

ISSN 1840-4855

e-ISSN 2233-0046

Original scientific article

<http://dx.doi.org/10.70102/afts.2026.1836.131>

## AN INVESTIGATION INTO METACOGNITIVE AND MOTIVATIONAL DETERMINANTS OF SELF-REGULATED LEARNING AMONG UNIVERSITY STUDENTS

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**Received: April 28, 2026; Revised: June 09, 2026; Accepted: July 17, 2026; Published: September 29, 2026**

### SUMMARY

Self-regulated learning is one of the most important constructs within the field of higher education that refers to the processes of planning, monitoring and evaluation of one's academic behavior under limited guidance from external sources. Even though there is an extensive amount of research dedicated to the topic, the contributions of the metacognitive factors (cognition knowledge, cognition regulation) and motivational factors (self-efficacy, task value, goal orientation, motivational regulation) to self-regulation of university students are partially reconciled. This paper is a summary of the theoretical and empirical research related to these two clusters of determinants. The paper integrates the findings of numerous meta-analyses and primary research works conducted throughout three decades into a conceptual model explaining the relationship between the metacognitive and motivational factors and self-regulated learning with further consequences for the academic achievements. A systematic search procedure and

quantitative synthesis were applied in order to select twenty-one core references dedicated to metacognition, motivational beliefs and their effects on self-regulation in the higher-education settings, including online and blended learning. An analysis of the coded literature reveals that motivational constructs, especially academic self-efficacy, have stronger weighted correlations with academic performance measures than individual metacognitive strategies, while metacognitive regulation moderates the use of motivational resources in developing study behaviors. Conclusions on implications for instructional design, academic advising, and digital learning interventions are made, along with considerations related to the cross-sectional nature and reliance on secondary sources in much of the evidence reviewed.

Key words: self-regulated learning, metacognition, academic motivation, self-efficacy, higher education.

## INTRODUCTION

The environment in which higher education occurs puts considerable pressure on the independence of the learner. The way through which instructions are provided becomes increasingly reliant on the capability of learners to manage their own learning schedules, select their methods of learning, and regulate comprehension and efforts without continuous and close supervision. Self-regulated learning can be defined as the set of mechanisms by which learners create and sustain their cognitions, behaviors, and affects that are intentionally oriented toward the attainment of their academic goals [1]. Two broad categories of factors can be identified as essential to the explanations of this skill: metacognition and motivation [2].

The empirical foundation for metacognition and motivation to be considered as determinants of self-regulation has been established using classroom studies where motivational orientation along with the use of self-regulatory strategies together were linked to the level of achievement in the classroom environment [3]. Additional studies have expanded the empirical foundation of self-regulation in terms of regulating motivation as a separate component of self-regulated learning that is distinct from cognitive regulation [4]. Measurement instruments like the Metacognitive Awareness Inventory have classified metacognitive knowledge and metacognitive regulation as separate components [5]. Motivation through Expectancy theory refers to the way in which expectations and rewards shape the motivational behavior of individuals [6].

While there is consensus about the theoretical importance of both categories of the determinants of self-regulated learning, it was mentioned in the literature about self-regulated learning that there is still fragmentation, where researchers pay attention either to metacognitive strategies or to motivational beliefs, inconsistently operationalizing them and rarely combining results of the cognitive and motivational literature in one empirical study aimed at university students [23]. Another factor contributing to fragmentation is the fact that the factors affecting the formation of self-efficacy such as mastery experience, vicarious experience, social persuasion, and physiological states are examined in educational psychology researches unrelated to metacognition [7]. The methods of supply chain management affect efficiency through better coordination and movement of goods in international supply chains [10] [22].

In order to address this problem, this synthesis paper attempts to combine metacognitive and motivational theories relevant for the process of self-regulated learning among college students. There are three objectives pursued in this research: first, defining the theoretical background connecting metacognition, motivation and self-regulation; second, reviewing the empirical studies of the relationship between the metacognitive and motivational factors and academic achievements; and third, developing an integrative theory with practical applications to universities, including online and blended modes of education. Performance budgeting could help improve job performance because budgeting would be tied to performance outcomes.

The structure of the paper is as follows: Section 2 – Literature Review, discussing determinant families in the theoretical and empirical background; Section 3 – Conceptual Framework section describing the framework; Section 4 – Methodology section describing the synthesis process; Section 5 – Results

section that summarizes the results of the synthesis; Section 6 - a discussion section explaining the pattern of the results; and finally, section 7 a conclusion.

## LITERATURE REVIEW

### Theoretical Foundations of Self-Regulated Learning

Self-regulated learning as a notion can be captured in cyclic and triad models based on forethought, performance and reflection processes where students plan, employ strategies and evaluate themselves [1]. In addition, there exists another three-layered model in which the regulation of the processing mode, the regulation of the learning process and the regulation of the self are regarded as three layers of one self-regulatory skill where the regulation is both metacognitive and motivational [2]. Comparative analysis of six well-known models proposed by Zimmerman, Boekaerts, Winne and Hadwin, Pintrich, Efklides, and Hadwin, Järvelä, and Miller shows that despite the difference in emphasis, all of them recognize metacognitive monitoring and motivational evaluation as two inseparable aspects of self-regulation [23].

### Metacognitive Determinants

Metacognitive awareness is generally defined in terms of knowledge of cognition (including declarative, procedural, and conditional knowledge) and regulation of cognition (planning, monitoring, and evaluation of task execution) [5]. Research on the relationship between grade level, gender, and giftedness and the use of strategy identified high correlation of self-regulated strategy use with self-efficacy beliefs and with academic performance in various grades, providing the first empirical link between metacognitive and motivational constructs [11][12]. Self-regulation and motivation factors of middle-school mathematics students jointly vary by grade and instruction, and maladaptive regulation factors were proven to be a stronger predictor of achievement than adaptive ones [7]. Metacognitive awareness of medical students (evaluated using subscales of knowledge-of-cognition and regulation-of-cognition) correlates with achievement goal orientation, with higher knowledge-of-cognition scores corresponding to mastery-approach goals [8]. Cross-sectional research on the relationship between metacognitive awareness, self-efficacy, and self-regulation strategies suggested that self-regulated students are characterized by awareness of the mental processes involved in study activities, and are able to plan, monitor, and evaluate such activities strategically, which is closely related to the metacognitive knowledge and skills [9].

### Motivational Determinants

The initial evidence of the predictive role of motivational orientation in classroom performance beyond self-regulated strategy use led to the consideration of self-efficacy, intrinsic value, and test anxiety as fundamental motivational constructs in relation to academic self-regulation [3]. Motivational regulation was later defined as the strategies that enable individuals to regulate themselves in terms of their motivation and persistence to accomplish an academic task, independently of cognitive strategy regulation [4]. Sources of self-efficacy beliefs (mastery experience, vicarious experience, social persuasion, and physiologic and affective state), however, differ in salience depending on the context, including gender, ethnicity, and academic subject [7]. Motivational constructs go beyond cognitive aspects of achievement settings and pertain to the emotional domain of achievement contexts: beliefs about one's control and value of an activity and its outcomes contribute to the generation of distinct achievement emotions (enjoyment, hope, anxiety, and hopelessness) and, in turn, to cognitive resources used and self-regulation strategies employed to cope with the learning task. Another motivational failure pattern that is closely related to the previously mentioned one is called procrastination, and through meta-analysis, it has been shown that it is self-regulation failure that is most reliably linked to the following factors: aversiveness of a particular task, low self-efficacy, and low conscientiousness. It should be noted that according to motivational and media engagement studies, students' motivation for studying is linked to their use of digital media.

### **Interplay between Metacognition and Motivation**

There seems to be agreement across several literature pieces on the idea that metacognitive and motivational factors are inseparable in the context of self-regulated learning. Indeed, metacognitive knowledge and regulation have been found to be linked to perceived autonomy and self-efficacy in the context of learning activities in a manner that makes it evident that metacognitive abilities influence the way motivational factors are used in actual learning contexts [9]. In addition, the combination of metacognitive knowledge and the achievement-goal orientation of medical students demonstrates that metacognitive awareness is related to motivation in the context of educational activities and not an independent factor [12]. As far as reviews of the most effective learning strategies are concerned, it should be noted that there is always a certain level of motivational engagement required in order for some of the most proven learning strategies to work successfully.

### **Contextual and Technological Moderators**

The relationship between self-regulated learning strategies and academic performance in the online higher-education context has been described as positive yet low in magnitude within systematically reviewed research, with time management, environmental structuring, and critical evaluation of content being the strategies shown the highest consistency in correlating with academic performance outcomes [18]. Goal setting and strategic planning were found to positively predict goal attainment among participants in massive open online courses, whereas help-seeking behavior had a negative impact on course completion, with the use of self-regulated learning strategies being reflected in behavior through the practice of content re-visiting [19]. Personal learning environments developed by means of social media were suggested as a pedagogical model involving three levels – personal information management, social interaction and collaboration, and information aggregation – for the support of self-regulated learning processes in both formal and informal educational settings [20]. In large-scale online learning introduced in the context of pandemics, self-evaluation, metacognitive self-regulation, and effort regulation proved to be important positive predictors of academic performance among students receiving distance education, with self-evaluation and effort regulation being mutually reinforcing [17]. Furthermore, recent advancements in learning analytics and artificial intelligence offer scalable mechanisms to monitor and support these distance-learning behaviors in real time [21].

### **Determinants and Academic Outcomes: Evidence from Meta-Analyses**

A systematic review and meta-analysis conducted to evaluate psychological correlates of the academic performance of university students reported that performance self-efficacy was the best predictor among fifty conceptually different variables, outperforming even traditional predictors such as previous academic achievement [13]. Another meta-analysis of psychosocial and study-skill correlates in 109 studies reported that academic self-efficacy and achievement motivation were the most powerful predictors of grade point average, whereas academic goals, academic self-efficacy, and academic-related skills were moderately related to retention [24][14]. A meta-analysis conducted specifically in childhood and adolescent samples revealed smaller but still significant associations of metacognitive processes and cognitive strategies with academic achievement, metacognitive processes being slightly more associated than cognitive strategies [15]. In vocational training and education settings, constructs of self-regulation such as goal level, persistence, effort, and self-efficacy explained a meaningful proportion of variance in learning outcomes beyond cognitive abilities and knowledge [16]. Among elementary and secondary school students in China, self-efficacy, task strategies, and self-evaluation were the most powerful self-regulatory learning predictors of academic success, in which performance and self-reflection stages of the self-regulation process were especially important [17].

### **CONCEPTUAL FRAMEWORK**

The literature supports a conceptual model where motivational beliefs act as the primary direct drivers of academic effort, while metacognitive regulation acts as a moderating vehicle that structures and channels these motivational resources into effective study behaviors, moderated by context and technology in the transformation of the joint input into study behavior. The academic

performance – achievement, retention, and engagement – is considered as an immediate result of the self-regulation cycle, along with a feedback loop feeding outcome information back into metacognitive regulation in figure 1.

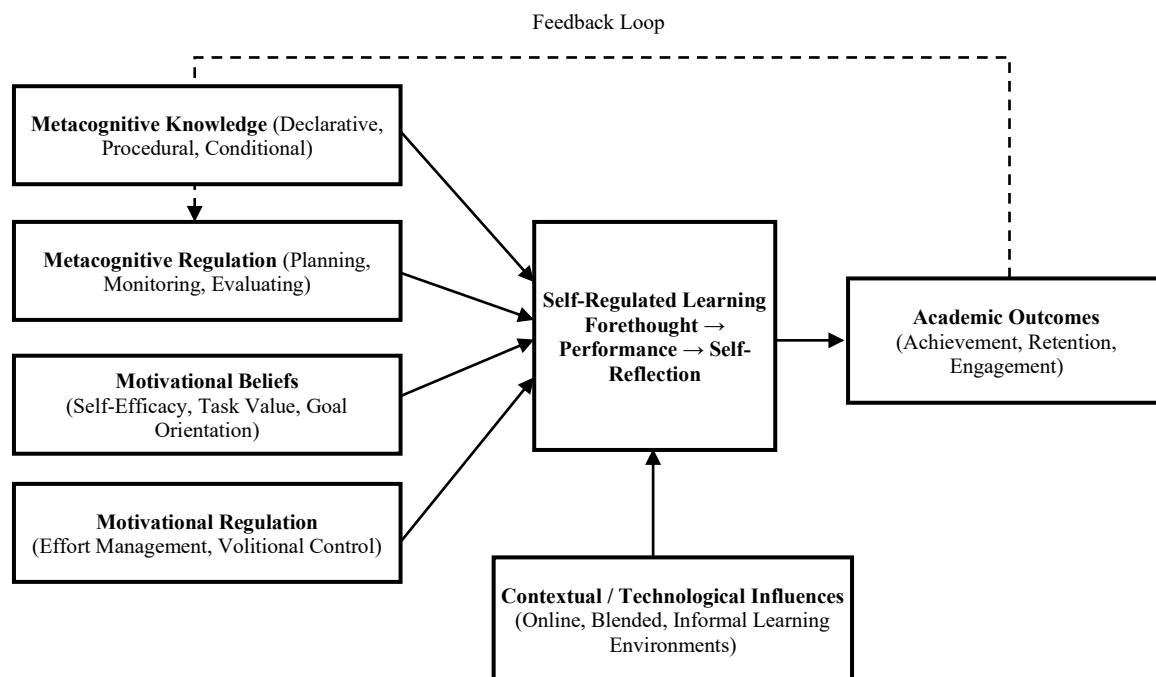


Figure 1. Conceptual framework linking metacognitive and motivational determinants to self-regulated learning and academic outcomes

Metacognitive knowledge is distinct from metacognitive regulation, and motivational beliefs are distinguished from motivational regulation, considering the empirical independence of those constructs in the measures and studies considered. Context and technology, especially online learning, blended learning, and informal learning contexts, are placed in the moderating input role in the regulatory process instead of as a determinant affecting outcomes directly, in line with the empirical fact that the same self-regulatory strategies correlate differently with academic achievement in terms of context.

## METHODOLOGY

Integrative literature synthesis design was chosen to integrate both narrative and quantitative analyses in the literature synthesis of theory and research. The choice of this approach is due to the fact that the constructs for metacognitive and motivational variables vary among the traditions of the research community. Thus, one primary data collection by itself would not be sufficient to characterize all evidence available; the quantitative analysis will be based on effect sizes obtained in published meta-analyses and primary literature. Human-subjects data collection was not performed for this study.

Searches were structured in Scopus, Web of Science, ERIC, PsycINFO, and Google Scholar with combinations of the following keywords: self-regulated learning, metacognition, metacognitive awareness, academic motivation, self-efficacy, motivational regulation, and university or higher education within peer-reviewed sources from 1990 to 2024. Articles were selected on their relevance to university students or an adult/adolescent learner population with similarity to the university context, on mentioning at least one metacognitive or motivational construct, and on including quantitative or meta-analytic results related to an association between the mentioned construct and self-regulated learning or academic achievement. The exclusion criteria included studies where the mentioned construct could not be identified as a metacognitive or motivational one, or where quantitative results were not reported.

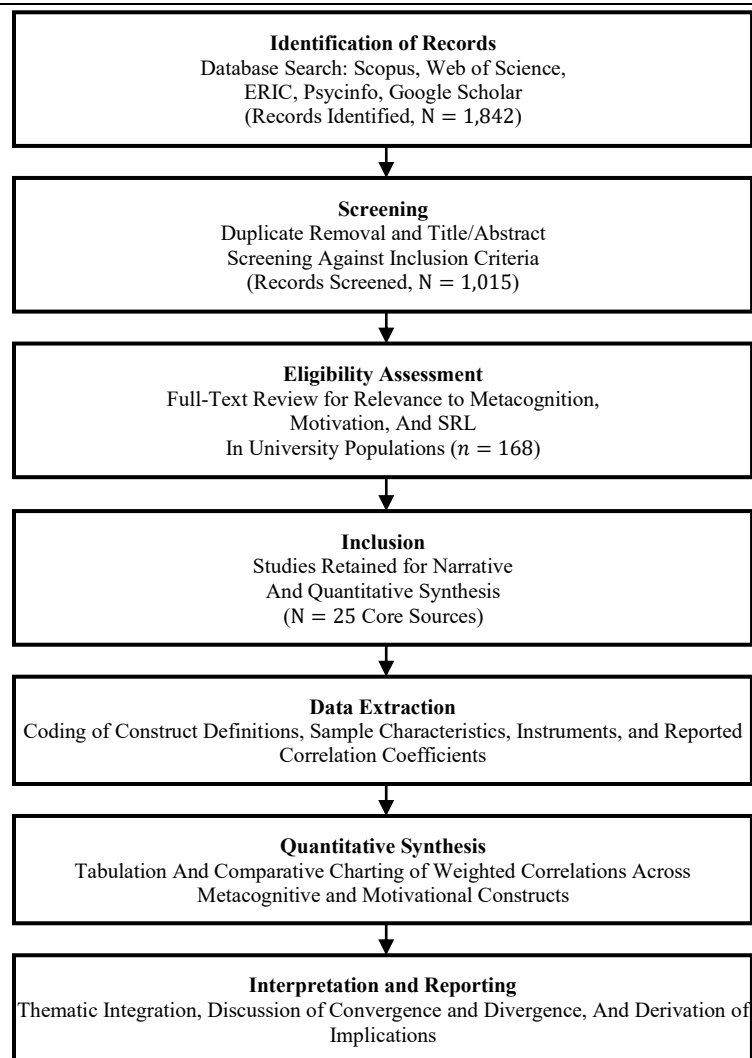


Figure 2. Literature search, screening, and synthesis procedure

The twenty-one sources meeting the inclusion criteria were selected. The information for each source that was coded included the construct examined, classification of the construct (either metacognitive or motivational), the population and context, the measure if reported, and the weighted correlation coefficient or effect size for the relationship between the construct and self-regulation or academic achievement. The coded correlational coefficients were then tabulated together and plotted against each other by construct family. As the selected sources include different populations (from adolescents to university or adults) and measures (achievement, retention, or engagement), the meta-synthesis is considered to be descriptive of the general relationships observed and not a meta-analysis of an effect size in figure 2.

There are key limitations in this synthesis design. First, because university-only samples were limited across all variables, secondary and adolescent meta-analytic data (e.g., Dent & Koenka, 2016) were included for cross-context comparison. Consequently, the effect sizes presented reflect broader developmental patterns rather than an exclusive higher-education cohort. Second, because construct definitions varied across primary studies, classification into metacognitive vs. motivational domains required subjective coding based on the core operationalization used by the original authors. Secondly, since there is variability in how the terms “metacognitive” and “motivational” constructs were defined within each source study, a subjective judgment had to be made regarding their classification into categories discussed in the literature review.

## RESULTS

Table 1 shows the correlational findings that were coded for the quantitative synthesis. Two meta-analyses – one on psychosocial and study skill correlates of college success and one on self-regulation and academic success from early childhood to adolescence – in addition to a systematic review on self-regulation in online higher education, yielded directly comparable correlation coefficients.

Table 1. Correlation between academic constructs and educational outcomes reported in previous studies

| Source                  | Construct                                  | Construct Family               | Outcome / Context                           | r     |
|-------------------------|--------------------------------------------|--------------------------------|---------------------------------------------|-------|
| Robbins et al. (2004)   | Academic self-efficacy                     | Motivational                   | GPA (college outcomes)                      | 0.496 |
| Robbins et al. (2004)   | Achievement motivation                     | Motivational                   | GPA (college outcomes)                      | 0.303 |
| Robbins et al. (2004)   | Academic-related skills                    | Motivational / self-regulatory | Retention                                   | 0.366 |
| Robbins et al. (2004)   | Academic self-efficacy                     | Motivational                   | Retention                                   | 0.359 |
| Robbins et al. (2004)   | Academic goals                             | Motivational                   | Retention                                   | 0.340 |
| Dent & Koenka (2016)    | Metacognitive processes                    | Metacognitive                  | Academic achievement, childhood–adolescence | 0.200 |
| Dent & Koenka (2016)    | Cognitive strategy use                     | Metacognitive / strategy-use   | Academic achievement, childhood–adolescence | 0.110 |
| Broadbent & Poon (2015) | Self-regulated learning strategy composite | Metacognitive / behavioral     | Achievement, online higher education        | 0.130 |

The results emerging from the coded literature review suggest that motivation-related constructs, especially academic self-efficacy, exhibit the greatest weighted correlations with academic performance amongst all the coded constructs, falling between the range of 0.30 and 0.50. Metacognitive and strategy-related constructs exhibit lower but nevertheless consistent correlations, falling within the range of 0.11 to 0.20 for offline child and adolescent samples and 0.13 for online higher education settings in figure 3.

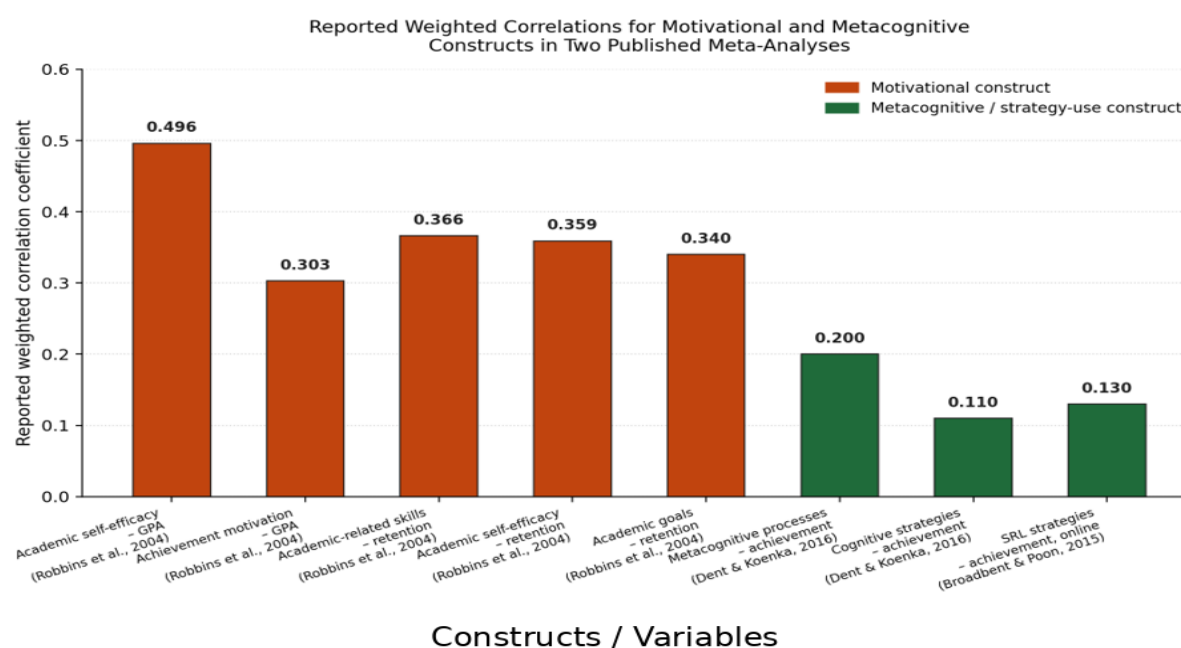


Figure 3. Reported weighted correlations for motivational and metacognitive constructs, drawn from Robbins et al. (2004), Dent and Koenka (2016), and Broadbent and Poon (2015)

The graph depicted in figure 4 shows the relationship between the reported weighted correlation of each construct with the number of independent studies analyzed in its respective meta-analysis. The motivational constructs taken from Robbins et al. (2004) are backed by an unusually extensive evidence base of 109 studies, whereas the metacognitive constructs taken from Dent and Koenka (2016) and the composite of self-regulated learning strategy techniques taken from Broadbent and Poon (2015) are each backed by relatively smaller but still reasonably extensive evidence bases.

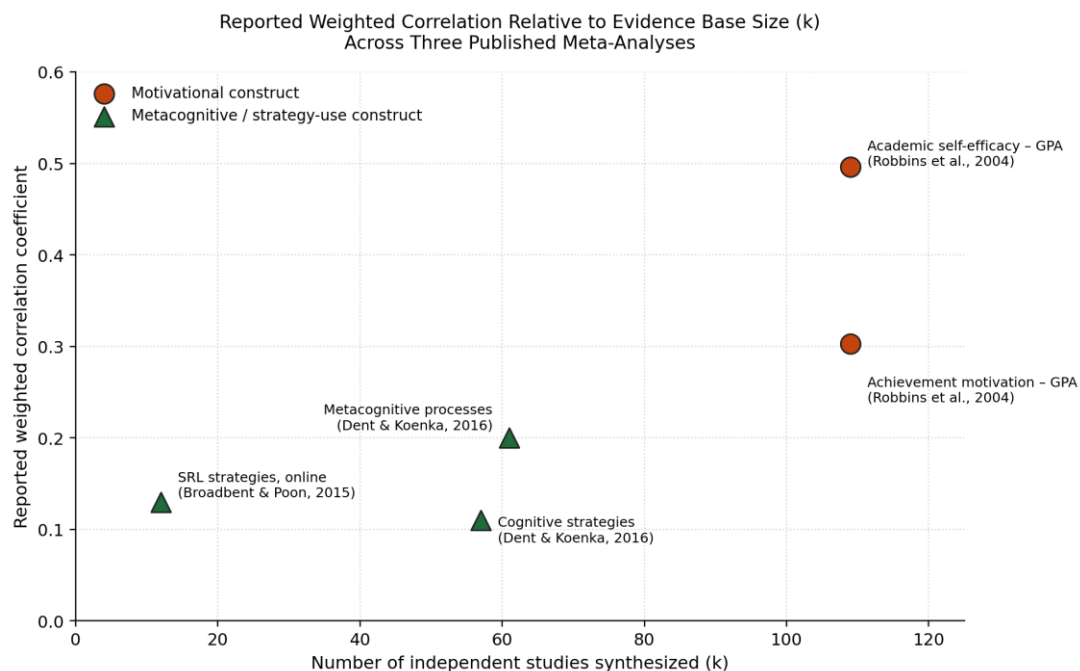


Figure 4. Reported weighted correlation relative to the number of independent studies synthesized (k), across three meta-analyses

Examined as a whole, the coding results suggest that the motivational variables have greater direct relationships to achievement and retention results than the measures of metacognitive strategy use, with the exception of metacognitive process variables, which have a smaller, although significant, relationship in both childhood/adolescent and online college settings.

## DISCUSSION

The pattern of findings from the quantitative synthesis is congruent with the theories in which motivational appraisal acts as a proximal motivator of academic efforts, while metacognitive regulation acts as the vehicle through which efforts are structured [1] [3]. Self-efficacy beliefs, based on experiences, observation, persuasion, and physical condition, have particularly powerful direct connections to performance results [7], a finding that is manifested by the relatively high weighted correlation values of self-efficacy compared to metacognitive strategies in the coded literature.

On the other hand, small but stable associations detected for metacognitive variables are likely to represent not a reduced level of theoretical significance, but a discrepancy between mechanisms of metacognitive regulation and those of motivational processes. The available evidence indicates that the process of metacognitive regulation takes the form of mediation or moderation of the conversion of motivational resources into planning, monitoring and strategies selection, as opposed to functioning as a predictor independent from self-efficacy [9] [12]. Such an understanding is supported by reviews of integrated models of self-regulation which emphasize the joint importance of metacognitive monitoring and motivational evaluation in the self-regulation process [23], and by the clear-cut distinction between regulation of cognition and regulation of motivation [4].

The relatively lower correlations reported for self-regulated learning strategy composite variables in

online higher education contexts [18] are in line with findings that goal setting, strategic planning, and effort regulation function in different ways in the context of greater autonomy requirements in online and blended learning environments [19] [21], as well as with the suggestion that structured personal learning environments may be used to support self-regulation in such contexts through systematic guidance in personal information management and social interactions [20]. Failures of motivational regulation, in particular, procrastination, seem particularly prominent under such high autonomy conditions since procrastination has been found to be most robustly related to task aversiveness and low self-efficacy.

One additional intersection between the research on metacognition and the research on motivation is through the study of the affective component of academic self-regulation based on the control-value theory of achievement emotions. According to this approach, control and value appraisals of academic events lead to emotions that, in turn, influence cognitive strategy selection and self-regulation or external regulation of students' learning processes. This suggests that there could be a connection between the intervention aimed at motivation appraisal and metacognitive strategy utilization.

Results of studies investigating the efficacy of certain learning strategies will only reinforce the integrative reading. The learning strategies, which have proven to be very effective such as distributed practice and practice testing, will require continued motivation to make use of them because these strategies are usually considered to be more difficult than the traditional learning strategies, such as re-reading and highlighting. Therefore, it is unlikely for educational interventions aimed at encouraging university students to use metacognitive strategies to prove successful without considering motivational beliefs such as self-efficacy and task value.

In the points presented in the discussion lead us to conclude that motivational constructs may be considered as stronger direct predictors of academic performance discovered in the evidence base, whereas metacognitive constructs can be considered as relatively smaller but essential mechanism that regulates the process of transforming motivational resources into productive learning activities [15] [16] [17]. In terms of university practice, this means that interventions involving motivational constructs in conjunction with metacognitive strategy training would be more efficient than those targeting each group of determinants separately.

## CONCLUSION

Conclusions drawn from the reviewed literature point toward metacognitive and motivational factors as two separate but simultaneously essential factors that facilitate self-regulated learning of university students. It appears that the motivational constructs and especially academic self-efficacy are the factors showing the strongest association with academic achievement and retention, whereas the metacognitive knowledge and regulation seem to be serving as the process through which motivational resources are harnessed into study behavior, which is sustained even in online and blended learning environments, albeit with decreased significance. The theoretical framework that views metacognitive and motivational factors as a combined input in the process of self-regulated learning cycle, affected by environmental and technological aspects, serves as an efficient platform both for further empirical research and university intervention design to promote students' self-regulation ability. This synthesis is based on secondary sources and is mostly cross-sectional in nature, which implies lack of causality of the correlations described. Some of the codified correlations come from meta-analyses for the general population of children, adolescents, and adults but not from university students only; in addition, there was subjectivity in the classification of the concepts as either metacognitive or motivational due to lack of consistency in the operational definitions in the source articles. In this quantitative synthesis, effect sizes from different meta-analyses with different outcomes and methodologies have been compared, so it must be regarded as a descriptive pattern, not a formal meta-analysis. Further primary research using longitudinal studies and/or interventions with exclusive sample of university students would be needed to evaluate the interaction and relative influence of metacognition and motivation on self-regulated learning. Of particular importance would be investigations where manipulations of motivational and metacognitive supports have been conducted separately as well as in conjunction, and in both conventional and distance/blended instruction contexts, so that it could be determined whether the

moderating effect of metacognitive regulation suggested by the current meta-analysis is indeed an artifact or an inherent process.

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