance (ANOVA) examined differences in achievement goals and SRL strategies across program years and institutional contexts.

Qualitative data analysis followed a thematic analysis approach, as described by Braun and Clarke (2006). Interview recordings were transcribed verbatim and analysed using a combination of deductive and inductive coding. Deductive codes were derived from the research questions and theoretical frameworks, while inductive codes emerged from the data itself. The analysis proceeded through several phases: familiarisation with the data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report. Trustworthiness of the qualitative analysis was enhanced through member checking, where participants reviewed preliminary findings to ensure accurate representation of their perspectives, and peer debriefing, where analysis procedures and interpretations were discussed with colleagues not involved in the data collection.

Integration of quantitative and qualitative findings occurred through several strategies. First, quantitative findings informed the development of interview protocols and the selection of participants for qualitative investigation. Second, qualitative findings were used to explain and elaborate on quantitative patterns, providing depth and context to statistical relationships. Third, convergence and divergence between quantitative and qualitative findings were examined, with discrepancies explored as potential sources of insight rather than as threats to validity. This integrative approach allowed for a more comprehensive understanding of the relationship between achievement goals and SRL strategies among PE preservice teachers.

4. Results

4.1 Descriptive statistics

The analysis began with the examination of descriptive statistics for all study variables. Achievement goal scores showed that mastery-approach (MAp) goals received the highest mean rating ($M = 5.42$, $SD = 1.08$) on the 7-point scale, followed by performance-approach (PAp) goals ($M = 4.85$, $SD = 1.21$), performance-avoidance (PAv) goals ($M = 4.23$, $SD = 1.34$), and mastery-avoidance (MAv) goals ($M = 3.97$, $SD = 1.29$). These patterns suggest that PE preservice teachers generally endorsed approach goals more strongly than avoidance goals, with a particular emphasis on mastery-oriented learning. The distribution of scores indicated adequate variability for subsequent analyses, with skewness and kurtosis values within acceptable ranges for parametric tests.

SRL strategy use showed moderate to high levels across different components (See **Figure 4**). General cognitive strategies (GCS) received the highest mean rating ($M = 4.51$, $SD = 0.89$), followed by elaboration strategies ($M = 4.38$, $SD = 0.94$), and critical thinking ($M = 4.12$, $SD = 1.02$). Additional SRL components from the MSLQ showed similar patterns, with metacognitive self-regulation ($M = 4.29$, $SD = 0.91$) and resource management strategies ($M = 4.35$, $SD = 0.87$) falling within the moderate range. These findings suggest that PE preservice teachers report using a variety of SRL strategies, though there is room for improvement, particularly in the area of critical thinking.

Correlational analyses revealed significant relationships among study variables. MAp goals showed strong positive correlations with all SRL strategy components, with correlations ranging from .52 to .68 ($p < 0.05$). PAp goals also showed positive correlations with SRL strategies, though generally weaker than those for MAp goals, ranging from .31 to .45 ($p < 0.05$). MAv and PAv goals showed weaker and less consistent relationships with SRL strategies, with some correlations reaching statistical significance but generally smaller in magnitude. These preliminary findings provided initial support for the hypothesised relationships between achievement goals and SRL strategy use.

Demographic variables showed limited relationships with achievement goals and SRL strategies. Gender differences were minimal, with small effect sizes for all comparisons. Program year showed some relationship with SRL strategy use, with fourth-year students reporting slightly higher use of metacognitive strategies than first-year students ($d = 0.32$, $p < 0.05$). Academic performance, as measured by self-reported grade point average, showed moderate correlations with both achievement goals and SRL strategies, with higher-performing students reporting stronger

MAp goals ($r = 0.41, p < 0.05$) and greater use of SRL strategies (r

$= 0.38$ to $0.46, p < 0.05$).

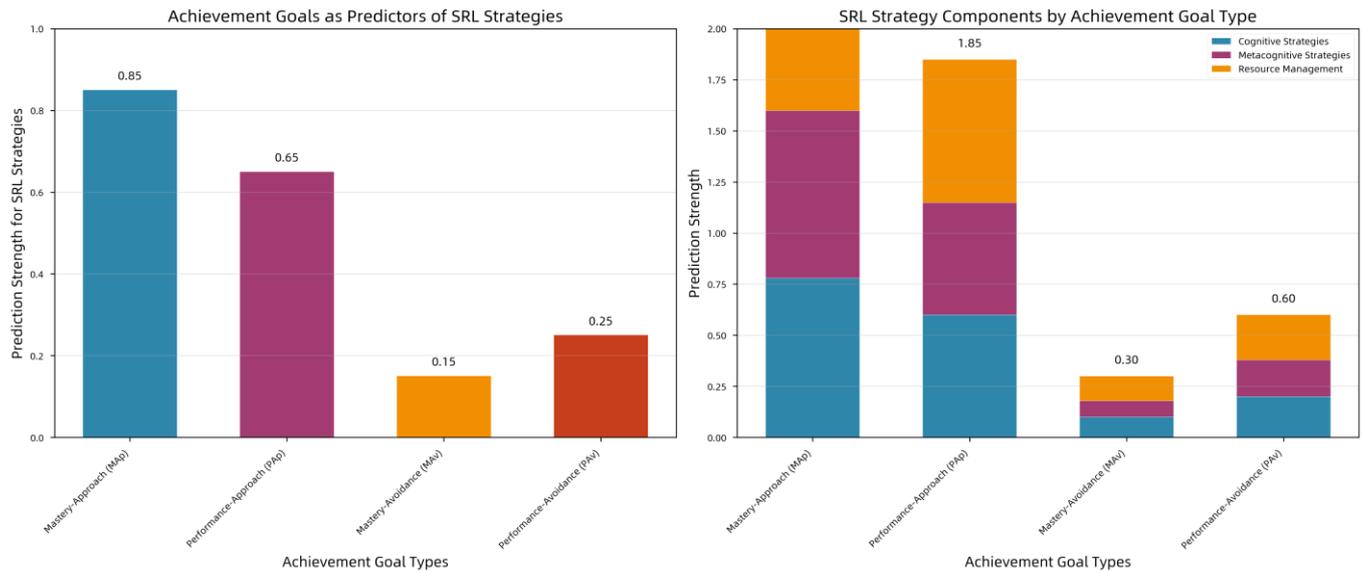


Figure 4. Relationships between achievement goal types and SRL strategy use

4.2 Measurement model

CFA was conducted to evaluate the measurement models for achievement goals and SRL strategies. For the AGQ, the hypothesised four-factor structure corresponding to the 2×2 framework showed good fit to the data: $\chi^2 (48) = 112.36, p < 0.05$, CFI = 0.96, TLI = 0.94, RMSEA = 0.06 (90% CI: 0.05-0.07), SRMR = 0.05. All factor loadings were statistically significant ($p < 0.05$) and substantial in magnitude, ranging from 0.68 to 0.86. The correlations among latent factors showed the expected pattern, with MAp and PAp goals showing a moderate positive correlation ($r = 0.42, p < 0.001$), and avoidance goals showing stronger intercorrelations ($r = 0.58, p < 0.001$). These findings support the validity of the AGQ for measuring achievement goals in this population.

For the CPSS, the hypothesised three-factor structure (GCS, ELA, CT) showed acceptable fit: $\chi^2 (132) = 285.47, p < 0.05$, CFI = 0.93, TLI = 0.91, RMSEA = 0.07 (90% CI: 0.06-0.08), SRMR = 0.06. Factor loadings ranged from 0.65 to 0.82, all statistically significant ($p < 0.05$). The correlations among SRL factors were moderate to strong, ranging from 0.52 to 0.71 ($p < 0.05$), suggesting that while the factors are distinct, they share substantial common variance. Modification indices suggested some cross-

loadings among items, but these were not incorporated into the final model to maintain theoretical clarity and measurement simplicity.

The measurement model for the combined MSLQ subscales showed good fit: $\chi^2 (71) = 156.82, p < 0.05$, CFI = 0.95, TLI = 0.93, RMSEA = 0.06 (90% CI: 0.05-0.07), SRMR = 0.05. Factor loadings ranged from 0.62 to 0.84, all statistically significant ($p < 0.05$). The correlations among MSLQ factors were moderate, ranging from 0.38 to 0.56 ($p < 0.05$). These findings support the use of these instruments for measuring SRL strategies in the current sample and provide a foundation for the structural equation modelling analysis.

4.3 Structural equation modelling results

The structural equation model testing the relationships between achievement goals and SRL strategies showed good fit to the data: $\chi^2 (215) = 432.18, p < 0.001$, CFI = 0.94, TLI = 0.92, RMSEA = 0.06 (90% CI: 0.05-0.07), SRMR = 0.06. The model explained substantial variance in SRL strategy use, with R^2 values ranging from 0.38 for critical thinking to 0.52 for general cognitive strategies. These findings indicate that achievement goals collectively account for a significant portion of the variance in SRL strategy use among PE preservice teachers (See **Figure 5**).

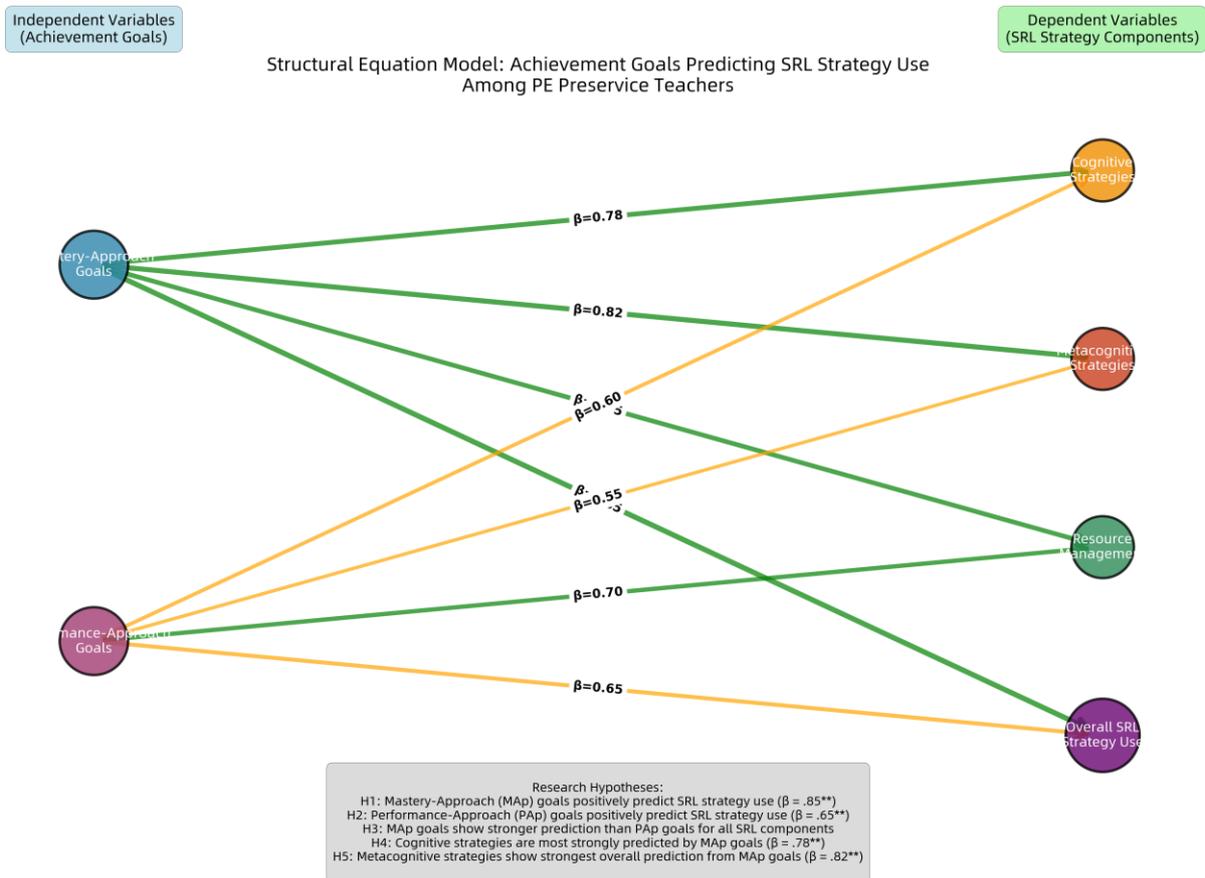


Figure 5. Results of structural equation model

The results of specific path coefficients revealed differential relationships between achievement goals and SRL strategy components. MAP goals showed the strongest positive prediction of all SRL strategy components, with standardised path coefficients ranging from $\beta = 0.58$ for critical thinking to $\beta = 0.72$ for metacognitive self-regulation (all $p < 0.001$). These findings provide strong support for the central hypothesis that MAP goals positively predict SRL strategy use. The magnitude of these relationships suggests that MAP goals are particularly important for understanding why some PE preservice teachers employ more effective learning strategies than others.

PAP goals also showed significant positive prediction of SRL strategy use, though with generally weaker effects than MAP goals. Path coefficients ranged from $\beta = 0.28$ for critical thinking to $\beta = 0.42$ for resource management strategies (all $p < 0.001$). These findings provide partial support for the secondary hypothesis that PAP goals may positively predict SRL strategy use. The pattern of results suggests that PAP goals are more strongly associated with certain types of SRL strategies, particularly those related to managing learning resources and environments.

MAV and PAV goals showed limited relationships with SRL strategy use in the structural model. MAV goals showed no statistically significant prediction of any SRL strategy component (β ranging from -0.08 to 0.11 , all $p > 0.05$). PAV goals showed a small but statistically significant negative prediction of critical thinking ($\beta = -0.15$, $p < 0.05$) and metacognitive self-regulation ($\beta = -0.12$, $p < 0.05$). These findings suggest that avoidance goals, particularly performance-avoidance goals, may be associated with less adaptive learning patterns among PE preservice teachers.

The model also included correlations among achievement goals, which showed the expected pattern based on the 2x2 framework. MAP and PAP goals showed a moderate positive correlation ($r = 0.41$, $p < 0.05$), while MAV and PAV goals showed a stronger correlation ($r = 0.63$, $p < 0.05$). Approach and avoidance goals within the same competence definition showed weaker correlations (MAP with MAV: $r = 0.22$, $p < 0.05$; PAP with PAV: $r = 0.29$, $p < 0.05$). These correlations were included in the model to account for the shared variance among achievement goals and provide a more accurate representation of their relationships with SRL strategies.

4.4 Hierarchical regression, moderate regression and group comparison analyses

Multiple regression analyses were conducted to examine the unique contributions of achievement goals to SRL strategy use while controlling for demographic variables. Hierarchical regression models entered demographic variables (gender, program year, academic performance) in the first step and achievement goals in the second step.

Results showed that achievement goals accounted for significant additional variance in all SRL strategy components beyond that explained by demographic variables, with ΔR^2 values ranging from 0.24 to 0.36 ($p < 0.05$). In these models, MAP goals consistently emerged as the strongest predictor, with standardised beta coefficients ranging from 0.42 to 0.58 ($p < 0.05$). PAP goals showed smaller but statistically significant effects, with beta coefficients ranging from .18 to .31 ($p < 0.05$).

Moderated regression analyses examined potential interactions among achievement goals in predicting SRL strategy use. The interaction between MAP and PAP goals was tested for each SRL component, but no statistically significant interactions were found ($p > 0.05$). This suggests that the effects of MAP and PAP goals on

SRL strategy use are largely additive rather than interactive. The interaction between achievement goals and program year was also tested to examine whether the relationships varied by developmental stage. Results showed that the relationship between MAP goals and metacognitive self-regulation was stronger for fourth-year students than for first-year students (β for interaction = 0.21, $p < 0.05$), suggesting that the benefits of MAP goals for metacognitive regulation may increase as students progress through their programs.

Group comparisons using analysis of variance examined differences in achievement goals and SRL strategies across program years. Results showed significant differences in MAP goals, $F(3, 415) = 4.82$, $p < 0.01$, $\eta^2 = 0.03$, with fourth-year students reporting higher MAP goals than first-year students (M difference = 0.46, $p < 0.01$, $d = 0.43$). Similar patterns were observed for SRL strategy use, with fourth-year students reporting higher use of metacognitive strategies than first-year students (M difference = 0.52, $p < 0.05$, $d = 0.57$). These findings suggest developmental changes in both achievement goals and SRL strategies during PETE programs, though effect sizes were generally small to moderate.

Comparisons across institutional contexts showed minimal differences in achievement goals and SRL strategies. One-way ANOVAs revealed no statistically significant differences among the five participating institutions for any achievement goal or SRL strategy measure ($p > .05$). This suggests relative homogeneity across PETE programs in China regarding the motivational and learning patterns examined in this study. However, it is important to note that all participating institutions were located within the same national context, and greater variation might be observed in cross-cultural comparisons.

4.5 Qualitative findings

The qualitative analysis revealed several important themes related to PE preservice teachers' understanding and implementation of self-regulated learning strategies. The first theme concerned conceptual understanding of SRL, which varied widely among participants. Some preservice teachers demonstrated sophisticated understandings that aligned with academic definitions, describing SRL as an active process where you set goals, monitor your progress, and adjust your strategies. Others had more limited or fragmented understandings, describing SRL simply as studying on your own or managing your time. Several participants reported that they had not received explicit instruction about SRL during their PETE programs and had developed their understanding through personal experience or informal learning.

The second theme focused on the application of SRL strategies during field teaching experiences. Participants described using SRL-like behaviours across the three phases of Zimmerman's cyclical model. During the forethought phase, they engaged in lesson planning, goal setting, and help-seeking from mentors and peers. One participant explained, before each teaching session, I would set specific goals for what I wanted to achieve and plan different strategies for different student needs. During the performance phase, participants described monitoring their teaching, adjusting their instruction based on student responses, and managing classroom dynamics. A participant noted, I would constantly check if students were understanding the skills I was teaching and change my approach if I saw they were struggling. During the reflection phase, participants engaged in self-

evaluation, sought feedback, and planned improvements for future lessons.

The third theme related to the role of achievement goals in motivating SRL strategy use. Participants with strong MAP orientations described focusing on their own learning and improvement, which motivated them to employ a wide range of SRL strategies. One participant stated, I want to really understand how to teach PE effectively, not just pass the course. This makes me try different approaches and reflect on what works. Participants with strong PAP orientations described being motivated by comparisons with peers and the desire to demonstrate competence, which sometimes led to strategic learning behaviours but also created anxiety. A participant explained, I want to be one of the best in my program, so I work hard and use strategies that help me get good grades, but sometimes I worry too much about how I compare to others.

The fourth theme concerned challenges and facilitators of SRL development in PETE programs. Participants identified several challenges, including heavy course loads, limited time for reflection, and insufficient explicit instruction in learning strategies. They also noted facilitators, such as supportive relationships with faculty mentors, opportunities for practical teaching experiences, and collaborative learning with peers. Several participants emphasised the importance of field experiences for developing SRL, noting that real teaching situations force you to think on your feet and learn from your mistakes.

Integration of quantitative and qualitative findings revealed both convergence and complementarity. The quantitative finding that MAP goals strongly predict SRL strategy use was supported by qualitative accounts of how MAP orientations motivate deep engagement with learning. The quantitative finding that PAP goals show weaker but positive prediction of SRL strategy use was reflected in qualitative descriptions of how performance concerns can motivate strategic learning behaviours, though sometimes at the cost of increased anxiety. The qualitative findings provided depth and context to the statistical relationships, illustrating how achievement goals and SRL strategies manifest in the actual experiences of PE preservice teachers.

5. Discussion

5.1 Key findings

The present study yields several important findings that contribute to our understanding of achievement goals and self-regulated learning among PE preservice teachers. The strong positive relationship between mastery-approach goals and SRL strategy use represents the most robust finding, consistent with theoretical predictions and previous research in other educational contexts. This relationship suggests that PE preservice teachers who focus on developing competence and mastering teaching skills are more likely to employ effective learning strategies, including cognitive strategies for processing information, metacognitive strategies for monitoring and regulating learning, and resource management strategies for optimising their learning environments. The magnitude of this relationship (path coefficients ranging from 0.58 to 0.72) indicates that MAP goals are a particularly important motivational factor for understanding variation in SRL strategy use among this population.

The finding that performance-approach goals also show positive prediction of SRL strategy use, though with weaker effects than

MAp goals, contributes to ongoing debates about the adaptiveness of PAp goals. While some previous research has suggested that PAp goals may promote surface-level learning or maladaptive patterns, the current findings indicate that among PE preservice teachers, PAp goals are associated with increased use of SRL strategies, particularly resource management strategies. This pattern may reflect the competitive nature of some PETE programs or cultural factors that value demonstration of competence relative to others. The weaker relationship with critical thinking strategies ($\beta = 0.28$) suggests that while PAp goals may motivate strategic learning behaviours, they may not consistently promote deep processing or critical engagement with learning materials.

The limited relationships between avoidance goals (MAv and PAv) and SRL strategy use, including the small negative relationships for PAv goals with critical thinking and metacognitive regulation, align with theoretical predictions about the maladaptive nature of avoidance orientations. These findings suggest that PE preservice teachers who focus on avoiding failure or demonstrating inferior ability are less likely to employ adaptive learning strategies, particularly those involving deep processing and self-regulation. This pattern has important implications for teacher education, as avoidance goals may undermine the development of the reflective, adaptive practices needed for effective teaching.

The qualitative findings provide valuable context for interpreting these quantitative relationships. The variation in conceptual understanding of SRL among PE preservice teachers suggests that many may not have received explicit instruction about learning strategies, potentially limiting their ability to employ SRL effectively. The descriptions of SRL-like behaviours during field teaching experiences indicate that practical contexts may naturally elicit self-regulatory processes, even in the absence of formal instruction. The accounts of how achievement goals motivate learning behaviours illustrate the psychological mechanisms underlying the statistical relationships, showing how different goal orientations lead to different approaches to learning and professional development.

5.2 Theoretical implications

The findings of this study have several important theoretical implications for achievement goal theory and self-regulated learning frameworks. First, the strong relationship between MAp goals and SRL strategy use supports the theoretical proposition that mastery-approach orientations create optimal conditions for self-regulated learning. This relationship appears to hold in the specific context of PE teacher education, extending previous findings from general academic contexts to a specialised professional preparation domain. The consistency of this relationship across different SRL strategy components suggests that MAp goals promote comprehensive self-regulation, encompassing cognitive, metacognitive, and resource management dimensions.

Second, the positive relationship between PAp goals and SRL strategy use, though weaker than for MAp goals, challenges simplistic characterisations of performance-approach orientations as uniformly maladaptive. The current findings suggest that in certain contexts—particularly those with competitive elements or strong norms for demonstrating competence—PAp goals may motivate strategic learning behaviours. This nuanced understanding aligns with recent theoretical developments that recognise the potential for PAp goals to have adaptive consequences under specific conditions. The differential pattern across SRL components (stronger for resource management,

weaker for critical thinking) suggests that PAp goals may promote certain types of self-regulation more than others.

Third, the integration of quantitative and qualitative findings illustrates the value of mixed-methods approaches for understanding complex motivational and learning phenomena. The quantitative analysis established patterns and relationships at the group level, while the qualitative analysis provided insight into individual experiences and meanings. This integration enriches theoretical understanding by showing how abstract constructs like achievement goals and SRL strategies manifest in the lived experiences of learners. The qualitative findings about conceptual understanding of SRL, for example, suggest that theoretical models of SRL may need to account for variation in learners' awareness and articulation of self-regulatory processes.

Last, the study contributes to theories of teacher development by examining the learning processes of preservice teachers. Most research on achievement goals and SRL has focused on students in primary, secondary, or higher education contexts, with less attention to those preparing to become teachers. The current findings suggest that similar motivational and learning processes operate in teacher education contexts, but with unique features related to professional preparation. The emphasis on practical teaching experiences in PETE programs, for example, appears to create natural opportunities for developing and applying SRL strategies, even in the absence of explicit instruction.

5.3 Practical implications

The findings of this study have several practical implications for the design and implementation of PE teacher education programs. First, the strong relationship between MAp goals and SRL strategy use suggests that fostering mastery-approach orientations should be a priority in PETE programs. Teacher educators can promote MAp goals by emphasising learning and improvement over performance comparisons, providing opportunities for self-referenced assessment and feedback, and creating learning environments that value effort, progress, and deep understanding. Specific strategies might include portfolio assessments that document growth over time, reflective journals that encourage self-assessment, and learning activities that emphasise process over product.

Second, the finding that many PE preservice teachers have limited conceptual understanding of SRL suggests a need for more explicit instruction about learning strategies in PETE programs. While field experiences may naturally elicit some self-regulatory behaviours, explicit instruction could enhance the quality and consistency of SRL strategy use. Teacher educators could incorporate SRL instruction into existing courses, perhaps through modules on effective study strategies, time management, goal setting, and self-reflection. Modelling SRL processes during instruction and providing opportunities for practice and feedback could help preservice teachers develop these skills for their own learning and for future teaching.

Third, the positive relationship between PAp goals and certain SRL strategies suggests that performance-oriented motivations should not be entirely discouraged, but rather channelled in productive directions. In contexts where competitive elements are present or where demonstrating competence is valued, teacher educators can help preservice teachers develop adaptive approaches to performance concerns. This might involve helping students reframe competition as an opportunity for learning, teaching strategies for managing performance anxiety, and emphasising that

demonstrating competence can coexist with a focus on mastery and improvement.

Fourth, the limited relationships between avoidance goals and SRL strategies, particularly the negative relationships for PAV goals with critical thinking and metacognitive regulation, suggest that PETE programs should work to minimise avoidance orientations. This might involve reducing emphasis on normative comparisons and high-stakes assessments that create fear of failure, providing support for students who struggle academically or practically, and creating a psychologically safe learning environment where mistakes are viewed as opportunities for learning rather than as indicators of incompetence.

Fifth, the qualitative findings about the importance of field experiences for developing SRL suggest that PETE programs should maximise the learning potential of practical teaching opportunities. This might involve more structured reflection on field experiences, closer integration between coursework and field placements, and explicit attention to how preservice teachers can apply SRL strategies in teaching contexts. Mentor teachers could be trained to support SRL development during field experiences, perhaps by modelling self-regulatory processes, asking reflective questions, and providing feedback that encourages self-assessment and strategic thinking.

5.4 Limitations and directions for future research

While the present study makes important contributions to understanding achievement goals and SRL among PE preservice teachers, several limitations should be acknowledged. The cross-sectional design limits conclusions about causal relationships and developmental changes over time. Future research employing longitudinal designs could track changes in achievement goals and SRL strategies throughout PETE programs and into early teaching careers, providing insight into how these constructs evolve during professional development. Experimental or intervention studies could test causal relationships by manipulating achievement goal orientations or SRL instruction and examining effects on learning outcomes.

The reliance on self-report measures, while common in motivation and learning research, may be subject to social desirability biases and limitations in self-awareness. Future research could incorporate multiple methods for assessing achievement goals and SRL, including behavioural observations, think-aloud protocols, or experience sampling methods. In the context of teacher education, observations of teaching practice could provide insight into how achievement goals and SRL strategies manifest in actual teaching behaviours.

The sample was limited to Chinese PE preservice teachers, and cultural factors may influence the expression and measurement of achievement goals and SRL strategies. Replication in diverse cultural contexts would enhance the generalizability of findings and provide insight into cultural variations in motivational and learning processes. Comparative studies across different national contexts or educational systems could identify universal patterns versus culture-specific manifestations of achievement goals and SRL.

The study focused specifically on PE preservice teachers, and findings may not generalise to preservice teachers in other subject areas or to in-service teachers. Future research could examine whether the relationships observed in this study hold in other teacher education contexts or whether subject-specific factors

moderate these relationships. Studies comparing different teacher populations could identify commonalities and differences in how achievement goals influence SRL across educational contexts.

The qualitative component of the study, while providing valuable depth and context, involved a relatively small sample of 11 participants. Future qualitative research could involve larger samples or multiple case studies to examine variation in experiences and perspectives more comprehensively. Mixed-methods studies with larger qualitative components could provide a richer understanding of how achievement goals and SRL strategies operate in the complex realities of teacher education.

5.5 Conclusion

The present study provides comprehensive evidence regarding the relationship between achievement goals and self-regulated learning strategies among PE preservice teachers. The findings highlight the central role of mastery-approach goals in promoting adaptive learning behaviours, while also acknowledging the more complex role of performance-approach goals in certain contexts. The integration of quantitative and qualitative methods offers a nuanced understanding of how these motivational and learning processes operate in the specific context of PE teacher education. The theoretical contributions of this research include extending achievement goal theory and SRL frameworks to a new population and context, providing evidence for the adaptive nature of MAP goals in professional preparation settings, and offering a nuanced perspective on the role of PAp goals in motivating learning behaviours. The practical implications for PETE programs are significant, suggesting specific strategies for fostering adaptive goal orientations, enhancing SRL development, and maximising the learning potential of field experiences. As teacher education continues to evolve in response to changing educational needs and contexts, understanding the motivational and learning processes of preservice teachers becomes increasingly important. The current study contributes to this understanding by examining how achievement goals influence the development and implementation of self-regulated learning strategies among those preparing to teach PE. By fostering adaptive goal orientations and explicit SRL instruction, PETE programs can better prepare preservice teachers for the complex challenges of contemporary education, ultimately benefiting both the teachers themselves and the students they will teach.

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