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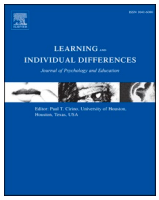

What are the principal and most effective strategies for motivational self-regulation? A systematic review and meta-analyses☆

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ABSTRACT

The regulation of motivation is considered a key aspect of self-regulated learning (SRL) as it is presumed that maintaining an adequate level of motivation is essential for engagement, effort and persistence in academic tasks. In this review, we aimed to improve our understanding of motivational regulation strategies, their supposed antecedents and the educational implications. A search was conducted in Web of Science, Scopus, PsycInfo, and ERIC databases. Of 4027 records identified, 64 (75 studies) were deemed eligible after inclusion and exclusion criteria were applied and studies with low methodological quality were discarded. Data on 18 different motivational regulation strategies were available. Extrinsic/controlling types of strategies were reported to be used more frequently than intrinsic/autonomous strategies. Motivational regulation strategies were significantly associated with metamotivational beliefs, academic skills and adjustment. Available evidence supports assumptions of theoretical models on antecedents and academic implications of motivational self-regulation.

Educational impact and implications statement: The present study provides a compendium of the different motivational self-regulation strategies studied to date, describes the nature of these and unifies the different denominations used. The available evidence on the frequency of use of the different strategies that has been collected may be useful for educators, enabling them to anticipate and adapt to the status of the different motivational facets in students. Drawing on theoretical models of motivational self-regulation, the interconnections between the use of the strategies and their supposed antecedents and the expected educational implications were explored. This will provide researchers and educators with an interpretive framework to draw upon when adapting to interindividual diversity in strategy use and when assessing the compatibility between educational practices and the efficient use and training of motivational strategies.

1. Introduction

Learners can both regulate their cognition and manage their motivation. In fact, regulation of motivation is nowadays considered a key aspect of self-regulated learning (SRL) as it is presumed that maintaining an adequate level of motivation is essential for engagement, effort and persistence in academic tasks (Wolters, 2011; Zimmerman & Schunk, 2012). Self-regulation of motivation is conceived as monitoring one's level or state of motivation and implementing measures aimed at activating, maintaining or increasing one's own motivation, including dealing with motivational challenges and setbacks (Grunschel et al., 2016; Wolters, 2003).

The number of studies examining this area of SRL has been increasing in recent years, and theoretical models focused on motivational regulation have been proposed. Thus, in her Dual Processing Model (see Fig. 1), Boekaerts (2006) considers two alternative processing paths, which correspond to the preponderance of one or other type of the principal motives of the student when confronted with a learning task.

The aspiration to expand personal knowledge and skills establishes the basis for a mastery mode and entails activation of cognitive and metacognitive learning strategies. On the other hand, the desire to preserve well-being and thus prevent any possible loss, damage or distortion of this state gives rise to a coping path, which involves

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activating self-defence strategies that may actually hamper learning. The balance between these paths depends on the appraisal based on an internal model of the learning situation (working model, WM), conformed according to three sources of information: (1) perception of the characteristics of the task in question (demands and conditions in which it is presented); (2) the domain knowledge and cognitive and metacognitive strategies activated by the task, and (3) motivational beliefs held in relation to the task. Perceived congruence between the value attributed to and the resources available for conducting the task will direct the student towards the mastery path. On the other hand, appreciation of incongruencies, which may threaten personal well-being, will direct the individual towards the coping path. The individual's actions linked to a task may be initiated by either of these routes and then vary depending on successive appraisals of the task being undertaken.

Considering assumptions of more recent models on self-regulated motivation, the coping mode may appear to correspond to a deficient motivational drive for the execution of the task at hand. In this context, the Motivational Regulation Model presented by Schwinger and Stiensmeier-Pelster (2012) directs our attention towards the role of awareness of motivational deficit when facing an academic task (see Fig. 2).

Perception of low motivation gives rise to a search for the possible reasons for this state (e.g. low expectancy of success), which may be situational (transitory) or fundamental (stable). Taking these aspects into account, the student will select suitable motivational regulation strategies (MRSs), i.e. procedures used to initiate, maintain or increase their own motivation in order to accomplish their goals (Wolters, 2003). Contextual (e.g. school subject or domain and school/home setting) and individual factors (e.g. motivational beliefs -motivational dispositions in Fig. 2- or prior declarative and procedural knowledge) are considered in the model as potential moderators of the frequency and effectiveness of use of different types of MRSs. Thus, for example, personal disinterest in a task may be addressed by interest-enhancing strategies. Motivational self-regulation is assumed to determine the effectiveness of cognitive and metacognitive learning strategies and ultimately promote effort and persistence.

More recently, Miele and Scholer (2016, 2018) posited the Meta-motivational Model of Motivation Regulation in which they delimited self-efficacy and subjective task value (interest or potential outcome) as

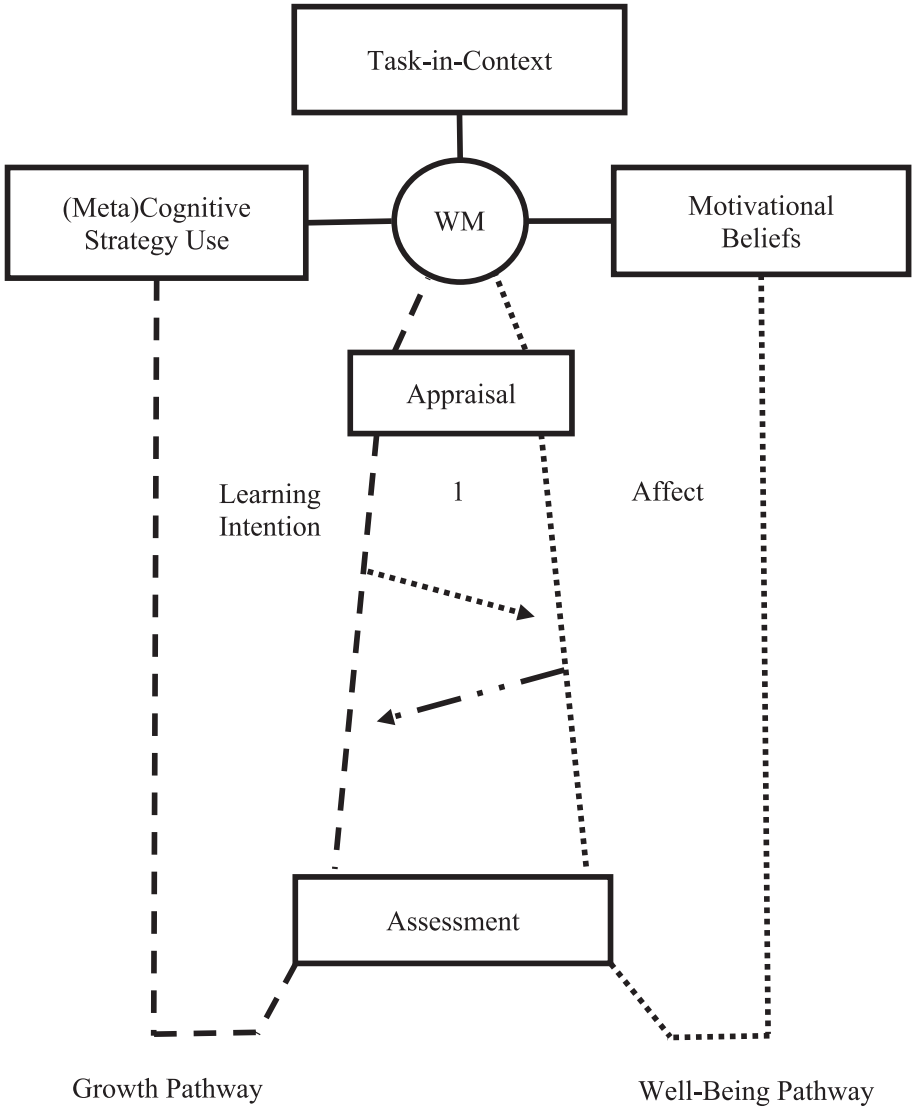

Fig. 1. Boekaerts' dual processing model.
Note. WM = working model. From "Self-Regulation and Effort Investment" by M. Boekaerts, in K.A. Renninger, I.E. Sigel, W. Damon and R.M. Lerner (Eds.), Handbook of child psychology: Child psychology in practice (5th ed., vol. 4, p. 350), 2006, John Wiley & Sons, Inc. (doi:10.1002/9780470147658.chpsy0409). Copyright 2006 John Wiley & Sons, Inc. Reprinted with permission.

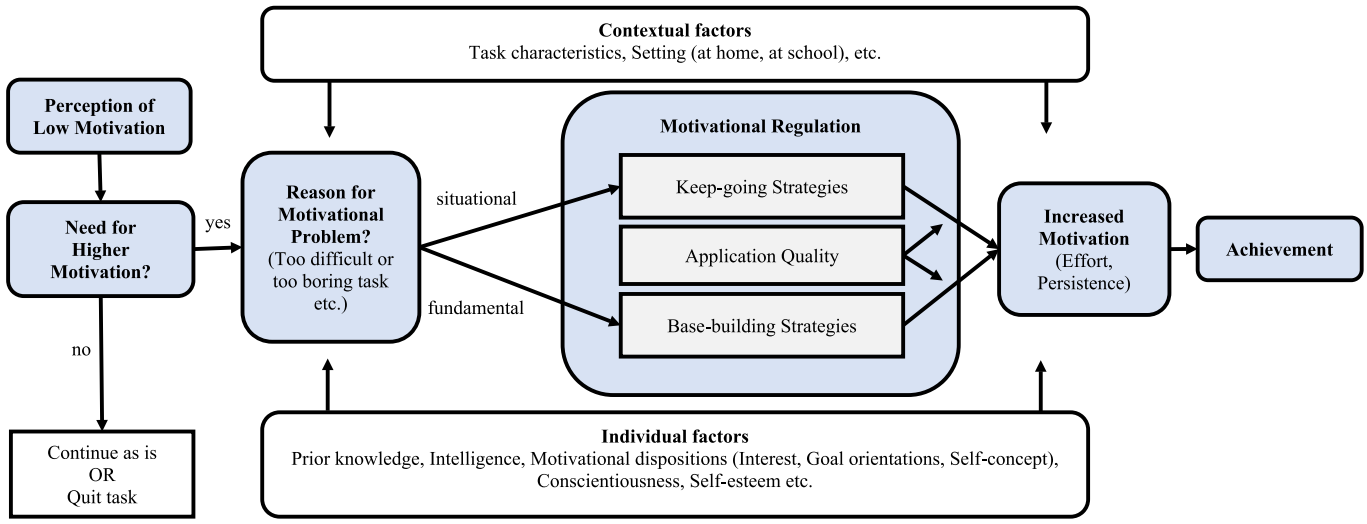

Fig. 2. Schwinger and Stiensmeier-Pelster's model of motivational regulation.
Note. From "Effects of motivational regulation on effort and achievement: A mediation model" by M. Schwinger and J. Stiensmeier-Pelster, International Journal of Educational Research, 56, p.38, 2012, Elsevier Academic Press (doi:10.1016/j.ijer.2012.07.005). Copyright 2012 Elsevier Inc. Reprinted with permission.

specific components of motivation that are likely to be the target of monitoring and control (see box B_1, in Fig. 3) once the task goal has been established (oval G) and its execution is in progress. In this model, a superordinate goal (e.g. doing well in a course) is assumed to determine the initial motivation, guiding the adoption of the subordinate/task goal (e.g. passing an exam).

The model also includes perceived costs (box A) and exogenous obstacles that can undermine motivational components. Metamotivational feelings (i.e. phenomenological experiences like enjoyment or frustration, oval C_1) evoked by appraisal of these components serve as indicators of motivational status, eventually leading the learner, in the case of deficient motivation, to abandon the activity or to switch to another goal. On the other hand, the learner can use metamotivational feelings and metamotivational knowledge (i.e. personal beliefs, ideas or theories, oval H) to identify the source of the motivational problem and select the appropriate MRSs (oval E) to increase task motivation and engagement (Oval B). For example, a low level of confidence in being able to perform a task could lead to frustration or hopelessness and could be targeted by self-talk focused on personal potential. Engagement is assumed to be manifested in the adjustment of quantity and quality of students' motivation to processing demands of the academic task, in terms of cognitive and metacognitive strategies.

In summary, theoretical models of self-regulated motivation concur in considering personal appraisals of both personal and contextual factors related to the ongoing learning episode as antecedents of the adoption of strategies for regulating one's own motivation. Among personal factors, special prominence is given to motivational beliefs, i.e. contents of the self-system such as self-efficacy, goal orientation and task value. Regarding contextual factors, both demands and conditions in which the task at hand is presented were considered. Awareness and monitoring of the phenomenological experiences evoked by the appraisals of these factors are thought to inform the individual about their motivational status at the beginning or during the execution of the task and the possible reason for a motivational deficit, if any. MRSs can be used to solve this deficit, boosting personal motivation and thus favouring a mastery mode for dealing with the task, as well as effort and persistence during its execution.

Researchers in motivational regulation have identified a variety of strategies aimed at controlling one's own academic motivation. The work by Wolters (1998) is central in this regard. This author used an open-ended questionnaire to ask university students how they maintained motivation in different academic situations. After two follow-up studies (Wolters, 1999; Wolters & Rosenthal, 2000), the findings led to the elaboration of an instrument including subscales for a group of principal MRSs (Wolters & Benzon, 2013). The contribution by Schwinger et al. (2009, 2007) is also widely recognized as important, leading to the delineation of additional strategies and an alternative evaluation scale.

Three main criteria have been proposed to differentiate between types of strategies (Fried & Chapman, 2012). First, the task completion phase (pre-actional, actional and post-actional) (Pintrich, 2000; Schmitz & Wiese, 2006), with some strategies being more appropriate for defining the task profile (i.e. considering demands, personal and context resources and setting goals and the action plan, establishing the necessary motivation to start the learning task), during its execution (when the motivational state is monitored and motivational interferences are addressed) or once completed (when subjective evaluation of results is generated and motivation for subsequent tasks is formed) (Miele & Scholer, 2016; Schwinger & Otterpohl, 2017). Second, the motivational dimension to which strategies may be more or less attuned, in particular those highlighted in the most commonly cited theories of academic motivation (e.g. goal orientations or attributions) (Urhahne & Wijnia, 2023). Third, the position in the continuum ranging from intrinsic/autonomous to extrinsic/controlling styles of motivational regulation, as described in the Self-Determination Theory by Deci and Ryan (2000), has led to differentiating between strategies that emphasize the task itself and its connection with personal values and those strategies focused on external incentives or pressures (Miele & Scholer, 2016; Wolters, 1998).

To our knowledge, no review has previously been conducted to provide an overview of the available empirical support regarding the motivational components and processes represented in models of motivational self-regulation. The interrelationship between the use of MRSs and both factors considered antecedents of this use and its expected consequences should be analysed in addition to the role of possible moderating or mediating factors. A tendency to a more frequent and adequate use of MRSs throughout the different educational levels may be expected. The possible moderation effect of gender also deserves attention, since this has previously been demonstrated in studies on self-regulated learning, indicating that women are more likely to use learning strategies (Meece & Painter, 2012).

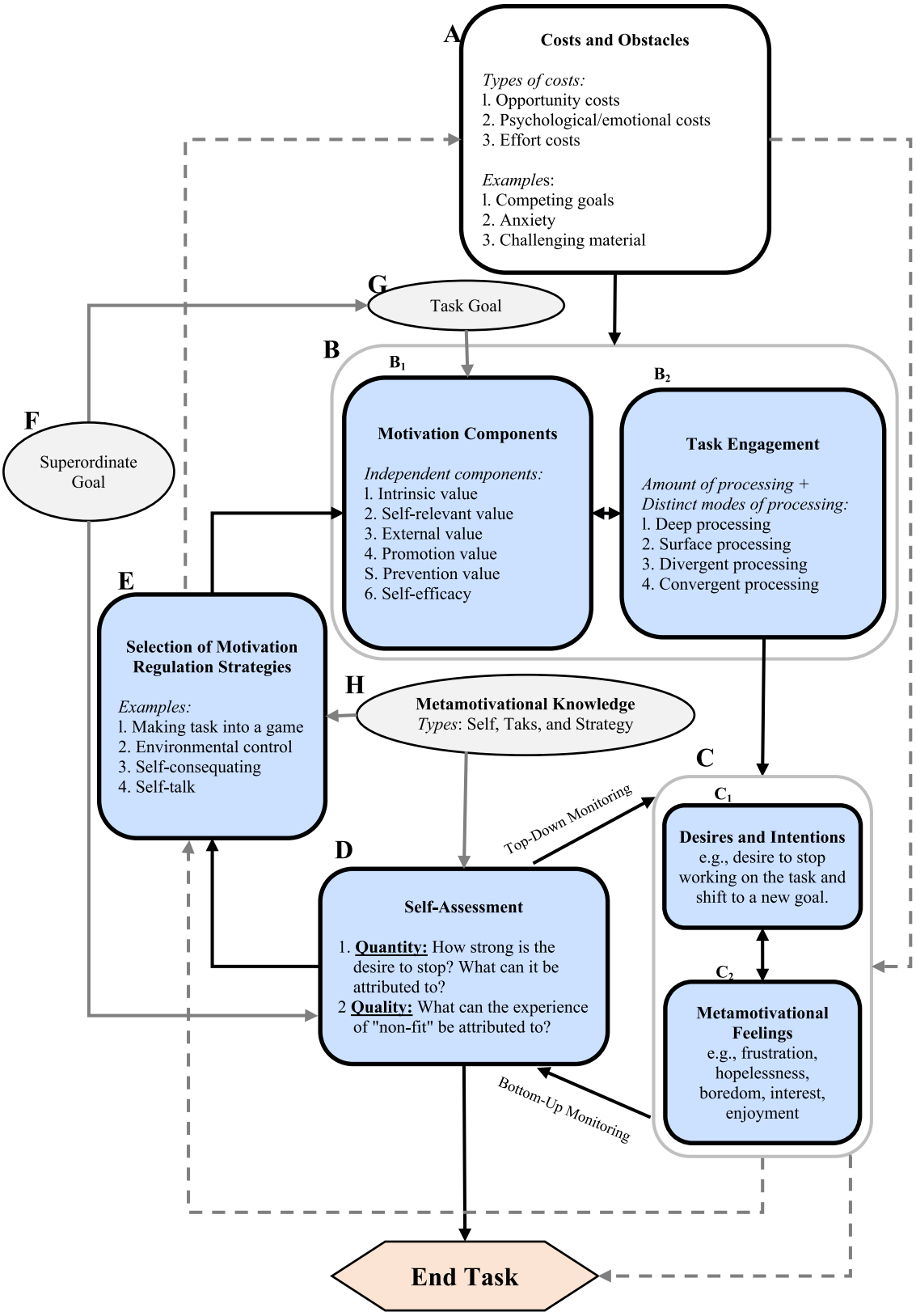

Fig. 3. Miele and Scholer's metamotivational model of motivation regulation.
Note. From "The role of metamotivational monitoring in motivation regulation" by D.B. Miele and A.A. Scholer, Educational Psychologist, 53(1), p. 2, 2018, Routledge/Taylor & Francis Group (doi:10.1080/00461520.2017.1371601). Copyright © 2017 Division 15, American Psychological Association. Reprinted with permission.

1.1. Purpose and objectives of this review

The present study aimed to improve our understanding of self-regulated motivation and its effects on the academic progress of ordinary students. Three research questions were posed: (1) what types of MRSs do students use most frequently?; (2) what psychological processes are involved in the activation of MRSs?; and (3) what are the most effective MRSs for academic success? The specific objectives intended to answer these research questions were as follows: (1) to analyse the types and frequency of use of MRSs, both under specific conditions and considered cross-sectionally; (2) to explore and evaluate the strength of the relationship between the individual and contextual dimensions theoretically proposed as antecedents of the MRSs and the use of these strategies; (3) to examine the possible effect of MRSs on indexes of academic skills, engagement, effort and adjustment, as well as the strength of the relationship when demonstrated; (4) to identify moderating and mediating factors in the frequency of use of MRSs and in the relationships between individual/contextual factors and MRSs, and also between MRSs and academic skills, engagement, effort and adjustment. Based on the theoretical background described above, we hypothesized that (1) personal and contextual dimensions concerned in academic tasks are associated with the use of MRSs; (2) MRSs are positively associated with indicators of good academic progress; (3) both sex and educational level moderate these associations as well as the frequency of use of MRSs. No hypothesis was formulated regarding the types and frequency of use of MRSs.

2. Method

2.1. Literature search

The systematic review process followed the PRISMA (Page et al., 2021) and Cochrane (Higgins et al., 2022) guidelines for the elaboration of systematic reviews. A literature search of four databases, namely Web of Science, Scopus, PsycInfo, and ERIC, was performed in November 2021, and it was regularly updated through search alerts created in the databases. The latest update was completed in October 2023. The search phrase used was: ("self-regulated learning" AND "academic motivation") OR ("self-regulated motivation" AND (university OR college OR school)) OR ("motivation* self-regulation" AND (university OR college OR school)) OR ("regulation of motivation" AND (university OR college OR school)) OR (metamotivation* AND (university OR college OR school)). No temporal restrictions or filters for document type were applied in the search strategy. Databases consulted included a wide range of formats (e.g. doctoral dissertations, conference papers and letters). In order to avoid overlooking relevant research and to minimize bias, the reference lists of the reports selected were also screened, and 13 eligible documents were identified.

2.2. Eligibility criteria and selection

The inclusion criteria were as follows: the study should involve MRSs; the sample should comprise primary, secondary and/or university students; and the language of publication should be Spanish, English, French or Portuguese. Studies focusing on remote teaching methods, specific innovative teaching methods or subjects not included in study plans (extracurricular activities) were excluded, as well as those whose samples were composed of students with mental disorders, disabilities, physical illnesses or high abilities or students of ages that did not correspond to their educational level.

Two team members independently screened titles and abstracts of the records and discarded those that did not match the eligibility criteria. The same team members then examined the full texts of the pre-selected reports to determine their eligibility for definite inclusion in the review. All disagreements during the pre-selection and selection phases were resolved by discussion until consensus was reached by all authors of the review.

The main reason for exclusion of records and reports was that they did not concern the topic of interest of the present review. Our comprehensive search strategy produced a substantial number of papers focused on different motivational dimensions (e.g. self-efficacy, goal orientations) rather than on their regulation. On the other hand, a large number of the studies on motivational self-regulation did not deal with strategies per se but focused on the degree of motivational regulatory autonomy. In total, 64 reports (75 studies) were finally selected for inclusion in the review. The details of this process are depicted in a flow diagram (Fig. 4).

Inter-rater reliability, measured using Cohen's Kappa coefficient, was intermediate ($k = 0.58$) during the preselection stage and high ($k = 0.87$) during the selection stage. The methodological quality of the studies was examined prior to their inclusion in the review, and low-quality studies were excluded. The NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (National Heart, Lung and Blood Institute, 2014), JBI Checklist for Analytical Cross-Sectional Studies (Joanna Briggs Institute, 2020), as well as Cochrane template for quality assessment were used as references, as appropriate. These tools include items on how well the studies meet methodological standards (e.g. "Was the study population clearly specified and defined?", "Were objective, standard criteria used for measurement of the condition?") The studies were categorised as of low quality (7.44 %), intermediate quality (23.85 %) and high quality (68.71 %).

2.3. Analysis

The characteristics and data of each study reviewed were extracted and summarized in a table, to enable analysis and integration of the findings of the studies. The table is included in Supplementary Material (see Table S1). Various meta-analyses were performed considering the correlational association between MRSs, as well as the global score for strategy use, and dimensions theoretically considered as antecedents (i.e. self-efficacy, task value, goal orientation) and academic implications (i.e. learning strategies, effort, achievement, and procrastination) of motivational self-regulation. A total of 43 studies on 8 MRSs were included in the meta-analyses. Following the guidelines outlined by Borenstein et al. (2009), 10 of the strategies identified could not be included in the meta-analyses, given the small number of studies (<5) that provided correlational data. This resulted in the exclusion of 17 of the selected reports containing correlational data (18 samples) in the meta-analyses; 14 additional studies were excluded because they did not provide correlational data. Several reports included more than one study, yielding a total of 43 samples (34 reports) to be included in the meta-analyses.

Statistical analyses, funnel plots and forest plots were constructed with the R package METAFOR (Viechtbauer, 2010). The procedures described by Hedges and Olkin (1985) were used to analyse the sample of effect size values: Q test for homogeneity and Q_b for categorical moderators. Pearson's product moment correlations were identified in the studies and then transformed to Fisher's Z value, to estimate the effect size. The degree of heterogeneity (tau^2) was calculated using a restricted maximum-likelihood estimator. The meta-analyses were performed assuming a random-effects model, as this allows generalization of the results beyond the specific set of studies included and is considered more conservative than fixed effects models regarding statistical inference (Botella & Gambara, 2006; Quintana, 2015). As an estimate of the risk of publication bias, deviations from symmetry in the funnel plot were analysed (Light & Pillemer, 1984), and Egger's regression and Rank correlation tests (Quintana, 2015) were applied. The results of these tests are reported together with the respective meta-analysis.

Pairwise comparisons of the effect sizes were performed using the Z test, to explore potential differences in the strength of the correlation between strategies and the other variables of interest. Sex (60.3 % of females across all samples), educational level (high school and

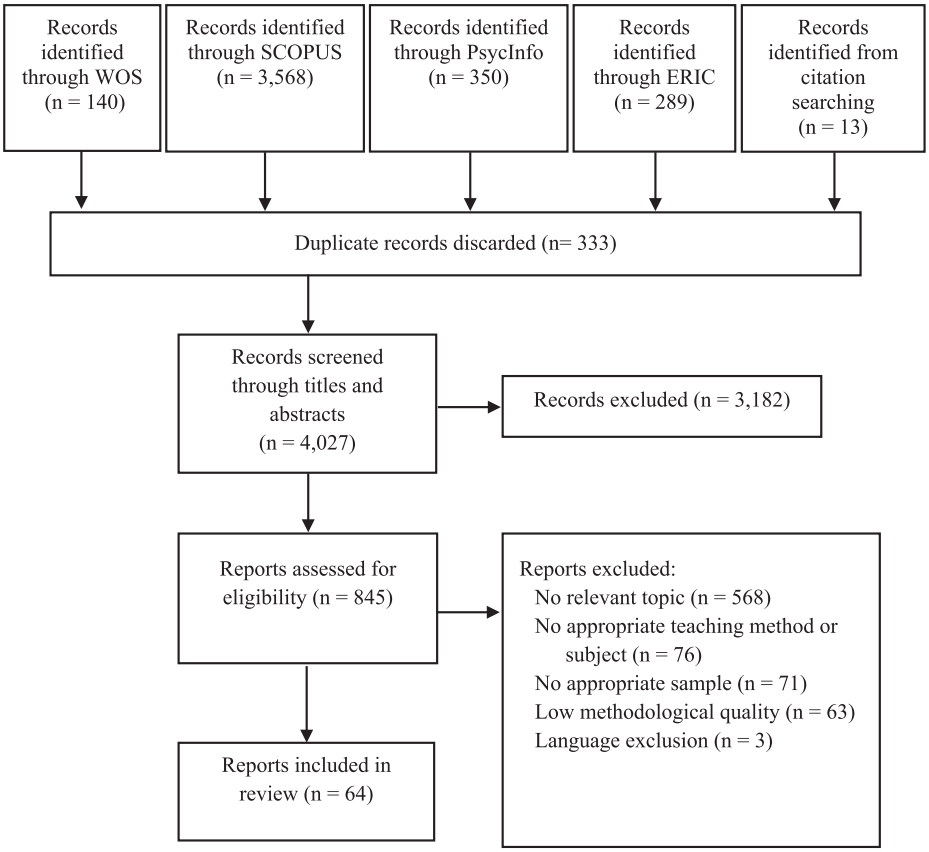

Fig. 4. Flow chart of the literature search process and selection of document.

university) and the type of instrument used to measure MRSs (i.e. whether they raised generic academic scenarios or specific motivational challenging situations) were considered potential moderators, in accordance with the characteristics and assumptions of the studies reviewed.

A narrative synthesis of the principal results was also elaborated and included complementary information on less well studied strategies.

2.4. Transparency and openness

In line with APA journal article reporting standards (Kazak, 2018), we report the inclusion/exclusion criteria and procedures used in this meta-analysis. The data analysis procedure has been described. Supplementary material for this article is available at https://doi.org/10.1016/j.lindif.2024.102480. Data are available from the authors upon request. The complete protocol was registered in PROSPERO (ID number CRD42023391598; http://www.crd.york.ac.uk/prospero/).

The research complied with the APA ethical standards, and it was approved by the Bioethics Committee of the University of Santiago de Compostela (registration USC-29/2020).

3. Results

3.1. Study characteristics

The main characteristics and results from the selected studies are presented in Table 1 (a more detailed version of this table is included in Supplementary Material see Table S1).

Most (93.7 %) of the studies were published during the last decade, and only 4 of them were published in or before 2000, thus reflecting the recent and increasing attention the topic has received.

The study samples were quite heterogeneous in terms of size, educational level, and country of origin. The sample size ranged between 38 (Zhang et al., 2022) and 3602 (Smit et al., 2017) students. The samples were almost evenly distributed across secondary (42.6 %) and university educational levels (54.7 %); only three studies with primary school students were identified. Regarding the origin of the samples, around 64 % of the studies were conducted in Europe (mainly Germany and Spain), 16 % in Asia, 16 % in the USA, 2.6 % in Latin America, and 1.4 % in Australia. This diversity of origins highlights the general interest attracted by the theme of the present review, at an international level.

In most of the studies, motivational regulation was measured in questionnaires composed by groups of items representing diverse strategies, which were rated on a Likert scale with statements on level of agreement or frequency of use. The Motivational Regulation Questionnaire (MRQ; Schwinger et al., 2009, 2007) deserves special mention, as it was used in 24 of the 75 studies reviewed. This questionnaire was derived from the initial work on MRSs by Wolters (1998, 1999, 2003) and includes eight subscales that measure different strategies: environmental control, enhancement of personal significance, enhancement of situational interest, mastery self-talk, performance-approach self-talk, performance-avoidance self-talk, proximal goal setting and self-consequating. The *Escala de Estrategias Motivacionales del Aprendizaje* [Scale of Motivational Strategies for Learning] (EEMA; Suárez-Riveiro & Fernández-Suárez, 2011) is also worthy of mention. This scale includes cost appraisal and generation of external attributions, as well as a variety of ego-protective strategies, specifically annulation of others, deception, defensive pessimism, enhancement of others, self-efficacy enhancement and self-handicapping.

We have observed some heterogeneity in the denominations used to identify MRSs in these and the other measures. With the intention of favouring the comparability and narrative description of the results of the reviewed studies, we elaborated a list of the motivational strategies

Table 1
Synthesis of characteristics and key findings of studies included in this review.

Authors (year)	Sample educational level (age, sex) home culture	Main findings
Studies included in the meta-analyses		
Wolters (1999)	88 high school students (M_{age} = 15.1, 48.5 % female) from the USA	- MST, PapST, EPS/ESI, SC and EC (+) effort and achievement. - MST predicted planning, monitoring and effort. - PapST predicted rehearsal, regulation and achievement. - SC predicted rehearsal and regulation. - EPS/ESI and EC were not significant predictors.
Wolters and Rosenthal (2000)	114 middle school students (M_{age} = 13.8, 60.5 % female) from the USA	- MST, PapST, EPS/ESI and EC (+) task value, task orientation, performance orientation and self-efficacy. - Task value predicted EPS/ESI, MST and SC. - Task orientation predicted EC, EPS/ESI, MST, PapST and SC. - Ego orientation predicted EPS/ESI, PapST and SC. - Achievement predicted SC.
Schwinger et al. (2009)	231 high school students (M_{age} = 16.8, 60.2 % female) from Germany	- MST, PapST, PavST, PGS, SC, EPS, ESI and EC (+) effort. PapST, PavST and ESI (+) achievement. - MRSsG directly predicted effort and indirectly (via effort) academic achievement.
Samadi and Davaii (2012)	245 middle school students (M_{age} = 13.1) from Iran	- MRSsG (+) achievement. - MRSsG predicted achievement.
Schwinger and Stiensmeier-Pelster (2012)	Study 1 231 high school students (M_{age} = 16.8, 60.2 % female) from Germany	- MST, PapST, PavST, PGS, SC and EC (+) effort. - 5 motivational latent profiles were identified regarding frequency of strategies use: (1) high (rather frequent use of each MRSs), (2) medium (average frequency of use of MRSs), (3) low (infrequent use of MRSs), (4) interest-focused (preference for interest enhancement) and (5) goal-focused (preference for goal oriented self-talk). - Profiles 1 and 5 obtained the highest scores on effort. Profile 3 obtained the lowest scores on effort. - No differences in academic achievement among groups were observed.
	Study 2 600 university students (M_{age} = 23.9, 80 % female) from Germany	- MST, PapST, PavST, PGS, SC, EPS, ESI and EC (+) effort. - 5 motivational latent profiles were identified: (1) high, (2) low, (3) interest-focused, (4) goal-focused and (5) performance self-talk. - Profiles 1 and 4 showed the highest scores in effort. Profiles 2 and 5 showed the lowest scores on effort. - Academic achievement was significantly higher in profile 1 students than in profile 2 and 5 students. Academic achievement was intermediate in the remaining profiles.
Schwinger and Stiensmeier-Pelster (2012)	301 high school students (M_{age} = 17.6, 56.5 % female) from Germany	- MST, PapST, PavST, PGS, SC, EPS, ESI and EC (+) effort. - Effort was predicted by EC, EPS, ESI, MST, PapST, PGS and SC. - Achievement was predicted by MST and PavST.
Fritea and Fritea (2013)	187 middle school students from Romania	- PapST (+) achievement. ESI (−) achievement. - PapST predicted achievement and moderated the relationship between boredom and achievement.
Wang (2013)	1096 middle school students (M_{age} = 16.8, 57 % female) from China	- MST, PapST, EPS and SEE (+) rehearsal and elaboration and (−) withdrawal and avoidance of challenge. - MST predicted rehearsal. - PapST predicted withdrawal and avoidance of challenge. - EPS predicted withdrawal, avoidance of challenge, rehearsal and elaboration. - SEE predicted withdrawal, avoidance of challenge and elaboration. - MRSs mediate the relation between goal orientations and the dependent variables.
Wolters and Benzon (2013)	215 university students (M_{age} = 20.3, 54 % female) from the USA	- Girls used PapST more frequently than boys. - MST, SC EPS, ESI and EC (+) task value, task orientation, academic self-efficacy and cognitive and metacognitive strategies, and (−) ego orientation and procrastination. - Task orientation predicted EC, EPS, ESI, MST and SC. - Ego orientation predicted EC and PapST. - Academic self-efficacy predicted EC, ESI and PapST. - Task value predicted EPS, MST, PapST and SC. - Metacognitive strategies considered globally predicted EC, EPS, ESI, MST, PapST and SC.
Cetin (2015)	166 university students (95.2 % female) from Turkey	- EC (+) achievement. - EC did not significantly predict achievement.
Paulino et al. (2015)	316 middle school students (M_{age} = 13.3, 49 % female) from Portugal	- MST, PapST, SC, EPS and ESI (+) task value, self-efficacy, task orientation, self-enhancing and self-defeating. - Self-enhancing predicted EPS, ESI and SC. - Self-defeating positively predicted PapST and SC. - Academic self-efficacy positively predicted ESI, MST and PapST. - Task value positively predicted EC, EPS, ESI, MST and PapST.
Wolters and Hussain (2015)	213 university students (88 % female) from the USA	- MRSsG (+) perseverance of effort, self-efficacy and cognitive and metacognitive strategies.

(*continued on next page*)

Table 1 (*continued*)

Authors (year)	Sample educational level (age, sex) home culture	Main findings
		- Perseverance of effort predicted MRSsG, but consistency of interest did not.
Grunschel et al. (2016)	Study 1 419 university students (M_{age} = 24.5, 68 % female) from Germany	- MST, PapST, PGS, SC, ESI and EC (+) achievement and (−) procrastination. - Procrastination was predicted by EC, EPS, ESI, MST, PapST, proximal goal setting and SC. - Achievement was predicted by MST, PapST and PavST. - Procrastination mediated the relationship between all MRSs (except PavST) and achievement.
	Study 2 229 university students (M_{age} = 25.9, 77 % female) from Germany	- PapST, PGS and EC (+) achievement. MST, PapST, PGS, SC, EPS, ESI and EC (−) procrastination. - Procrastination was predicted by EC, EPS, ESIt, MST, PapST, PavST, proximal goal setting and SC. - Positive emotional activation was predicted by ESI, EPS, MST, PavST, PGS and MRSsG. - Negative emotional activation was predicted by PapST, PavST and PGS. - Satisfaction with life was predicted by PapST and PavST. - Achievement was predicted by PavST. - Procrastination mediated the relationship between all MRSs (except for EC and SC) and well-being.
Paulino et al. (2016)	550 middle school students (12–18 years, 52.7 % female) from Portugal	- MST, PapST, SC and ESI (+) task value, self-efficacy, self-enhancing and self-defeating.
Suárez-Riveiro et al. (2016)	1103 secondary students (14–19 years, 46.5 % female) from Spain	- MST, PapST, PavST and CA (+) rehearsal, elaboration, organization and metacognitive self-regulation. WavST (−) with rehearsal, elaboration, organization and metacognitive self-regulation. - Rehearsal was predicted by PapST and WavST. - Elaboration was predicted by CA, MST and PapST. - Organization was predicted by CA. - Metacognitive self-regulation was predicted by CA, MST and WavST and it mediated the relationship between MRSs and cognitive strategies.
Engelschalk et al. (2017)	188 university students (M_{age} = 21.8, 56.9 % female) from Germany	- Number and quality of MRSs (+) effort, self-efficacy and achievement. - Number of MRSs used predicted effort. - Quality of MRSs used predicted self-efficacy. - Self-efficacy for motivation regulation and effort mediated the relationship between quality of MRSs and achievement.
Schwinger and Otterpohl (2017)	Study 1 513 university students (M_{age} = 24.2, 68 % female) from Germany	- MST, PapST, PavST, PGS, SC, EPS, ESI and EC (+) effort. - Effort was predicted by EC, MST, PapST, PavST, PGS and SC. - The relative weight of MST was higher for boys, while the relative weight of PavST was higher for girls. - EPS and ESI were not significant predictors.
	Study 2 University students assessed in two waves (N_{t1} = 613, M_{age} = 23.9, 79.4 % female; N_{t2} = 386) from Germany	- MST, PapST, PavST, PGS, SC, EPS, ESI and EC (+) effort. - Effort at t2 was predicted by effort at t1 and by EC, MST, PapST, PavST and PGS. - Altogether, the MRSs explained 31 % of the variance in current effort, after controlling for initial effort. - EC was relatively more effective for females. - Conscientiousness moderated the relative effectiveness of motivational regulation, but gender did not.
	Study 3 301 high school students (M_{age} = 17.6, 56.5 % female) from Germany	- MST, PapST, PavST, PGS, SC, EPS, ESI and EC (+) effort. - Effort at t2 was predicted by MST, PapST and PGS, after controlling for effort at t1. - Altogether, the eight MRSs explained 41 % of the variance in effort at t2, after controlling for effort at t1. - Conscientiousness, dispositional interest and goal orientations were significant moderators.
Smit et al. (2017)	3602 pre-vocational secondary education (M_{age} = 14.04) from The Netherlands	- MST, PapST, SC, EPS/ESI and EC (+) task value, engagement and effort. - Task value predicted EC, EPS/ESI, MST, PapST, SC and MRSsG. - Academic self-efficacy predicted EC, EPS/ ESI, MST, PapST and MRSsG. - Engagement was predicted by EC, EPS/ ESI, MST, PapST, SC and MRSsG. - Effort was predicted by EC, EPS/ESI, MST, PapST, SC and MRSsG.
Wang et al. (2017)	1096 high school students (M_{age} = 16.8, 53 % female) from a highly selective school in China	- MST, PapST and SEE (+) task orientation, ego orientation and involvement. MST, PapST and SEE (−) withdrawal, avoidance of challenge, and disruptive behaviours. - Task orientation predicted MST, PapST and SEE. - Ego orientation predicted PapST and SEE. - MST predicted involvement. - PapST predicted withdrawal, avoidance of challenge and disruptive behaviours. - SEE predicted avoidance of challenge.

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Table 1 (*continued*)

Authors (year)	Sample educational level (age, sex) home culture	Main findings
		- MRSs mediated the relationship between task orientation and engagement.
Kim et al. (2018)	396 university students (M_{age} = 20.4 years, 44 % female) from the USA	- MRSsG (+) persistence, task orientation, self-efficacy for self-regulated learning and cognitive and metacognitive strategies and (−) procrastination and self-defeated. - Motivational regulation was predicted by persistence and self-efficacy for self-regulated learning. Goal orientations and task value were not significant predictors. - Motivational regulation predicted cognitive and metacognitive strategies and procrastination.
Teng and Zhang (2018)	512 English-major students university students (M_{age} = 21.5, 61 % female) from China	- MRSsG (+) cognitive and metacognitive strategies and writing performance. - MRSsG directly predicted cognitive strategies, metacognitive strategies. - MRSsG directly and indirectly (via cognitive and metacognitive strategies) predicted writing performance.
Eckerlein et al. (2019)	115 university students (M_{age} = 23.9, 74.8 % female) from Germany	- Number and quality of MRSs (+) effort and achievement; and (−) motivational difficulties. - Number and quality of MRSs used predicted effort. - Quality of motivational regulation moderated the negative effect of motivational difficulties on effort. - Number and quality of MRSs used predicted achievement.
Ljubin-Golub et al. (2019)	274 university students (M_{age} = 21, 71 % female) from Croatia	- MST, PapST, PGS, SC, EPS, ESI and EC (−) procrastination and (+) intellect, agreeableness, conscientiousness and extraversion. MST, PapST, PavST, PGS, SC, ESI and EC (−) emotional stability. - Agreeableness predicted EC, EPS, ESI, MST, PapST, PGS, SC and MRSsG. - Conscientiousness predicted MST, PapST, PGS, EC and MRSsG. - Extraversion predicted ESI, PapST and MRSsG. - Emotional stability predicted MST, PapST, SC and MRSsG. - Intellect predicted EPS and MST and MRSsG. - EC predicted procrastination and mediated the relationship between personality (conscientiousness, agreeableness and intellect) and procrastination.
Garn and Morin (2021)	193 university students from USA (M_{age} = 20.7, 70 % female) followed every	- MRSsG (+) achievement and autonomous motivation.

Table 1 (*continued*)

Authors (year)	Sample educational level (age, sex) home culture	Main findings
	two weeks through a semester (7 waves)	- Students' initial achievement predicted initial levels of MRSsG. - A general gradual decrease in the use of MRSsG was constated followed by rebound in the last moth of the semester. - Variations in motivational regulation corresponded with variations in autonomous motivation in the same direction.
Kim et al. (2020)	273 university students (M_{age} = 20.5, 46.5 % female) from the USA	- MRSsG and EC (−) procrastination and (+) self-efficacy for self-regulated learning, time management and task value. - Self-efficacy for self-regulated learning predicted MRSsG and EC. Task value and time management were not significant predictors. - MRSsG predicted achievement and procrastination.
Kryshko et al. (2020)	Study 1 249 university students (M_{age} = 21.6, 66.3 % female) from Germany	- MST, PapST, PavST, PGS, SC, EPS, ESI and EC (+) academic effort and (−) achievement and drop-out intention. - Achievement was predicted by EPS, MST and MRSsG. MRSsG were not significant predictors of drop-out intention. - Effort mediated the relation between motivational regulation (except for EPS and ESI) and achievement.
	Study 2 Fist year university students assessed in two times (N_{t1} = 210, M_{age} = 20.1, 34.8 % female; N_{t2} = 194; N_{t3} = 187) from Germany	- MST, PapST, PavST, PGS, SC, EPS, ESI and EC (+) academic effort and (−) drop-out intention (except for PavST) and achievement. - Achievement was predicted by EPS. - Drop-out intention was predicted by EC and PapST. - Effort mediated the relationship between MRSs (except for PavST) and achievement.
Reindl et al. (2020)	469 university students (M_{age} = 21.7, 77.4 % female) from Germany	- MST (+) metacognition, rehearsal, organization, elaboration, academic self-efficacy, effort, affective adaptivity and action adaptivity and (−) rumination. PapST (+) rumination, metacognition, rehearsal, organization, effort, and action adaptivity and (−) academic self-efficacy, affective adaptivity and elaboration. - Three profiles were identified: (1) goal-directed learners (high motivational regulation and reappraisal), (2) worried performers (low MST and reappraisal and high PapST) and (3) inhibited ruminators (high rumination).

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Table 1 (*continued*)

Authors (year)	Sample educational level (age, sex) home culture	Main findings
		- Profile 1 scored significantly higher than profile 2 in elaboration, metacognition, academic self-efficacy, effort, affective adaptivity and action adaptivity. - Profile 2 scored significantly higher than profile 3 in rehearsal, effort, academic self-efficacy and affective adaptivity. - Profile 1 scored significantly higher than profile 3 in metacognition, rehearsal, organization, academic self-efficacy, effort, affective adaptivity and action adaptivity.
Trautner and Schwinger (2020)	Study 1 146 university students (M_{age} = 23.4, 76.8 % female) from Germany	- MST, PapST, PavST, PGS, SC, EPS, ESI, EC and MRSsG (+) effort and self-efficacy motivation regulation. - Self-efficacy motivation regulation predicted MRSsG. - MRSsG predicted effort and mediated the relationship between self-efficacy motivation regulation and effort.
	Study 2 588 university students (M_{age} = 23, 69.4 % female) from Germany	- MST, PapST, PavST, PGS, SC, EPS, ESI, EC and MRSsG (+) effort, self-efficacy motivation regulation, positive emotions and achievement (except for PavST). - Self-efficacy for motivation regulation predicted MRSs. - MRSsG predicted effort and positive emotions indirectly predicted achievement via effort and mediated the relationship of self-efficacy with effort.
	Study 3 531 university students (M_{age} = 24.2, 68.6 %) from Germany	- MST, PapST, PGS, SC, EPS, ESI, EC and MRSsG (+) effort, self-efficacy motivation regulation (except for PavST), positive emotions and achievement. - MRSsG were predicted by self-efficacy for motivation regulation and self-efficacy for self-regulated learning. - MRSs directly predicted effort and achievement via effort.
Bäulke et al. (2021)	Study 1 160 university students (M_{age} = 21.7, 53 % female) from Germany	- State strategy fit (−) procrastination. - State strategy use and fit fluctuated across learning situations. - Procrastination was predicted by trait strategy use and state strategy fit. - Trait strategy fit predicted procrastination decrease during one moth in an exam preparation phase.
	Study 2 233 university students (M_{age} = 20.7, 90 % female) from Germany	- State strategy use and fit (−) procrastination. - State strategy use and fit fluctuated across learning situations. - Neither trait strategy use, nor state strategy use had a statistically significant effect on academic procrastination during seven weeks in the middle of a semester. - Procrastination was predicted by trait strategy fit and state strategy fit, but not procrastination decrease.
Kim et al. (2021)	365 university students (M_{age} = 19.4, 57.3 % female) from the USA	- MRSsG (−) goal conflict and (+) goal facilitation and achievement. - Goal facilitation predicted MRSsG, while goal conflict did not.
Ilishkina et al. (2022)	716 university students (M_{age} = 22; 77.5 % female) from Russia	- MST, PapST, PavST, PGS, SC, EPS, ESI, EC and MRSsG (+) intrinsic and extrinsic (except for EPS) motivational regulation. - Females showed higher use of ESI. - A model of two MRSs factors (intrinsic and extrinsic) reached adequate fit. - Intrinsic MRSs showed stronger correlations with intrinsic motives than with extrinsic motives and extrinsic MRSs showed weaker correlations with intrinsic motives than with extrinsic motives.
Lohbeck and Moschner (2021)	415 university students (78.8 % female, M_{age} = 22.38) from Germany	- MST, PapST, SC, EPS/ESI and EC (+) rehearsal, elaboration and organization. - ESI predicted rehearsal and organization. - SC positively predicted elaboration and organization. - PapST positively predicted rehearsal and organization.
Trautner and Schwinger (2022)	Study 1 376 university students (M_{age} = 22.9) from Germany	- MST, PapST, PavST, PGS, SC, EPS, ESI, EC and MRSsG (+) effort, self-efficacy for motivational regulation (except for PavST) and incremental theories about intrinsic (except for PapST and PavST) and extrinsic motivation. - MRSsG were predicted by self-efficacy for motivation regulation and by incremental theories about intrinsic motivation. - Incremental theories about intrinsic motivation predicted EC, EPS and ESI. - MRSs predicted effort.
	Study 2 365 university students (M_{age} = 22.8) from Germany	- MST, PapST, PGS, SC, EPS, ESI, EC and MRSsG (+) effort, self-efficacy for motivational regulation and incremental theories about intrinsic and extrinsic motivation. - Models separating general and personal implicit theories did not fit the data acceptably. - Incremental theories about extrinsic motivation directly predicted MRSsG and via

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Table 1 (*continued*)

Authors (year)	Sample educational level (age, sex) home culture	Main findings
		self-efficacy for motivation regulation. - Incremental theories about extrinsic motivation predicted EC, ESI and PGS. - Incremental theories about intrinsic motivation predicted MST and PGS. - MRSs predicted effort.
Xu and Corno (2022)	318 middle school students (M_{age} = 13.7, 45.6 % female) from China	- MRSsG (+) achievement. - MRSsG predicted achievement.
Studies not included in the meta-analyses		
Wolters (1998)	115 university students from the USA (M_{age} = 19.1, 46 % female)	- Volition (EC) was more frequent than extrinsic (PapST and SC) strategies and intrinsic (EPS, ESI, MST and SEE) strategies in response to difficult material, and more frequent than intrinsic strategies in response to boring material. - Intrinsic regulation predicted task orientation, elaboration, critical thinking and metacognition. - Extrinsic regulation predicted ego orientations and achievement.
Aunola et al. (2000)	354 middle school students (M_{age} = 14, 50 % female) from Sweden	- Children of authoritative and permissive parenting styles obtained significantly higher scores in SEA than children of neglectful and authoritarian styles.
Suárez-Riveiro et al. (2001)	595 university students (18–28 years old, 69 % female) from Spain	- SH and DP (−) task orientation, and (+) ego orientation. - Three clusters were identified: (1) high self-enhancing/self-defeating/ work-avoidance and medium task orientation, (2) high task/self-defeating and medium self-enhancing/work-avoidance goals and (3) high task orientation, medium work-avoidance and low self-enhancing and self-defeating goals. - Proportion of males and females was similar in cluster 3. Proportion of males was higher in cluster 1, while proportion of females was higher in cluster 2. - Students in group (1) reported the highest use of MRSs. - No differences were observed between groups (2) and (3), except for the use of DP, which was higher in group (2).
Nota et al. (2004)	81 high school students (M_{age} = 17.1, 87.7 % female) from Italy 49 of them (85.72 % female) followed to university	- SC and EC (+) rehearsing and memorizing. - SC predicted intention to continue with further education and achievement.
Cooper and Corpus (2009)	16 primary first-grade students (M_{age} = 6.1), 16 primary third-grade students (M_{age} = 9), 16 primary fifth-grade students (M_{age} = 11), and 16 university students (M_{age} = 20) from the USA	- University students had greater knowledge of the effectiveness of five motivation regulation strategies (EC, SC, EPS/ESI, PapST and MST) than fifth grades, who had greater knowledge than did third graders and first graders. - University students had greater understanding of why the motivation regulation strategies were effective than did fifth graders, who had greater understanding than did third graders, who had greater understanding than did first graders.
Xu (2008)	377 rural (51.7 female) and 182 urban middle school (55.3 % female) students from the USA	- High achieving students obtained higher scores in MRSsG and EC than low achievers.
Acee and Weinstein (2010)	82 university students (M_{age} = 21.4, 83 % female) distributed in 2 groups (control and value-reappraisal intervention - VR) from Spain	- VR group showed significant gains on task-value, but not on academic self-efficacy.
Tas and Tekkaya (2010)	1950 high school students (M_{age} = 13.1; 48.8 % female) from Turkey	- SH (−) self-efficacy, task and ego orientations. - SH significantly explained cheating behaviour.
Suárez-Riveiro and Fernández-Suárez (2011)	1080 high school students (between 14 and 19 years old, 46 % female) from Spain	- SH and EO (−) cognitive and metacognitive strategies (except for elaboration with EO). SEE, DP and GEA (+) rehearsal, organization, elaboration and metacognitive strategies. - Rehearsal was predicted by DP, EO, GEA and SEE. - Elaboration was predicted by AO, DP, EO, SEE and SH. - Organization was predicted by DP, SEE and SH. - Metacognitive self-regulation was predicted by DP, SEE and SH. - Metacognitive self-regulation partially mediated the relationships between cognitive strategies and DE, SEE and SH.
Fernández-Suárez et al. (2012)	2387 secondary students (52.9 % female) from Spain	- Three clusters were identified: (1) effort avoiding students, (2) high academic self-efficacy and task orientation students, and (3) high ego orientation students. - Best discriminant MRSs between groups were PavST, SEE and SC.
Gaeta et al. (2012)	604 secondary students (12–17 years, 50 % female) from Spain	- MRSsG (+) task orientation, ego orientation, and metacognitive self-regulation. - Task orientation predicted MRSsG. - MRSsG predicted ego orientation and mediated the relation between task orientation and metacognitive self-regulation.
Metallidou (2012)	160 primary students (55.6 % female) from Greece	- SC and EC (−) ability to learn and speed of learning. - Ability to learn predicted SC.

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Authors (year)	Sample educational level (age, sex) home culture	Main findings
		- Speed of learning predicted EC and SC.
Park and Sperling (2012)	41 university students (19–21 years; 60 % female) from the USA	- SH (−) intrinsic goal orientation, self-efficacy, rehearsal, elaboration, time and study environment, and effort regulation and effort. - High procrastinator students obtained significant higher scores in SH than low procrastinators.
Schwinger (2013)	Study 1 105 high school students (M_{age} = 13.9, 53.3 % female) from Germany	- A two-factor model was found to fit the data obtained, representing SH in Math vs. Verbal domains (German and English). - SH factors were differentially related to students' self-concept, interest, and achievement in both math and verbal domains, except for math SH that showed similar associations with self-concept and interest across subjects.
	Study 2 749 high school students (M_{age} = 13.7, 50.4 % female) from Germany	- Significantly higher SH was obtained for boys in German, English, and Biology, but not in Math, Physics, and History. - A six-factor model was found to fit the data obtained, representing SH in the six domains evaluated. - Domain specific SH were correlated with their corresponding domain specific ability self-concept, interest and achievement. - Correlations between domain specific SH and domain specific ability and interest were significantly higher than the non-corresponding ones, except for SH and interest in history. - Correlations between domain specific SH and domain specific achievement were significantly higher only for English and Biology.
King and Gaerlan (2015)	385 university students (M_{age} = 17.7, 45.2 % female) from Philippines	- Female students used EC, MST, PapST, and SC more frequently. - MST, PapST, SC, EPS/ ESI and EC (+) past-positive and future view. - Past-positive view predicted EC, EPS/ ESI, MST, PapST, and SC. - Past-negative view predicted PapST. - Present hedonistic view predicted EPS/ ESI and SC. - Future view predicted EC, EPS/ ESI, MST, PapST, and SC.
Torrano and Soria (2016)	374 middle school students (13–14 years, 49 % female) from Spain	- SH (−) with task orientation, self-efficacy, regulation of effort, elaboration, organization, metacognitive self-regulation and achievement. - Low-achievement students obtained significantly higher scores in SH than their intermediate and high-achievement peers.
Torrano and Soria (2017)	374 high school students (between 13 and 14 years old, 49 % female) from Spain	- Men obtained significantly higher scores on SH. No significant differences were obtained when controlling for previous performance.
Bäulke et al. (2018)	515 university students (M_{age} = 23.2, 58 % female) from Germany	- Motivational regulation knowledge (−) procrastination and drop-out intentions. - Motivational regulation knowledge predicted self-efficacy. - Self-efficacy for motivation regulation mediated the relationships between conditional motivational regulation knowledge and both procrastination and drop-out intentions.
Ferradás et al. (2018)	1028 university students (M_{age} = 21.4, 86.3 % female) from Spain	- DP (+) self-esteem, task orientation, self-enhancing, and self-defeating, except work-avoidance. - Four clusters were identified: (1) high self-esteem and a moderate DP, (2) low self-esteem and low DP, (3) high self-esteem and low DP, and (4) low self-esteem and high DP. - Group 2 obtained significantly higher scores than the rest in task orientation, and self-defeating. - Groups 2 and 4 obtained higher scores in self-enhancing. - Group 3 obtained higher scores in work-avoidance.
Ferradás et al. (2019)	1028 university students (M_{age} = 21.4, 86.3 % female) from Spain	- SH (+) self-enhancing and self-defeating. DP (+) self-enhancing, self-defeating and learning goals, except with self-esteem. SH and DP (−) self-esteem. - Four clusters were identified: (1) high self-esteem, self-enhancing and self-defeating, low task orientation, (2) high self-esteem and task orientation, low self-enhancing and self-defeating, (3) low self-esteem and task orientation, high self-enhancing and self-defeating, (4) low self-esteem, moderate self-defeating, high task orientation and self-enhancing. - Group 3 obtained significantly higher scores than the rest in SH. - Group 4 obtained higher scores DH.
Suárez-Riveiro et al. (2019)	Sample 1 613 secondary students (M_{age} = 15.7, 57.1 % female) from Spain	- AO (+) task orientation, self-enhancing, self-defeating, work-avoidance, attributions, and academic self-efficacy. EO (−) task orientation, attributions and academic self-efficacy.

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Authors (year)	Sample educational level (age, sex) home culture	Main findings
		- No sex differences were obtained regarding motivational regulation. - Three clusters were identified: (1) highest scores in motivational beliefs, and AO, (2) highest scores on self-defeating, work-avoidance orientation, and EO, (3) lowest scores on all dimensions except self-defeating. - Self-enhancing and academic self-efficacy positively predicted the use of AO. - Task orientation, and academic self-efficacy negatively predicted use of the EO strategy, while the other goal orientations positively predicted it. - Attributions negatively predicted EO.
	Sample 2 910 secondary students (M_{age} = 15.8, 46.5 % female) from Spain	- DE (+) self-enhancing, self-defeating, and work avoidance, and (−) task orientation and attributions. - Three clusters were identified: (1) lower scores in motivational beliefs and DE, (2) highest scores on task and self-enhancing, and lower scores on work-avoidance orientation, (3) higher scores on self-defeating, work-avoidance and DE. - Females reported significantly lower scores on DE than boys. - DE was positively predicted by academic self-efficacy and ego and work avoidance orientations, and negatively predicted by task orientation.
Boyle et al. (2020)	395 university students from Thailand (93.4 % female) and 313 from Australia (78 % female)	- Thailand students obtained significantly higher scores on NBI and SEE. - Students with lower NBI and higher SEE obtained higher achievement.
Peng and Bai (2020)	41 high school students (M_{age} = 17.5 68.3 % female) and 21 university students (M_{age} = 20.8, 52.4 % female) from Taiwan	- High school students reported significantly less use of EC than university students.
Rodríguez-Guardado and Gaeta (2020)	204 high school students (M_{age} = 16.6, 63.7 % female) from Mexico	- Four profiles were identified: (1) extrinsic consequences orientation, (2) multiple goals orientation, (3) no orientation, (4) task orientation. - Profile 2 showed higher use of SEE than profile 1, profile 3 and profile 4. - Profile 2 showed lower use of NBI than profile 3 and profile 4. Profile 1 showed lower use of SC than profile 2. - Use of SEE predicted achievement.
Michalsky (2021)	202 high school students (M_{age} = 15.5; 49 % female) from Israel, distributed in 3 experimental conditions of metamotivational scaffolding: before (N = 52), during (N = 50) and after (N = 54) a study unit, and a control group (N = 46)	- MRSs (+) domain-specific science achievement. - In terms both of domain-specific and general science achievement, the before group outperformed the other three groups, the after group outperformed the during group, and the control group was the lowest.
Góes and Boruchovitch (2022)	233 high school students (M_{age} = 15.9, 57.1 % female) from Brazil	- MST, PapST, SC, EPS/ESI and EC (+) learning strategies. - Female students obtained higher scores in EC, PapST, and SC.
Kryshko et al. (2022)	4 measurement waves in university students (N_{t1} = 445, 56.2 % female; N_{t2} = 455, 59.3 % female; N_{t3} = 414, 58.2 % female; N_{t4} = 386, 57.8 % female; M_{age} at t1 = 22.1) from Germany	- MRSsG (+) self-efficacy for motivational regulation, satisfaction with study content and coping with academic stress. - Self-efficacy for motivational regulation predicted MRSsG. - Higher (lower) levels of self-efficacy in relation with the own expected score were associated with subsequent decrease (increase) in MRSs. - MRSs predicted satisfaction with study content and with coping with academic stress.
Zhang & Dong (2022)	230 university students from China (M_{age} = 23.4, 39.6 % female) evaluated in 2 times	- MRSs (+) self-regulated writing strategies, writing enjoyment, and (−) writing anxiety. - MST predicted enjoyment in t1 and t2. - PapST predicted enjoyment in t1 and t2. - PapST predicted anxiety in t1 and t2.
Zhang et al. (2022)	38 university students (M_{age} = 18.2, 57.9 % female) from China completing a reflective journal in 3 moments along a semester	- No significant differences were obtained between the high- and low-proficiency groups in their use of any of the MRSs. - No statistically significant changes were observed in the use of MRSs along the completion of reflective journals.
Norouzi et al. (2023)	508 university students (55.7 % female) from Iran	- EC predicted task orientation, self-enhancing, and self-defeating. - EPS predicted task orientation, self-enhancing, and self-defeating. - ESI predicted task orientation, self-enhancing, and self-defeating. - SC predicted task orientation, self-enhancing, and self-defeating.

Note. MRSs = motivational self-regulation strategies; MRSsG = motivational self-regulation strategies (globally considered); AO = annulation of others; CA = cost appraisal; DE = deception; DP: defensive pessimism; EC = environmental control; EO = enhancement of others; EPS = enhancement of personal significance; ESI = enhancement of situational interest; GEA = generation of external attributions; MST = mastery self-talk; NBI = Negative-based incentives; PapST = performance-approach self-talk; PavST = performance-avoidance self-talk; PGS = proximal goal setting; SC = self-consequating; SEA = self-enhancing attributions; SEE = self-efficacy enhancement; SH = self-handicapping; WavST = work avoidance self-talk; (+) = correlated positively with; (−) = correlated negatively with.

measured in these studies (Table 2) and we unified the names and description of coincident strategies. Original denominations used in each measure can also be consulted in the table. Only those strategies directly aimed at managing motivational dimensions were considered, although some of the reviewed studies also covered information processing strategies (Suárez-Riveiro et al., 2016; Wolters, 1998) and/or emotional self-regulation strategies (Gaeta et al., 2012; Reindl et al., 2020; Rodríguez-Guardado & Gaeta, 2020; Suárez-Riveiro et al., 2001, 2019; Suárez-Riveiro & Fernández-Suárez, 2011; Wolters, 1998) as means of influencing motivation (for a review on emotional self-regulation strategies see Martínez-López et al., 2021).

In addition, the wording before items or the items themselves also differed between questionnaires in relation to the conditions raised. Thus, the MRQ (Schwinger et al., 2007, 2009) poses generic academic scenarios, the EEMA (Suárez-Riveiro & Fernández-Suárez, 2011) includes generic and problematic situations, and the other questionnaires focus on motivational challenging situations (i.e. discouragement, difficulties or distractions) (McCann & Turner, 2004; Paulino et al., 2015; Wolters, 1999; Wolters & Benzon, 2013). Vignettes on prototypical learning situations, an on-line think aloud protocol, and a learning diary have also been used as alternatives for situated assessment (Bäulke et al., 2018, 2021; Engelschalk et al., 2017).

3.2. Synthesis of results

3.2.1. Types and frequency of use of motivational regulation strategies

The data provided in the articles reviewed refer to 18 types of strategies, although they are mainly concentrated around the 8 strategies originally identified by Wolters (1998, 1999, 2003) and Schwinger et al. (2007, 2009). We organized this last group according to the frequency of use of each strategy by considering the mean scores for the subscales representing those strategies as reference values (see Table 3). Performance-approach self-talk and self-consequating consistently appeared in the top positions, while enhancement of situational interest and performance-avoidance self-talk always occupied the bottom positions; environmental control and proximal goal setting occupied intermediate positions, with enhancement of personal significance being consistently closer to the least frequent point. Mastery self-talk was also among the least frequent strategies, except in the studies by Smit et al. (2017), with pre-vocational secondary education students, and Wang et al. (2017), with students from highly selective secondary schools in China. In addition, self-efficacy enhancement, another of the strategies originally identified by Wolters (1998), did not show a consistent position when evaluated.

Wolters (1999) demonstrated by means of statistical comparison that performance self-talk was used significantly more frequently than the other strategies evaluated in high school students: self-consequating and environmental control were reported with similar frequency, while interest enhancement was used significantly less frequently than the other strategies. These differences were replicated in a later study by Wolters and Benzon (2013) with university students, although in this case the mean frequency of environmental control was significantly higher than the mean frequency of self-consequating.

Besides the general use of different types of strategies, some authors have drawn attention to the phase and situational specificity of motivational regulation (Bäulke et al., 2021; Eckerlein et al., 2022). In fact, Bäulke et al. (2021) found that self-reported frequency of the use of MRSs by university students, considered globally, fluctuated (21 % of variance within persons) across four out of six situations of a typology proposed by Engelschalk et al. (2016), in which pre-actional, actional and post-actional phases as well as two types of motivational problems were distinguished: (1) low expectancy for success in the face of a difficult/complex task, and (2) low subjective task value due to boring or uninteresting learning material.

As for the validity of the other classification criteria of MRSs described in the Introduction (i.e. the intrinsic/autonomous versus

Table 2
Motivational regulation strategies evaluated, and examples of items from the measures used in the studies reviewed.

Denominations	Definition	Examples of items
Annulation of others[a]	Denying or minimizing classmates' good results to protect self-worth.	"I try to ignore the academic performance of the others and thus see myself as more competent"
Cost appraisal[a]	Students' generation of appreciations to establish the adequacy of the task costs (time, affects, effort).	"Before starting a demanding task, I usually think that its accomplishment will compensate the effort I will have to invest"
Deception[a]	Simulating expectations of being surpassed by peers, lying about the own progress in academic tasks or expressing external attributions for success.	"Although I put a lot of effort into my studies, I try to make others see that my good results are due to luck or to how easy the test or assignment was"
Defensive pessimism[a,b]	Creating expectations of failure that should be avoided by effort.	"I imagine the results that I would achieve in the worst possible scenario and use this as motivation for my studies"[a] "Considering what can go wrong helps me to prepare"[b]
Enhancement of others[a]	Valuing classmates' capabilities to protect self-worth.	"Often I think that I am unlucky that my classmates have a high capacity for learning, which prevents me from standing out more"
Enhancement of personal significance[c] (regulation of value[d,e,f,g])	Students' attempts to increase the subjective value of the task by connecting it to one's own personal interests and preferences.	"I try to stablish relations between work and my personal interests"[c] "I think up situations where it would be helpful for me to know the material or skills"[d] "I try to see the usefulness of the content/tasks for my life"[e] "I try to relate educational materials to my future profession, remind their importance and value"[f] "I try to find ways that the material relates to my life"[g]
Enhancement of situational interest[b,c] (regulation of situational interest[f,g,h])	Refers to making non-appealing tasks more enjoyable.	"I make myself look for ways to bring more fun to the tasks"[b] "I make studying more enjoyable by turning it into a game"[c] "To make studying more enjoyable, I try to focus on a fun aspect it might have"[d] "I think of a way to make the work seem enjoyable to complete"[e]
Environmental control[c,d] (environmental structuring[e,f,g,h,i,j,k])	Minimizing disruptive factors in the learning environment.	"I make sure that distractions occur as seldom as possible"[c] "I try to get rid of any distractions that are around me[d] "I try to have no distractions around me"[e] "I try to eliminate the factors that distract my concentration in the

(continued on next page)

Table 2 (*continued*)

Denominations	Definition	Examples of items
		environment"[f] "I change my surroundings so that it is easy to concentrate on the work"[g] "I keep myself away from distraction in the learning to write process"[h] "I turned off the radio so I can concentrate on what I am doing"[i] "I isolate myself from unnecessary noisy places"[j] "I choose the location where I study to avoid too much distraction"[k]
Generation of external attributions[a]	Generating external causes that can facilitate positive results.	"To motivate myself before some tasks, I think that if the teacher is not very demanding I will get a good result"[a]
Mastery self-talk[b,c] (generation of mastery goals[a], regulation of mastery goals[e], regulation of learning goals[d,e,Error! Bookmark not defined.])	Students' tendency to focus the aim to enlarge one's competence and knowledge.	"Sometimes when faced with a task I think that my objective is to learn new things"[a] "I tell to myself that I should keep on learning in order to learn as much as possible for me personally"[b] "I persuade myself to keep at it just to see how much I can learn"[c] "I challenge myself to complete the work and learn as much as possible"[e] "I tell myself that I must study to learn as much as I can"[d]
Performance-approach self-talk[c] (generation of self-enhancing goal[a], regulation of performance goals[d,e,g], performance self-talk[b])	Reminding to oneself the goal of getting good grades and outperforming others.	"I plan to do my homework better than others"[a] "I call my attention to the fact of how important it is to do well in tests and exams"[c] "I remind myself how important it is to do well on the tests and assignments in this course."[d] "I think that if I do not study my grades will get worse"[e] "I remind myself about how important it is to get good grades."[g] "I tell myself that it is important to get good grades in writing courses"[h]
Performance-avoidance self-talk[c] (generation of self-defeating goal[a], regulation of performance[e])	Students' attempts to highlight their goal of not performing worse than others.	"I try not to let my classmates notice my mistakes"[a] "I think about that it would be very unpleasant for me to perform worse than the others"[c] "I think that if I do not study my grades will get worse"[e]
Proximal goal setting[c]	Division of distant long-term goals into smaller subgoals that are easier to accomplish.	"I tell myself that I can master the tasks if I set myself subgoals"
Self-consequating[a,c,d,g] (self-consequences[i], self-reinforcement[f]) Negative-based incentives[l]	Establishing self-provided consequences associated with task completion.[a,c,d,g,i,f] Students' self-generated thoughts about potentially negative consequences aimed at increasing effort before performance to avoid failure.[l]	"When faced with a difficult task, I motivate myself by telling myself that I will get positive results"[a] "I make a deal with myself saying that I will do something pleasant after I finish work"[c] "I tell myself I can do something I like later if right now I do the work I have to get done"[d] "I promise myself some kind of a reward if I get the assignment done"[g] "If I do well on a test, I treat myself to a movie"[i] "I promise myself that I will receive an award or reward for completing my assignments"[f] "I think about how disappointed my family and friends will be if I fail"[l]
Self-efficacy enhancement[l] (generation of positive expectations[a])	Involves creating positive thoughts about one's competence or self-efficacy.	"When facing a task or subject, I think that I am capable of exerting sufficient effort to be successful"[a] "I tell myself; you can do this!"[l]
Self-enhancing attributions[m]	Generating self-attributable reasons.	"Try to remember a situation in which things went well and which ended up in success. Think about the possible reasons why this happened. How much was this due to you?"
Self-handicapping[a,n,o,p,q]	Creating excuses or obstacles that may be used to justify a potential failure.	"Sometimes I deliberately do not put effort into tasks, so that if my results are not good, I can say that it was due to the fact that I did not make enough effort"[a] "Some students purposely don't try hard in class. Then if they don't do well, they can say it is because they didn't try. How true is this of you?"[n] "I try not to get too intensely involved in competitive activities, so it won't hurt too much if I lose or do poorly"[o] "Some students purposely don't try hard in school so that if they don't do well, they can say it is because they didn't try. How true is this of you?"[p] "Some students purposely get involved in a lot of activities. Then if they don't do as well on their schoolwork as they hoped, they can say it is because they are involved with other things. How true is this of you?"[q]

(*continued on next page*)

Table 2 (*continued*)

Denominations	Definition	Examples of items
Work avoidance self-talk[a]	Involves investing the minimum effort in academic tasks.	"I aim to pass, but try to work as little as possible"[a]

Note. Names of the strategies used in the text are highlighted in bold.

[a] Escala de Estrategias Motivacionales del Aprendizaje [Scale of Motivational Strategies for Learning] (EEMA; Suárez-Riveiro & Fernández-Suárez, 2011).

[b] Defensive Pessimism Questionnaire (Norem, 2002).

[c] Motivational Regulation Questionnaire (MRQ; Schwinger et al., 2007, 2009).

[d] Motivational Regulation Questionnaire (MRSQ; Wolters & Benzon, 2013).

[e] Escala de Autorregulação da Motivação para a Aprendizagem [Self -Regulation of Motivation in Learning Scale] (EAM; Paulino et al., 2015).

[f] Metamotivational Strategies in Medical Students Questionnaires (MSMQ; Norouzi et al., 2021).

[g] Motivational Regulation Strategies Questionnaire (MRSQ; Wolters, 1999).

[h] Second Language Writing Strategies for Motivational Regulation Questionnaire (L2WSMRQ; Teng & Zhang, 2016).

[i] Self-regulated Learning Strategies Interview Schedule (SRLIS; Zimmerman & Martinez-Pons, 1990).

[j] Academic Self-Regulated Learning Scale (Magno, 2010).

[k] Adapted Self-Regulated Learning Questionnaire (SRLQ; Barnard et al., 2009).

[l] Academic Volitional Strategies Inventory (AVSI; McCann & Garcia, 1999; McCann & Turner, 2004).

[m] Strategy and Attribution Questionnaire (SAQ; Nurmi et al., 1995).

[n] Patterns of Adaptive Learning Survey (PALS; Midgley et al., 1996, 2000).

[o] Self-Handicapping Scale (SHS; Jones & Rhodewalt, 1982).

[p] Adapted Self-handicapping Scale (Urdan et al., 1998).

[q] Self-Handicapping Scale (Midgley et al., 1996).

extrinsic/controlling and the adequacy for different motivational dimensions), two of the studies differentiated between strategies for regulating intrinsic and extrinsic motivation and found empirical support for this classification. First, Wolters (1998) combined performance-approach self-talk and self-consequating in an extrinsic category and mastery self-talk, enhancement of personal significance, enhancement of situational interest and self-efficacy enhancement in an intrinsic category. A negative significant correlation between these groups of strategies was observed. Recently, Ilishkina et al. (2022) applied the same classification to the eight principal strategies assessed in the MRQ (Schwinger et al., 2007, 2009). These researchers added performance-avoidance self-talk, proximal goal setting and environmental control to the extrinsic category and restricted intrinsic category to mastery self-talk and interest enhancement. This division was sustained by confirmatory factor analysis, and the MRSs in the intrinsic factor were more closely correlated with intrinsic motives (learn, achieve, self-develop) than with extrinsic motives (self-respect, self-protection, incentives); the opposite was true for the MRSs in the extrinsic factor.

3.2.2. *Dimensions of individual differences, contextual factors and motivational self-regulation*

Our first hypothesis stated that personal and contextual dimensions involving academic tasks are associated with the use of MRSs. Several personal dimensions that may affect how students deal with academic motivation have been studied. We have gathered the available evidence based on this assumption in this subsection (although the results obtained to date do not allow a causal direction to be established). Meta-analysis models *tested* in the current review, confirmed the existence of (1) moderate to high correlations between task value and various MRSs, (2) low to high correlations between both self-efficacy for SRL and task orientation[1] with the use of a series of MRSs, 3) low to moderate correlations between general academic self-efficacy and part of the MRSs, and (4) low positive correlations between self-enhancing and some MRSs (see Table 4).

A forest plot of effect sizes for each of the meta-analyses performed was constructed (included as part of Supplementary Material, see Figs. S1–S46). The results of the pairwise comparisons of the strength of the correlations between dimensions of individual differences and MRSs are indicated by superscripts in Table 4. The strongest effects were found for the relationships between motivational beliefs and mastery self-talk. The relationships between both task orientation and task value and performance-approach self-talk and environmental control were also some of the strongest.

Some other relationships between personal dimensions and the use of MRSs have been noted, although we did not find a sufficient number of studies reporting correlational data to allow us to perform a meta-analysis. Specifically, regarding motivational beliefs a significant predictive positive effect has been found for global motivation regulation from academic self-efficacy (Smit et al., 2017; Suárez-Riveiro et al., 2019); self-efficacy for self-regulated learning (Kim et al., 2018, 2020; Trautner & Schwinger, 2020, 2022); task value (Smit et al., 2017), task and self-enhancing goal orientations (Gaeta et al., 2012; Wolters & Rosenthal, 2000), internal attributions (Suárez-Riveiro et al., 2019), and personal theories about intrinsic motivation (Trautner & Schwinger, 2022).

Complementary to regression data regarding the effect of goal orientations on MRSs, the results obtained by cluster or latent profile analyses suggest that those students who combine different goal orientations use MRSs (globally considered) more often (Rodríguez-Guardado & Gaeta, 2020; Suárez-Riveiro et al., 2001, 2019). Nevertheless, considering other motivational beliefs can help to qualify this observation, as suggested by the results obtained by Ferradás et al. (2019). Clusters of students with low self-esteem and high/moderate task and ego orientations identified in the aforementioned study showed a greater tendency to use deception and self-handicapping. On the other hand, in a more recent study, the compatibility between academic, social and well-being goals was found to facilitate global MRSs use (Kim et al., 2021).

The results obtained regarding the relationship between motivational beliefs and specific MRSs are somewhat more complex. Regression analysis revealed that academic self-efficacy, task value and task orientation show a rather consistent positive effect on the use of different MRSs, while the effect of ego orientation varies between studies. Environmental control, performance-approach self-talk and self-consequating were associated with a greater diversity of motivational beliefs, with performance-approach self-talk being the strategy that was most consistently predicted. A table summarizing regression results on all these relations is included in Supplementary Material (see Table S2).

Some other dimensions of individual differences, in addition to motivational beliefs, have been explored as possible antecedents of MRSs. King and Gaerlan (2015) focused on time perspectives of university students and found that both a positive view of the past and a personal orientation towards future goals and rewards positively predicted all of the MRSs evaluated (environmental control, personal/

[1] To facilitate the distinction between goal orientations and goal-oriented self-talk strategies, the terminology of Skaalvik (1997) for goal orientations is used throughout the text: (1) task orientation refers to the tendency to focus on increasing one's own competences (2) self-enhancing ego orientation refers to the tendency to demonstrate superior abilities than others, and (3) self-defeating ego orientation refers to the tendency to avoid failure.

Table 3
Order of mean scores for the use of motivational regulation strategies.

Study	Order							
	1st	2nd	3rd	4th	5th	6th	7th	8th
Wolters (1998)[c]	PapST	EC	EPS	ESI	SC	MST	SEE	
Wolters (1999)[b]	PapST	EC	SC	MST	EPS/ESI			
Nota et al. (2004)[b]		EC	SC					
Metallidou (2012)[a]		EC	SC					
Schwinger et al. (2009)[b]	PapST	SC	PGS	EC	MST	EPS	PavST	ESI
Schwinger and Stiensmeier-Pelster (2012) study 1[b]	PapST	SC	PGS	EC	MST	EPS	PavST	ESI
Schwinger and Stiensmeier-Pelster (2012) study 2[c]	PapST	SC	PGS	EPS	PavST	EC	MST	ESI
Schwinger and Stiensmeier-Pelster (2012)[b]	PapST	SC	EC	PGS	MST	EPS	PavST	ESI
Fritea and Fritea (2013)[b]	PapST	SEE	EC	SC	MST			ESI
Wolters and Benzon (2013)[c]	PapST	EC	SC	MST	SEE			ESI
Wang (2013)[b]	PapST			MST	EPS/ESI	SEE		
King and Gaerlan (2015)[c]	PapST		SC	MST	EC			
Paulino et al. (2015)[b]	PapST	EC	SC		SEE	MST	ESI	
Suárez-Riveiro et al. (2016)[b]				MST	SEE	PavST	WavST	PapST
Grunschel et al. (2016) Study 1[c]	SC	PapST	PGS	EC	EPI	MST	PavST	ESI
Grunschel et al. (2016) Study 2[c]	SC	EPS	PGS	PapST	EC	MST	ESI	PavST
Paulino et al. (2016)[b]				PapST		MST	SC	ESI
Schwinger and Otterpohl (2017) Study 1[c]	SC	PapST	PSG	EC	MST	EPS	PavST	ESI
Schwinger and Otterpohl (2017) Study 2[c]	PapST	SC	PGS	EPS	EC	MST	ESI	PavST
Schwinger and Otterpohl (2017) Study 3[b]	PapST	SC	EC	PGS	MST	EPS	PavST	ESI
Smit et al. (2017) VOC[b]	MST	PapST	EC	SC	EPS + ESI			
Wang et al. (2017)[b]	PapST	EST	MST					
Ljubin-Golub et al. (2019)[c]	SC	EC	PGS	PapST	EPS	MST	ESI	PavST
Kryshko et al. (2020) Study 1[c]	PapST	SC	PGS	EC	EPS	MST	SIE	PavST
Kryshko et al. (2020) Study 2[c]	PapST	SC	EC	PGS	MST	EPS	ESI	PavST
Trautner and Schwinger (2020) Study 1[c]	SC	PapST	EC	PGS	EPI	MST	PavST	ESI
Trautner and Schwinger (2020) Study 2[c]	SC	PapST	EC	PGS	EPI	MST	ESI	PavST
Trautner and Schwinger (2020) Study 3[c]	SC	PapST	PGS	EC	EPI	MST	ESI	PavST
Góes and Boruchovitch (2022)[b]		PapST		EC	MST	SC	EPS/ESI	
Trautner and Schwinger (2022) Study 1[c]	SC	PapST	PGS	PIE	EC	MST	ESI	PavST
Trautner and Schwinger (2022) Study 2[c]	SC	PapST	PGS	EC	EPS	MST	ESI	PavST
Lohbeck and Moschner (2021)[c]	EPS + ESI	PapST	MST	EC	SC			

Note. EC = environmental control; EPS = enhancement of personal significance; ESI = enhancement of situational interest; MST = mastery self-talk; PapST = performance-approach self-talk; PavST = performance-avoidance self-talk; PGS = proximal goal setting; SC = self-consequating; SEE = self-efficacy enhancement; WavST = work avoidance self-talk.
[a] Primary school student.
[b] Secondary school students.
[c] University students.

situational interest enhancement, mastery and performance-approach self-talk, and self-consequating).

Personality traits have also attracted attention as possible antecedents of self-regulated motivation. Thus, Ljubin-Golub et al. (2019) explored the association between the Big Five factors and different MRSs in university students and found that students with high scores for agreeableness, extraversion, conscientiousness and intellect, and low scores for emotional stability would be more likely to use various MRSs, with agreeableness predicting a greater number of strategies (7/8) and intellect predicting the lowest number of strategies (3/8); on the other hand, none of the personality traits predicted performance-avoidance self-talk.

Autonomous styles of motivation and academic achievement have also been found to positively predict the global use of MRSs (Garn & Morin, 2021). Along the same line, Wolters and Hussain (2015) also demonstrated a predictive effect of the self-reported tendency of university students to sustain the time and energy necessary for accomplishing long-term tasks on the use of MRSs, globally considered.

Unsurprisingly, a positive effect of metamotivational strategy knowledge has also been identified. Thus, in a recent study, Trautner and Schwinger (2022) observed that personal incremental theories (assuming malleability) about intrinsic and extrinsic motivation were associated with both motivational regulation considered globally and diverse MRSs. These findings are consistent with those of a previous study with primary school students (Metallidou, 2012), in which both conceiving learning as a quick process and the ability to learn as innate and fixed were negatively associated with environmental control and self-consequating.

Finally, although the potential incidence of contextual factors in the use of MRSs remains almost unexplored, the available data indicate moderating effects of culture (Boyle et al., 2020), and parental styles (Aunola et al., 2000), at least regarding the use of negative-based incentives, self-enhancing attributions and self-efficacy enhancement. With respect to the possible incidence of more proximal contextual conditions, we found only one intervention study (Zhang et al., 2022) in which a group of university students (English majors) were required to keep reflective journals on their self-perceived use of self-regulated writing strategies, throughout one semester. An increase in students' strategic awareness was observed, although it did not lead to greater self-perceived use of MRSs.

3.2.3. *Effects of motivational self-regulation*

As indicated in our second hypothesis, we expected a positive association between the use of MRSs and indicators of good academic progress. Several possible academic implications of motivational self-regulation have been examined. Results of the meta-analyses of the relationship between motivational self-regulation and some expected outcomes (i.e. effort, academic achievement and procrastination) are reported in Table 5, where pairwise comparisons of the strength of the correlations are indicated by superscripts. Forest plots of effect sizes for each of the meta-analyses can be consulted in the Supplementary Material (Figs. S1–S46).

Overall, models were significant, confirming a positive low to high correlation between the use of MRSs and effort, with the correlation

Table 4
Results of the meta-analyses on the relation between interindividual differences dimensions and MRSs.

		No of studies	Sample size	Combined effect size [95 % CI]	Q	*p*	Tau^2	Egger test	Rank test
Self-efficacy for SRL	MST	5	2006	0.43 [0.39, 0.46][a]	0.69	0.95	0.00	−0.39	−0.20
	PGS	5	2006	0.34 [0.27, 0.41][b]	11.92*	0.02	0.01	−2.40*	−0.60
	EC	5	2006	0.30 [0.23, 0.37][b]	10.76*	0.03	0.01	−0.99	−0.20
	EPS	5	2006	0.26 [0.18, 0.34][c]	13.17*	0.01	0.01	2.56*	0.80
	ESI	5	2006	0.26 [0.21, 0.31][c]	6.56	0.16	0.00	−0.06	0.20
	SC	5	2006	0.25 [0.21, 0.29][c]	1.62	0.81	0.00	−0.60	0.00
	PapST	5	2006	0.25 [0.21, 0.29][c]	1.93	0.75	0.00	0.08	0.20
	PavST	5	2006	−0.01 [−0.08, 0.07][d]	10.74*	0.03	0.00	0.63	0.00
	GS	5	2006	0.47 [0.44, 0.50]	6.64	0.47	0.00	0.84	0.21
Self-efficacy general	MST	6	5266	0.37 [0.30, 0.44][a]	22.13**	<0.001	0.01	−0.70	−0.20
	PapST	5	9982	0.29 [0.11, 0.44][b]	86.97**	<0.001	0.04	−0.21	−0.40
	SC	5	4797	0.21 [0.15, 0.28][c]	12.94*	0.01	0.00	−0.21	−0.40
Task orientation	MST	7	4103	0.54 [0.44, 0.63][a]	61.41**	<0.001	0.03	2.26*	0.50
	PapST	6	3553	0.43 [0.34, 0.51][b]	26.62**	<0.001	0.01	−0.96	−0.14
	EC	5	1527	0.37 [0.21, 0.50][c]	26.03**	<0.001	0.03	0.22	0.20
	ESI	5	2893	0.28 [0.24, 0.31][d]	5.63	0.23	0.00	1.55	0.40
	SC	5	1911	0.27 [0.16, 0.37][d]	18.30**	<0.001	0.01	0.68	0.40
Self-enhancing	PapST	6	3553	0.27 [0.20, 0.33][a]	13.25*	0.02	0.01	−3.16*	−0.83*
	EC	5	1527	0.07 [−0.13, 0.28][b]	53.63**	<0.001	0.05	−4.67**	−0.80
	MST	6	3553	0.06 [−0.23, 0.34][b]	194.69**	<0.001	0.13	−2.42*	−0.43
Task value	MST	6	5513	0.58 [0.49, 0.65][a]	96.17**	<0.001	0.02	−0.47	−0.07
	PapST	5	4963	0.48 [0.29, 0.63][b]	114.13**	<0.001	0.06	−1.42	−0.40
	EC	5	4963	0.42 [0.34, 0.50][c]	29.79**	<0.001	0.01	−0.41	−0.20
	SC	6	5513	0.31 [0.21, 0.40][d]	86.94**	<0.001	0.01	−0.92	0.20

Note. EC = environmental control; EPS = enhancement of personal significance; ESI = enhancement of situational interest; GS = global score; MST = mastery self-talk; PapST = performance-approach self-talk; PavST = performance-avoidance self-talk; PGS = proximal goal setting; SC = self-consequating. Effect size values with different superscripts are significantly different (p values < .05).
*p < .05, **p < .01, ***p < .001.

Table 5
Results of the meta-analyses on the relation between MRSs and academic implications.

		No of studies	Sample size	Combined effect size [95 % CI]	Q	*p*	Tau^2	Egger test	Rank test
Cognitive learning strategies	MST	6	3386	0.35 [0.20, 0.49] [a]	107.55**	<0.001	0.04	0.43	0.33
	PApST	6	3386	0.29 [0.14, 0.44] [b]	98.92**	<0.001	0.04	0.58	0.33
	GS	5	1639	0.60 [0.40, 0.75]	119.01**	<0.001	0.09	2.29*	0.80
Effort	MST	15	8714	0.45 [0.39, 0.51] [a]	216.59	<0.001	0.02	−1.46	−0.09
	PapST	15	8714	0.37 [0.31, 0.43] [b]	216.49	<0.001	0.02	−1.06	0.08
	EC	15	8714	0.34 [0.28, 0.40] [c]	206.19	<0.001	0.02	−1.21	0.04
	PGS	13	5024	0.32 [0.27, 0.37] [d]	51.32	<0.001	0.01	−2.02*	−0.32
	SC	15	8714	0.29 [0.22, 0.35] [e]	371.74	<0.001	0.02	−2.14*	0.15
	ESI	13	5024	0.18 [0.13, 0.22] [f]	32.61	0.001	0.01	−0.90	−0.12
	EPS	13	5024	0.17 [0.12, 0.22] [f]	36.11	0.001	0.01	1.63	0.30
	PavST	13	5024	0.10 [0.06, 0.15] [g]	27.53	0.01	0.00	2.08*	0.32
	GS	9	2866	0.48 [0.41, 0.54]	41.82	<0.001	0.01	−0.24	−0.11
Procrastination	GS	5	1336	−0.25 [−0.44, −0.03]	55.96	<0.001	0.06	2.57*	0.60
Achievement	PapST	13	3978	0.08 [−0.01, 0.16] [a]	74.92	<0.001	0.02	0.33	0.06
	PavST	11	4139	−0.07 [−0.14, −0.00] [b]	46.09	<0.001	0.01	−3.33*	−0.44
	EC	14	4144	0.05 [−0.00, 0.09] [c]	25.27	0.02	0.00	−0.04	−0.04
	SC	14	4528	0.04 [−0.01, 0.09] [c]	29.49	0.005	0.00	−0.51	−0.27
	ESI	12	4326	−0.03 [−0.11, 0.05] [d]	61.47	<0.001	0.01	−3.77*	−0.38
	EPS	10	3589	−0.02 [−0.08, 0.04] [d]	24.02	0.001	0.01	−2.64*	−0.50
	MST	14	4528	0.01 [−0.07, 0.09] [d]	93.41	<0.001	0.02	−1.77	−0.27
	PGS	10	3589	0.01 [−0.06, 0.09] [d]	41.22	<0.001	0.01	−2.50*	−0.32
	GS	13	5002	0.21 [0.02, 0.38]	358.57	<0.001	0.12	0.20	0.05

Note. EC = environmental control; EPS = enhancement of personal significance; ESI = enhancement of situational interest; GS = Global score; MST = mastery self-talk; PapST = performance-approach self-talk; PavST = performance-avoidance self-talk; PGS = proximal goal setting; SC = self-consequating. Effect size values with different superscripts are significantly different (p values <.05).
*p < .05. **p < .01. ***p < .001.

between mastery self-talk and effort being significantly higher than all the other correlations with which it was compared. The opposite pattern was observed for the correlation between effort and performance-avoidance self-talk, which was significantly weaker than the other correlations.

Mastery self-talking and performance-approach self-talk were found to maintain high and moderate correlations respectively with cognitive learning strategies, globally considered. As observed for MRSs and achievement, the correlations were very low, which is in line with the inconsistent regression results reported for this relationship. A table summarizing these and the other regression results on the relationships between MRSs and their supposed academic implications has been included as Supplementary Material (see Table S3).

Globally, motivational self-regulation has been found to positively predict positive emotions (Grunschel et al., 2016; Trautner & Schwinger, 2020), cognitive and metacognitive learning strategies (Kim et al., 2018; Teng & Zhang, 2018), effort (Eckerlein et al., 2019; Engelschalk et al., 2017; Schwinger et al., 2009; Schwinger & Otterpohl, 2017; Schwinger & Stiensmeier-Pelster, 2012; Smit et al., 2017; Trautner & Schwinger, 2022; Wolters, 1999), engagement (Smit et al., 2017)

and achievement (Eckerlein et al., 2019; Kim et al., 2020; Kryshko et al., 2020; Michalsky, 2021; Rodríguez-Guardado & Gaeta, 2020; Trautner & Schwinger, 2020) and to negatively predict procrastination (Bäulke et al., 2021; Grunschel et al., 2016; Kim et al., 2018, 2020; Ljubin-Golub et al., 2019) and drop-out intentions (Bäulke et al., 2018; Kryshko et al., 2020). Relative to achievement, the experimental study by Michalsky (2021) confirmed the favourable effect of metamotivational scaffolding on academic performance in science tasks. Nevertheless, the relationship between MRSs and achievement will probably vary depending on the academic subjects considered, and e.g. it has not been verified for writing proficiency (Zhang et al., 2022).

Different specific MRSs have also been found to predict the above-mentioned dimensions, either positively or negatively. In this regard, effort has attracted special interest, and it has been found to be positively predicted by 7 out of the 8 strategies assessed in the MRQ (Schwinger et al., 2007, 2009) and negatively predicted by performance-avoidance self-talk, while the reverse relationship has been found for the same strategies and procrastination. We must also point out that the results of regression analyses between MRSs and achievement are inconsistent.

Regarding dimensions inherent to self-regulated learning, metacognitive self-regulation, measured both globally and by strategy, have been consistently shown to be predicted by mastery self-talk. Among the strategies occasionally evaluated, cost appraisal, defensive pessimism and self-efficacy enhancement have shown a positive predictive effect on metacognitive self-regulation while self-handicapping and work-avoidance self-talk showed a negative effect. Results on cognitive learning strategies are quite inconsistent, except for the following: (1) self-efficacy enhancement and defensive pessimism, which have a positive effect on rehearsal, elaboration and organization; (2) self-consequating, which has a positive effect on rehearsal and elaboration; (3) cost appraisal with a positive effect, and self-handicapping with a negative effect on elaboration and organization; (4) environmental control, which does not manifest as a significant predictor (see Table 6).

Finally, several authors have explored the relationship between MRSs and several adjustment indexes, finding the following: (1)

Table 6
Moderating effects of educational level, sex and measure on the correlations of MRs with dimensions of individual differences and with academic implications.

		Educational level		Sex		Measure	
		Q_b	β	Q_b	β	Q_b	β
Dimensions of individual differences							
Self-efficacy for SRL	EC			0.31	0.01		
	EPS			2.10	0.01		
	ESI			2.09	0.01		
	MST			0.01	−0.00		
	PapST			0.00	0.00		
	PavST			3.04	−0.01		
	PGS			0.34	−0.01		
	SC			0.13	0.00		
General academic self-efficacy	MST	18.94**	−0.18	1.79	−0.01	0.04	−0.02
	PapST	1.68	−0.22	55.32**	−0.02	0.77	−0.17
	SC	0.01	−0.01	0.42	−0.01	11.34**	0.11
Task orientation	EC	3.26	−0.26	4.74*	−0.01	2.86	−0.25
	ESI	0.47	0.04	0.62	−0.00	0.67	−0.04
	PapST	4.12*	−0.16	2.64	−0.01	0.70	−0.12
	MST	0.11	0.05	0.06	0.00	0.03	−0.04
	SC	0.66	0.10	0.29	−0.00	0.53	−0.11
Self-enhancing	EC	0.68	0.19	0.27	0.00	1.75	0.26
	MST	0.16	0.14	0.79	0.02	3.23	0.59
	PapST	0.63	−0.06	0.04	0.00	0.24	0.05
Task value	EC	28.12**	−0.19	3.39	−0.01	0.05	−0.03
	MST	8.78*	−0.24	18.77**	−0.01	0.00	−0.01
	PapST	0.09	−0.08	0.98	−0.01	0.07	0.07
	SC	0.00	−0.00	0.31	−0.00	0.54	0.09
	PapST	0.69	0.15	0.13	−0.00	3.80*	−0.26
Academic implications							
Cognitive learning strategies	MST	0.03	0.03	0.83	−0.01	13.80**	−0.33
	PapST	0.69	0.15	0.13	−0.00	3.80*	−0.26
Effort	EC	0.05	0.02	0.00	0.00	0.29	0.09
	EPS	2.53	0.10	0.27	0.00		
	ESI	6.35*	0.13	4.41*	0.00		
	MST	0.07	0.02	2.66	0.00	0.02	0.03
	PapST	0.06	0.02	0.04	0.00	0.14	0.06
	PavST	15.17**	−0.15	4.82*	−0.01		
	PGS	4.36*	0.13	0.72	0.00		
	SC	0.01	−0.01	1.20	0.00	0.06	0.04
Achievement	EC	0.24	−0.02	1.49	0.00	0.28	−0.04
	EPS	0.03	0.01	7.87*	0.01		
	ESI	6.12*	0.16	3.13	0.01	0.24	0.05
	MST	0.04	0.02	2.13	0.01	0.09	−0.03
	PapST	0.59	−0.07	2.70	0.01	2.74	−0.17
	PGS	2.21	0.12	8.12*	0.01		
	PavST	0.01	−0.01	0.68	0.00	1.60	−0.14
	SC	0.00	−0.00	0.70	0.00	1.11	−0.07

Note. EC = environmental control; EPS = enhancement of personal significance; ESI = enhancement of situational interest; MST = mastery self-talk; PapST = performance-approach self-talk; PavST = performance-avoidance self-talk; PGS = proximal goal setting; SC = self-consequating; SE = self-efficacy.
* $p < .05$.
** $p < 001$.

performance-approach self-talk positively predicts withdrawal and avoidance of challenge and negatively predicts disruptive behaviours, satisfaction with life and drop-out intention; (2) positive emotions are positively predicted by interest enhancement, mastery self-talk and proximal goal setting and negatively predicted by performance-avoidance self-talk; (3) negative emotions are positively predicted by performance-approach and performance-avoidance self-talk and negatively predicted by proximal goal setting; (4) the association between MRSs and achievement has been inconsistently demonstrated.

3.2.4. Moderating and mediating effects

As our third hypothesis contends, both sex and educational level were expected to moderate the frequency of use of MRSs and its relationship with dimensions of individual differences as well as with academic implications. Some of the studies included in the present review explored sex differences regarding frequency of MRSs use, showing that female secondary students obtained higher scores on environmental control, performance-approach self-talk, self-consequating and self-efficacy enhancement (Góes & Boruchovitch, 2022; Suárez-Riveiro & Fernández-Suárez, 2011), male secondary students used annulation and enhancement of others and also deception and self-handicapping more frequently (Suárez-Riveiro et al., 2019; Suárez-Riveiro & Fernández-Suárez, 2011; Torrano & Soria, 2017), while female university students used enhancement of situational interest, environmental control, mastery self-talk, performance-approach self-talk and self-consequating more frequently than their male counterparts (Ilishkina et al., 2022; King & Gaerlan, 2015; Wolters & Benzon, 2013). Regarding the expected effect of educational level, university students have been found to have a more complete understanding of MRSs (Cooper & Corpus, 2009) and more frequent use of environmental control (Peng & Bai, 2020). On the other hand, the study by Schwinger (2013) suggests a domain-linked specificity of the use of self-handicapping that would correspond (showing higher significant correlations) to a domain-specific self-concept of ability, interest and achievement in the students.

The moderating effects on the associations between dimensions of individual differences and MRSs and between MRSs and academic implications were also explored in the meta-analyses conducted in this review (see Table 6). The correlation between motivational beliefs (except for self-efficacy for SRL) and several MRSs was moderated by sex and educational level, and in all cases was significantly higher in women than in men and also higher in secondary school students than in university students. The type of measure used for MRSs was found to moderate only the relationship between academic self-efficacy and self-consequating, and it was higher when the latter motivational strategy was measured by instruments that include generic and problematic conditions than those centered on motivationally challenging situations (i.e. discouragement, difficulties or distractions).

Regarding the correlations between MRSs and possible educational implications, a moderating effect of sex was found in the relationship between performance-avoidance self-talk and effort, which was higher in women. However, the relationship between enhancement of situational interest and effort was higher in men. On the other hand, the relationship between personal goal setting and effort and that between enhancement of personal significance and effort were higher in university students than in secondary students, while the relationship between performance-avoidance self-talk and effort was higher in secondary students. The correlations between two of the MRSs (enhancement of personal interest and personal goal setting) and achievement were higher in men. A moderating effect of the type of measure in the relationship between both mastery self-talk and performance-approach self-talk and cognitive learning strategies was also observed. The effect was greater when the strategies were evaluated in a questionnaire focused on motivational challenging situations.

Finally, we did not find any data on possible mediating factors in the relationships between dimensions of individual differences or contextual factors and the use of MRSs. Regarding indirect effects of MRSs, metacognitive regulation has been found to mediate the relationships between defensive pessimism, self-efficacy enhancement and self-handicapping and the use of learning strategies (Suárez-Riveiro et al., 2016; Suárez-Riveiro & Fernández-Suárez, 2011), and a mediational effect of effort in the relationship between MRSs, globally or individually considered, and achievement has consistently been reported (Engelschalk et al., 2017; Grunschel et al., 2016; Kryshko et al., 2020; Schwinger et al., 2009; Trautner & Schwinger, 2020).

4. Discussion

The aim of this systematic review was to explore and summarize the available evidence regarding the strategies that students use to self-regulate their academic motivation. The increasing attention given to the topic of the review has been demonstrated in the specialized literature, particularly in Europe, although to date most studies have focused on secondary school and university students. This expansion has been favoured by theoretical models on the dimensions and processes involved in motivational self-regulation and the types of strategies that students tend to use (Miele & Scholer, 2016, 2018; Schwinger & Stiensmeier-Pelster, 2012; Wolters, 2003). Although more investigation is clearly needed to understand the role of MRSs in learning and achievement, particularly regarding the specificity of the antecedents and effects of MRSs, some tentative conclusions can be reached from the evidence accumulated to date, and these may serve to guide future research and interventions.

4.1. The most frequently studied and used motivational regulation strategies

Starting with our first objective, relative to analysing the types and frequency of MRSs used by students, the data gathered in the present review refer to 18 types of strategies. We found disagreements in terms of the denomination and operationalization of strategies and a clear bias towards those strategies delimited by Wolters (1998) and Schwinger et al. (2007, 2009). Examination of the informed use of strategies suggests that both secondary and university students primarily resort to extrinsic/controlling types of strategies such as performance-approach self-talk and self-consequating rather than intrinsic/autonomous strategies (e.g. interest enhancement or mastery self-talk).

Consistent with this observation, when considering the motivational dimension being targeted, and based on the theoretical categorizations of MRSs taking this dimension into account (Miele & Scholer, 2016; Wolters, 2003), those strategies focused on the utility task value (usefulness for achieving long-term goals of external rewards), such as performance self-talk and self-consequating, and task cost (e.g. environmental control) are more frequent than those focused on intrinsic task value, such as interest enhancement, and attainment task value (consistency with self-image), such as mastery self-talk. According to Wolters and Benzon (2013), this preference could be explained by either greater declarative or procedural knowledge about the prioritized strategies or the belief that they are more efficient; students are probably responding to high levels of challenge and competitive pressure, which would lead them to focus on achievement goals and self-discipline (Elliot et al., 2005; Yeo et al., 2009). By contrast, students may be less conscientious about strategies directed to intrinsic/autonomous motivation or they may consider these ineffective in the academic context. These arguments are consistent with the role attributed to both individual and contextual factors as antecedents of the adoption of MRSs in theoretical models of motivational self-regulation (Miele & Scholer, 2016, 2018; Schwinger & Stiensmeier-Pelster, 2012).

However, a more complete picture will be obtained as data on scarcely studied strategies are provided, especially on those considered maladaptive, i.e. those assumed to lead to negative academic consequences, like performance-avoidance self-talk. The adequacy of different strategies in the pre-actional, actional and post-actional phases

of the learning cycle and the motivational situation should be also further explored.

4.2. The presumed antecedents of motivational self-regulation

Our second objective was to explore and evaluate the strength of the relationship between dimensions of individual differences or contextual factors and MRSs. In accordance with models of motivational self-regulation, where metamotivational knowledge (in combination with metamotivational feelings) is conceived as the basis of awareness and control of academic motivational regulation, the findings demonstrate a positive association between different manifestations of motivational beliefs (about tasks, strategies and self) and the use of MRSs, namely self-efficacy, task value, goal orientations, internal attributions and meta-motivational knowledge. In this regard, self-efficacy, task value and goal orientations must be highlighted, as they show a rather consistent positive predictive effect on the use of MRSs, suggesting that activating beliefs on personal competence and/or the relevance of academic tasks, as well as focusing on increasing personal competence would lead the subject to what Boekaerts described as *self-driven self-regulation* (Boekaerts, 2006), which means that the subject's high order goals direct the learning process. In accordance, the present review found that the effect of motivational beliefs on mastery self-talking (a strategy centered on attainment task value) was the strongest. The relationships between both task orientation and task value with performance-approach self-talk (focused on utility task value) and environmental control (related to task cost) also had strong effects. Pending further research, the evidence available to date, thus suggests that trying to establish a balance between the cost and the value of the academic task seems to be a strategic guideline for students, which is consistent with expectancy-value models of academic motivation (Eccles & Wigfield, 2002, 2020). On the other hand, our results support the relevance given in the Meta-motivational Model of Motivation Regulation (Miele & Scholer, 2016, 2018) to academic goals and task cost as motivational beliefs that may establish the conditions for self-regulation of motivation and also to self-efficacy and task value as components of motivation to be monitored and controlled in relation to academic activities.

Regarding distal and proximal contextual factors that may determine the frequency and effectiveness of MRS use, the scant data available at present suggest a moderator effect of family educational styles and culture and also the effectiveness of training motivational self-regulation. Diverse models have emphasized the importance of an ecological view of self-regulated learning, distinguishing multiple contextual layers that should be considered when exploring learning skills development and execution (see for example Ben-Eliyahu & Bernacki, 2015; Butler et al., 2011). This is clearly a line of development for future research on MRSs.

4.3. The expected repercussion of motivational self-regulation

Both cognitive and metacognitive learning strategies (inherent processes of self-regulated learning), evaluated globally and separately, have been found to be positively predicted by MRs, as assumed in theoretical models focused on motivational regulation (Miele & Scholer, 2016, 2018; Schwinger & Stiensmeier-Pelster, 2012). MRSs considered globally have also been found to predict positive emotional activation (Grunschel et al., 2016; Trautner & Schwinger, 2020) and engagement (Smit et al., 2017). These processes plausibly constitute the means by which academic effort is influenced, which is considered the main purpose of motivational self-regulation (Schwinger & Stiensmeier-Pelster, 2012; Wolters & Benzon, 2013).

In fact, the data compiled in the present review show significant positive correlations between various MRSs and effort, with the combined effect size of mastery self-talk being high and significantly stronger than for the other MRSs examined. According to their presumed importance for regulation of effort, as indicated by meta-analytical results, the best strategies seem to be those focused on the utility value (performance-approach self-talk, self-consequating), intrinsic value (enhancement of situational interest) and cost (proximal goal setting, environmental control) of the academic work. Thus, regarding the relative efficiency of MRSs, the findings of the present review suggest progression from intending to persuade oneself of the importance of the academic task, to enlarging one's skill and knowledge, to reminding oneself of the outcomes of the effort and trying to reduce task cost, either by avoiding the salience of disruptors like competing waived activities or by dividing the task into smaller, more manageable objectives. Although a significant effect of enhancing personal significance of the tasks on effort has also been observed, it seems to be less important. To our knowledge, no other studies have compared the strength of the association between different MRSs and effort. Pending further data, the results of the present review may serve to qualify the general assumption made in theoretical models of motivational self-regulation (Miele & Scholer, 2016, 2018; Schwinger & Stiensmeier-Pelster, 2012) about the association between MRSs and effort, since they suggest differential effect of the diverse strategies as factors conditioning task processing and ultimately volition and achievement.

Regarding meta-analysis results for achievement, combined effect sizes were low, which is consistent with the regression results gathered in the present review, showing an inconsistent positive predictive effect. Mediational effects, which are discussed below, may shed some light on those results.

4.4. Moderating and mediating factors

In the present review, we collected data regarding the moderating effect of sex relative to the frequency of use of MRSs and also regarding three different possible moderating factors (educational level, sex, and type of instrument used to measure MRSs) in the associations between MRSs and those dimensions considered antecedents (motivational beliefs) from a theoretical point of view and between MRSs and those dimensions proposed as academic implications of MRSs. Data on the moderating effects of sex on the frequency of use of MRSs suggest that female secondary students use a series of strategies (e.g. self-efficacy enhancement and performance-approach self-talk) more frequently than their male companions, and that male university students make more frequent use of other strategies viewed as ego-protective and academically maladaptive (e.g. annulation of others and self-handicapping). These tendencies may contribute to the demonstrated higher academic achievement of females in secondary school and university courses (Jere et al., 2022; Voyer & Voyer, 2014). In any case, this argument should be considered tentative as data on the moderating effect of sex on the use of MRSs remain scarce.

The relationships between various MRSs and dimensions presumed to be antecedents or repercussions of the strategies have been found to be moderated by educational level and sex, indicating an incidence of the development of metamotivational knowledge and gender-roles on the potential of motivational beliefs to activate forms of strategic motivational self-regulation, as well as in the efficacy of at least some MRSs. Further investigation on these moderating effects could contribute to replicating if feasible and understanding the nature of the effects found in the present review. Based on our data, the type of measure should be also considered, although its moderating effect seems to be more limited. Those measures regarding generic and problematic academic conditions are probably more sensitive to personal preferences or tendencies, while those focused on specific motivationally challenging situations (i.e. discouragement, difficulties or distractions) are more representative of the suitability of MRSs for the specific tasks and/or learning situations.

Finally, regarding the mediation effects explored in the studies analysed in the present review, effort has been consistently found to mediate the relationship between MRSs and achievement (Engelschalk et al., 2017; Kryshko et al., 2020; Schwinger et al., 2009; Trautner &

Schwinger, 2020), in accordance with the expected role of activating MRSs (Schwinger & Stiensmeier-Pelster, 2012; Wolters & Benzon, 2013). No other mediation variables in this relationship have been explored. The previously observed mediation effect of metacognitive regulation in how self-efficacy enhancement, defensive pessimism and self-handicapping are related to cognitive learning strategies is also important for disentangling the nature of the processes involved in self-regulated learning (Suárez-Riveiro et al., 2016; Suárez-Riveiro & Fernández-Suárez, 2011), suggesting that some strategies could favour or hinder metacognitive awareness and control, which in turn would determine the activation of conditional knowledge on learning strategies and their use. As illustrated in the Metamotivational Model of Motivation (Miele & Scholer, 2016, 2018) when students process tasks, they often must overcome obstacles (e.g. distractions) and assimilate costs (e.g. psychological discomfort), which would cause metamotivational feelings that would lead them to resume motivational monitoring and control. The interplay between cognitive, metacognitive and motivational learning strategies thus clearly deserves further attention in future research.

5. Limitations and future lines of research

Some limitations of the studies conducted to date on MRSs should be noted. First, although the data collected in the present study give empirical consistency to the theoretical models on motivational self-regulation, there is a lack of experimental research that tests theoretical assumptions regarding antecedents and consequences of MRSs. Most of the studies reviewed involved cross-sectional designs, which prevent us from establishing causal relationships, although the predictive effects demonstrated may guide future longitudinal and intervention studies on motivational regulation. Second, the number of MRSs explored to date is rather limited, and maladaptive MRSs in particular should be studied further. In fact, the results of meta-analysis conducted in this study were restricted to sufficiently large data sets that include similar variables. Some variables of interest and their relationship with MRSs (as suggested by regression data gathered) were not included in the analyses, because of the small number of studies that provided correlational specific data. Third, more investigation is needed about the mediating (e.g. effort, procrastination, metacognitive strategies) and moderator (e.g. culture, education level) factors of supposed antecedents and consequences of MRSs, to enable us to understand the nature of personal and contextual conditions and the psychosocial processes involved.

As a main line of progress, research on the incidence of contextual factors, both distal (e.g. perceived parental support) and proximal (e.g. classroom instructional dynamics), on the use of MRSs should be highlighted. Examining the balance between competitiveness and collaboration in the classroom climate and its effect on the adoption of MRSs focused on the utility value of academic tasks or those focused on their intrinsic value and achievement would be of particular interest. Variations in the use of the strategies as a function of content domain and task completion phase (pre-actional, actional and post-actional) should also be explored. Moreover, longitudinal studies should be conducted to obtain data on the development of the MRSs and on plausible causal links between the MRSs and the dimensions that are assumed to be their antecedents and consequences. The relationship between MRSs and both cognitive and metacognitive strategies should be given priority insofar as it could shed light on the nature of the psychological processes involved in self-regulated learning. Finally, conducting studies on possible intervention actions aimed at improving the knowledge and application of MRSs would also be valuable.

6. Conclusion

The following conclusions can be drawn from this study:

- The data provided in the reviewed articles refer to 18 MRSs and indicate the importance of distinguishing between intrinsic/autonomous and extrinsic/controlling forms of motivational self-regulation.
- Meta-analysis of the relationship between the assumed antecedents of motivational self-regulation and MRSs showed consistent correlations between some motivational beliefs (self-efficacy, task orientation and self-enhancing) and the use of diverse MRSs. The strongest effects were found for the relationships between motivational beliefs and mastery self-talk, and between both task orientation and task value and performance-approach self-talk and environmental control.
- Complementarily, the compiled regression analysis data indicated an effect of some other dimensions of individual differences (personality traits, autonomous styles of motivation, metamotivational strategy knowledge) and contextual factors (culture, parental styles).
- Meta-analysis of the relationship between MRSs and indicators of their expected educational implications showed a consistent positive correlation between the use of MRSs and both the use of cognitive learning strategies and effort.
- In addition, the compiled regression analysis data indicated a predictive positive effect of MRSs for positive emotions, cognitive and metacognitive learning strategies, engagement and achievement and a predictive negative effect for procrastination.
- Moderating effects of sex, educational level and type of measure used for strategy use in the relationship between MRSs and their assumed antecedents and consequences were identified.
- The data gathered demonstrated a mediation effect of effort on the relation between MRSs and achievement, as well as a mediation effect of metacognitive strategies in the relation between MRSs and achievement.

CRediT authorship contribution statement

Eva Villar: Writing – original draft, Methodology, Formal analysis, Conceptualization. **Mª. Emma Mayo:** Writing – review & editing, Visualization, Methodology, Investigation. **Zeltia Martínez-López:** Writing – review & editing, Visualization, Methodology. **Carolina Tinajero:** Writing – original draft, Visualization, Supervision, Project administration, Conceptualization.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.lindif.2024.102480.

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