REVIEW

A Systematic Review of Interventions to Reduce Academic Procrastination and Implications for Instructor-based Classroom Interventions

Melanie Turner[1] · Flaviu A. Hodis[1]

Abstract

Academic procrastination is a prevalent and pernicious self-regulation failure, which affects students' academic performance, health, and well-being. We conducted a systematic review of the recent (i.e., 2018 and subsequent) literature on the efficacy of interventions designed to reduce academic procrastination in several relevant online databases. Twenty-one studies, which matched our criteria for inclusion, were included in our review. These studies reported on a variety of interventions; 17 of them reported significant reductions in students' academic procrastination. Our research adds to the existing literature on procrastination by identifying critical recent findings from academic procrastination intervention research. In addition, our review identified gaps in the existing literature that should be explored in future research, such as the lack of interventions focusing on strengthening conscientiousness and the need to conduct mediation and moderation analyses to understand the mechanism(s) through which interventions affect procrastination and identify boundary conditions for their effectiveness. Finally, we included a set of recommendations to guide teachers/instructors when selecting procrastination interventions they could feasibly implement in their classrooms.

Keywords Academic Procrastination · Interventions · Systematic Review · Emotion Regulation · Motivation

Introduction

Academic procrastination is a form of self-regulation failure in which students voluntarily postpone academic tasks they intend to complete (in order to reduce/change their negative moods; Sirois & Pychyl, 2013) despite knowing that the negative

✉ Flaviu A. Hodis
  flaviu.hodis@vuw.ac.nz

[1] School of Education, Victoria University of Wellington, Wellington, New Zealand

consequences of this delay will leave them worse off (Sirois & Pychyl, 2013; Steel, 2007). "Self-regulation is a process in which people organise and manage their capacities—that is, their thoughts…, emotions…, behaviours…, social—contextual surroundings…—in the service of attaining some future state" (Reeve et al., 2008, p. 223). Procrastination is highly prevalent among the student population, as 80–95% of college students occasionally procrastinate (Ellis & Knaus, 1979; Fentaw et al., 2022; O'Brien, 2000; Steel, 2007) and 25–50% of college students chronically procrastinate (Day et al., 2000; Haycock, 1993; Onwuegbuzie, 2000; Özer et al., 2009; Rahimi & Hall, 2021; Solomon & Rothblum, 1984). Chronic procrastinators are students who habitually delay initiating and completing most, if not all, of their academic work.

Research findings have consistently indicated that academic procrastination impedes students' academic success, with chronic procrastinators having lower GPAs, assignment grades, and exam scores than non-procrastinators (Akpur, 2020; Day et al., 2000; Goroshit & Hen, 2019; Kim & Seo, 2015; Kim et al., 2017; Klassen et al., 2008; Steel, 2007; Steel & Klingsieck, 2016; Tao et al., 2021; Tian et al., 2021). In addition, the pervasive effects of academic procrastination extend to increased stress levels, sleep-related problems that can impair future learning and self-control, emotional difficulties (e.g., feelings of anxiety, shame, guilt, anger, sadness, time pressure, and dissatisfaction; Grunschel et al., 2013; Steel & Klingsieck, 2016), poor health and well-being (Sirois et al., 2003; Sirois & Pychyl, 2013; Tice & Baumeister, 1997), lower life satisfaction (Rozental et al., 2022; Sirois, 2016), and higher rates of school dropout (Grunschel et al., 2013). Moreover, procrastination can become habitual (Svartdal & Løkke, 2022) and generalise across other life domains (Hen & Goroshit, 2018; Rozental et al., 2022; Sirois et al., 2003; Sirois & Pychyl, 2013; van Eerde & Klingsieck, 2018). These aspects indicate that it is critical to intervene to reduce students' procrastination.

Literature Review

Conceptual Frameworks Informing the Study of Procrastination

Two major conceptual frameworks explain why students procrastinate their academic work. These are the Temporal Motivation Theory (Steel, 2007) and the Short-Term Mood Repair Theory (Sirois & Pychyl, 2013). The former proposes that students' motivation to complete an academic task is determined by expectancy of success in that task, value associated with doing or completing the task, impulsiveness, and delay. That is, the higher students' expectations of success (i.e., high self-efficacy beliefs) and the more they value the task (e.g., high intrinsic motivation, low task aversion) and/or the outcome of task engagement, the more likely they are to complete this academic task without unnecessary delay. However, even when students have high expectancies of success for, and value an academic task, they may still delay working on it if they are impulsive (i.e., have high distractibility and low self-control) and the deadline to complete the task is in the distant future (sensitivity to delay; Steel, 2007). With regard to

intervention, this theory suggests that effective interventions that reduce academic procrastination increase students' expectancy and value whilst also reducing their impulsivity and sensitivity to delay.

The Short-Term Mood Repair Theory proposes that aversive tasks induce negative affect (e.g., frustration, uncertainty, boredom, anxiety) that leads to a self-control dilemma between students' desire of "giving into the feel good" now and their long-term goals (Tice & Bratslavsky, 2000, p. 149). Thus, in this theory, procrastination is considered an emotion (mis)regulation strategy because students are motivated to regulate their immediate mood by postponing working on their academic task and engaging in a more pleasurable activity (e.g., scrolling social media, hanging out with friends). However, the benefits of procrastination on mood are only short-term, and students often feel worse than if they had worked on their assignment without the unnecessary delay(s) (Sirois & Pychyl, 2013; Tice & Bratslavsky, 2000). Interventions informed by this theory aim to ensure decreases in procrastination by reducing task aversiveness (e.g., by strengthening emotion regulation skills).

Procrastination is not solely influenced by individual differences, such as student motivation or ability to regulate task-related negative emotions. In fact, "the core problem of procrastination, poor self-regulation, … is amplified by common aspects of the student environment" (Svartdal et al., 2020, p. 8). A recent review identified nine context-related factors (operating at the institution, program, and/or course levels) that make it more likely that students procrastinate in their learning (Svartdal et al., 2020). Specifically, unstructured conditions for learning – such as when students face complex choices regarding their learning or program of study – make procrastination more likely. In addition, long deadlines and learning environments where temptations/distractions (including distractions from peers) abound also create "procrastination-friendly" learning contexts (Svartdal et al., 2020, p. 1). Moreover, learning environments that seldom facilitate students' access to information needed to monitor their performance in a course (or evaluate their progress toward attaining their learning goals) are also linked to elevated procrastination. Furthermore, learning contexts that offer students limited opportunities to develop their self-efficacy regarding learning, include little/no group work, or involve poorly designed group work are also conducive to procrastination (Svartdal et al., 2020).

Svartdal et al.'s (2020) review and the empirical research supporting its conclusions indicate that efforts to reduce procrastination should not solely rely on interventions aiming to strengthen individuals' self-regulation. These efforts need to be "supplemented with specific contextual and organizational measures that can support productive self-regulation" (Svartdal et al., 2020, p. 8). Consistent with this call, existing research has highlighted some promising initiatives that targeted the learning environment or context. For example, Motz and colleagues have recently conducted personalized interventions that reminded students when they were about to miss an assignment deadline (Motz et al., 2021b) or praised them for submitting their work on time (Motz et al., 2021a). Both interventions, which aimed to strengthen students' learning/achievement by increasing adherence to assignments in a non-paternalistic way, were successful. Specifically, the first was associated with significantly lower levels of missed assignments (compared to active controls), stronger assignment adherence, and higher course

grades (Motz et al., 2021b). The second led to elevated assignment submission rates and course performance (Motz et al., 2021a).

Key Findings from Previous Reviews of Procrastination Interventions

In undertaking this research, we identified four published reviews on the efficacy of interventions aiming to reduce academic procrastination (i.e., Malouff & Schutte, 2019; Rozental et al., 2018; van Eerde & Klingsieck, 2018; Zacks & Hen, 2018). In the following, we highlight their key findings and conclusions. Malouff and Schutte's (2019) meta-analysis found that psychological interventions produced large reductions in procrastination (i.e., Hedge's $g = 1.18$). This review comprised of a variety of interventions (e.g., cognitive-behaviour therapy (CBT), paradoxical, rational emotive behavioral therapy, strengths training, visual feedback, etc.); no clear differences in the effectiveness of different types of interventions were found. This review also revealed that interventions were more effective when they targeted student samples, were delivered in person, and involved a no-treatment control group.

Rozental et al.'s (2018) meta-analysis also examined the efficacy of a variety of psychological interventions, including CBT, paradoxical, therapeutic metaphor, emotion regulation, dyadic coaching, SMART goals, acceptance commitment and behaviour therapy, and self-monitoring. Overall, interventions collectively produced modest benefits in reducing academic procrastination (i.e., Hedge's $g = 0.34$). At the same time, there was significant heterogeneity in the effect sizes across studies. These authors reported that the type of intervention that produced more robust effects was CBT (i.e., Hedge's $g = 0.55$).

Zacks and Hen's (2018) review highlighted the limited number of intervention studies, randomised control trials, or holistic interventions that target individual and situational causes of procrastination. These authors discussed three main types of interventions: therapeutic prevention targeting the general student population, therapeutic treatment targeting procrastinators, and instructor-based interventions. Therapeutic procrastination interventions consist of counselling services administered to students by a trained psychologist in order to reduce academic procrastination. Zacks and Hen (2018) argued that although therapeutic interventions produce large effect sizes, instructor-based interventions are more cost-effective, easier to implement, and provide an opportunity to address concerns about the prevalence of procrastination among students by teaching students how to effectively regulate their own learning.

Finally, van Eerde and Klingsieck's (2018) meta-analysis discussed four main types of interventions: self-regulation training, CBT, other therapeutic approaches, and strengths-based interventions. These authors reported that interventions caused medium to large reductions in academic procrastination. In line with Rozental et al. (2018), van Eerde and Klingsieck (2018) found (a) significant heterogeneity in effect sizes and (b) that CBT produced the largest effect sizes of all types of interventions.

Unresolved Issues and Unanswered Questions in Procrastination Intervention Research

What Types of Procrastination Interventions Have Been Recently Used? To what Extent are they Informed by the Main Conceptual Frameworks Supporting Procrastination Research?

Rozental et al.'s (2018) review and meta-analysis included only randomized control trials (RCTs) and assessed the intervention effects only by means of self-reports. Similarly, Malouff and Schutte's (2019) review and meta-analysis included only RCTs (i.e., 12 articles). In contrast, van Eerde and Klingsieck's (2018) review and meta-analysis included several different types of studies. Overall, these previous reviews reported that it was difficult to classify the interventions they examined in clear-cut types. This is because different interventions had overlapping content and used many different intervention methods (Malouff & Schutte, 2019). Case in point, van Eerde and Klingsieck (2018) noted that they found it "difficult to assign labels to intervention types because these combined different approaches" (p. 82). These prior reviews suggest that the field of procrastination interventions is rapidly developing from a heterogeneous base. In this review, we continue previous efforts and try to map the types of procrastination interventions that were conducted after the publication of these major reviews; see our first research question below.

Existing reviews could not provide a clear picture on the extent to which specific interventions were informed by a given theory or model. Regarding this aspect, Malouff and Schutte (2019) stated that the interventions they reviewed "were not designed to test a specific model" (p. 123). In a related vein, van Eerde and Klingsieck (2018) noted that while some of the interventions they examined were based on theories, "others vaguely relied on empirical findings concerning procrastination" (p. 83). The only exception to this pattern is that Rozental et al. (2018) proposed that procrastination interventions involving CBT fit well with Steel's (2007) Temporal Motivation Theory. The lack of (or uncertain) theoretical grounding of many procrastination interventions is clearly not optimal and van Eerde and Klingsieck (2018) suggested that "in future studies, theory-based and evidence-based interventions would be preferable" (p. 83). In our review, we evaluate the extent to which recent interventions have a strong conceptual grounding; see our second research question.

Are Recent Interventions Effective in Reducing Academic Procrastination?

Previous reviews found that most (yet not all) interventions they analyzed were effective. For example, of the 21 comparisons that comprised their meta-analysis, Rozental et al. (2018) found five (about 23%) that favored control over treatment. Similarly, Malouff and Schutte (2019) reported that for three of the 12 studies they analyzed (i.e., 25%), the 95% confidence intervals for the intervention's effect size included zero (see their Figure 2). This suggests that the effects of the given interventions were not reliably different from zero. In the van Eerde and Klingsieck (2018) review, of the 35 studies that included comparisons between change in

treatment and control groups, in 12 studies (about 34%) the 95% confidence intervals for the effect size included zero; in one study, the intervention appeared to favor the control group (see their Figure 2). Considering that the effectiveness of an intervention is a pivotal desideratum, in this review, we map the extent to which recent interventions were effective (see our third research question). In addition, we investigate whether any important information could be uncovered by examining the overarching characteristics of successful and unsuccessful interventions.

Do Recent Interventions Assess their Long-Term Effects on Reducing Procrastination?

The recent reviews and meta-analyses we discussed paint a slightly different picture regarding the extent to which the interventions they examined included follow-up measures to assess the interventions' long-term effects. On the one hand, Rozental et al. (2018) noted that their review explored only post-treatment outcomes because "there were too few studies reporting data at follow-up" (p. 3). On the other hand, the Malouff and Schutte's (2019) review – which, similarly to Rozental et al. (2018) included only RCTs – found that 50% of the interventions they analyzed included follow-up measures; the length of follow-up ranged between one week and 24 weeks. A similar pattern was found by van Eerde and Klingsieck (2018). These authors reported that many of the interventions they analyzed included follow-up tests (i.e., 23 follow-up effect sizes compared to 44 pre-post effect sizes); the interval for the follow-up measures in the van Eerde and Klingsieck (2018) review ranged between one week and one year. Our review continues this work and investigates whether recent procrastination interventions assessed their long-term effects (see our fourth research question).

Do Recent Interventions Evaluate Boundary Conditions for the Intervention (i.e., Moderation)? Do these Interventions Investigate (Mediation) Mechanisms/Processes via which Procrastination Interventions Influence Outcomes?

Twenty years ago, van Eerde (2003) argued that the absence of moderators in studies examining procrastination "is a serious shortcoming" (p. 1401). In intervention research, information on potential moderators of intervention effects enables mapping possible boundary conditions of the intervention (e.g., whether an intervention has differential effects in different subgroups or under different conditions; MacKinnon et al., 2007). The need for consideration of moderators in the procrastination intervention literature has also been highlighted in a recent review and meta-analysis. Specifically, Malouff and Schutte (2019) found that although the interventions they examined were effective overall, they benefitted more some participants than others. In addition to mapping boundary conditions of the effects of current interventions, knowledge of moderating processes could productively inform future work in procrastination (intervention) research (Huang et al., 2021). Considering these aspects, and consistent with recent calls for studies focusing on procrastination to "investigate moderators" (Koppenborg & Klingsieck, 2022a, p. 7), we examined the

extent to which interventions reviewed in the present research assessed moderators (see our fifth research question).

In addition to moderating factors, it is important that the procrastination intervention literature considers mediation processes. In intervention programs, examination of mediation mechanisms "generates evidence for how a program achieved its effects" (MacKinnon et al., 2007, p. 597). In turn, identifying the critical elements that channel intervention effects "can streamline and improve these programs by focusing on effective components" (MacKinnon et al., 2007, p. 597) and discarding the ones that are not effective or relevant (Windgassen et al., 2016). Moreover, theory-informed assessment of mediation processes in intervention research could contribute to both theory-refinement and improved outcomes for participants (Windgassen et al., 2016). Despite the importance of examining mediation mechanisms, a recent review of procrastination interventions (Rozental et al., 2018) identified only one study that involved mediation. Considering these aspects, we thought it was important to examine in this review the extent to which recent procrastination intervention investigated mediation mechanisms/processes (see our fifth research question).

The Elephant in the Room: The Missing Type of Procrastination Interventions

A large and consistent body of substantive and meta-analytic research has reported strong negative associations between procrastination and a personality trait, namely conscientiousness (e.g., Cheng et al., 2023; Sanchez-Ruiz & El Khoury, 2019; Steel, 2007; Steel & Klingsieck, 2016; van Eerde, 2003). "Conscientiousness encompasses several overlapping constructs that describe individual differences in the propensity to be self-controlled, responsible to others, hard-working, orderly, and rule abiding" (Spielmann et al., 2022, p. 2746; see also Roberts et al., 2014). Although between four and ten facets of conscientiousness have been proposed in the personality literature (Spielmann et al., 2022), three facets have received consistent support across different measures of conscientiousness and samples. These facets are (i) industriousness, which subsumes the tendencies to work diligently to get things done, persist when encountering difficulties, be ambitious, and aspire to excellence; (ii) orderliness, which encompasses the tendencies to plan one's future/actions and be systematic/meticulous in what one does; and (iii) impulse control (also called self-control), which captures the tendencies to delay gratification and control/inhibit impulses that go counter to long-term goals (Costantini & Perugini, 2016; Spielmann et al., 2022).

Recent research and theorizing suggest that conscientiousness is generally malleable (Magidson et al., 2014; Roberts et al., 2017; see also Allemand & Flückiger, 2022) and most changeable during adolescence (Spielmann et al., 2022). Especially relevant to its association with academic procrastination, conscientiousness "is influenced by various life experiences, such as school activities" (Spielmann et al., 2022, p. 2746). Therefore, interventions could help strengthen conscientiousness (Spielmann et al., 2022). Considering these key aspects (i.e., the strong and consistent negative association between procrastination and conscientiousness and the malleable nature of conscientiousness), it follows that conscientiousness could be productively targeted in interventions aimed to reduce academic procrastination.

Nevertheless, no such interventions were identified in the pre-2018 literature. This study examines whether procrastination interventions focusing on strengthening students' conscientiousness were recently conducted; see our sixth reearch question.

To what Extent Can Instructors/Teachers Implement More Recent Procrastination Interventions in their Classrooms?

The recent major reviews of procrastination interventions indicated that many effective procrastination interventions are therapeutic in nature and resource intensive (Malouff & Schutte, 2019; Rozental et al., 2018; van Eerde & Klingsieck, 2018; Zacks & Hen, 2018). Although therapeutic interventions tend to produce sizeable reductions in academic procrastination, they need to be administered by a trained therapist, which, in turn, might lead to budgetary strains for some educational institutions. In addition, these types of interventions could involve specific staff training and are generally more resource-intensive than non-therapeutic interventions (e.g., they generally require individual or small group settings). Another potentially important limitation of therapeutic interventions is that they might be less accessible to students who do not have time outside of class to participate in this intervention (Zacks & Hen, 2018).

Some researchers commented that insufficient attention has been paid to what interventions can be readily implemented in classrooms by instructors (Miyake & Kane, 2022; Zacks & Hen, 2018). Administering non-therapeutic interventions, such as instructor led interventions, has several advantages over therapeutic approaches. For example, non-therapeutic approaches can be administered to all students to ensure equity. In addition, small changes in how the assignments are implemented/scheduled or how the learning materials are made accessible do not require extensive resources (e.g., in terms of time, training, and materials), could be cost-effective (Zacks & Hen, 2018), and might be more likely to be adopted by educational institutions (Miyake & Kane, 2022). At the same time, classroom-based procrastination interventions also have drawbacks. For instance, these types of interventions require buy-in from teachers; considering the notoriously high workloads of the teachers, this buy-in is far from being guaranteed. In addition, teacher-led interventions may be implemented with varying levels of fidelity. In this review, we evaluate the extent to which recent interventions could be relatively easily implemented by instructors/teachers in their classrooms; see our seventh (and final) research question.

Research Questions/Aims

Our study aims to address the questions we highlighted above; the specific research questions we examined are included below. To answer these questions, we conducted a systematic search of the literature to identify interventions designed to reduce academic procrastination that were developed after these major reviews were published (i.e., Malouff & Schutte, 2019; Rozental et al., 2018; van Eerde & Klingsieck, 2018; Zacks & Hen, 2018). In this article, we use the term "intervention" in a broad sense to describe any intentional effort to reduce academic procrastination by means of

(i) altering students' internal states (e.g., reducing negative moods), (ii) changing relevant individual difference factors (e.g., motivation; impulsivity; ability to manage emotions), and/or (iii) modifying one or more aspects of students' learning-related contexts (e.g., assigning group work vs. individual work for an assessment). Examining the research questions we propose is important because new information gleaned from engaging with them could be productively taken into account when designing or selecting future procrastination interventions. Our review employs this specific timeframe (2018-March 2023) to examine recent developments in academic procrastination intervention research.

This review examines seven research questions (RQs):

RQ1: What types of interventions were reported post 2018?

RQ2: What theory of academic procrastination (if any) informed these interventions?

RQ3: Were the reported interventions effective?

RQ4: Were follow-up measures used to assess the long-term effects of the interventions on academic procrastination?

RQ5: Were moderation and/or mediation factors/mechanisms assessed?

RQ6: Were interventions that targeted conscientiousness to reduce academic procrastination reported?

RQ7: What types of interventions are realatively easy to implement and, thus, could be realistically applied by instructors/teachers in the classroom?

Method

We conducted a systematic search of seven online databases (i.e., Google Scholar, ERIC, Web of Science, Scopus, ProQuest, PsycINFO, and A + Education) to identify empirical studies testing the efficacy of an intervention in reducing academic procrastination. The publication date was restricted to 2018-March 2023 to capture the articles published after the most recent major reviews of procrastination interventions (i.e., Malouff & Schutte, 2019; Rozental et al., 2018; van Eerde & Klingsieck, 2018; Zacks & Hen, 2018). We conducted the initial search in November 2022 using "academic procrastination" OR "procrastinat*" with any of the following search terms: intervention, treatment*, school, university, college, reduce, decrease, experiment*, control group, or random*. The search was rerun in March 2023 to ensure that no relevant articles were missed from our review. Following the recommendations of Alexander (2020) we searched the reference lists of relevant articles identified from our search for additional articles. However, no additional articles were identified.

To be included in the review, articles had to: (i) use a student sample ranging from primary to tertiary education, (ii) employ a pre-test post-test quantitative design with a control group, (ii) be peer-reviewed, (iii) be written in English, (iv) include a self-reported or behavioral measure of academic procrastination, and (v) provide sufficient information to understand what the intervention consisted of and how it was evaluated.

Our search excluded grey literature (e.g., conference papers, thesis, dissertations, government reports, or unpublished articles that have not been peer reviewed) because we did not have a large enough research team to undertake a timely examination of these studies, they are at times difficult to access, and there is high variability in the quality of reports from grey literature (Alexander, 2020). Although removing from consideration grey literature may increase the risk of publication bias by potentially excluding non-significant results from our review (Alexander, 2020), it is important to note that Rozental et al. (2018) reported "small sample sizes and high risk of bias in many of these doctoral theses" (p. 12), which would be a key part of the grey literature. Moreover, we also excluded articles that did not describe their intervention in enough detail ($n = 2$; e.g., Armani Kian et al., 2020; Kang & Zhang, 2020), did not include a control group ($n = 3$; e.g., Gagnon et al., 2018; Gonda et al., 2021), involved a non-experimental study ($n = 1$; Hensley & Munn, 2020), had a small sample size (i.e., less than 20 participants per condition; $n = 3$; e.g., Dinç & Ekşi, 2019; Wilson Van Voorhis & Morgan, 2007), did not include a post-test measure of academic procrastination ($n = 1$; Gading, 2020), involved an intervention that was not specifically designed to reduce academic procrastination ($n = 3$; e.g., Amoke et al., 2021; Baker et al., 2018), or involved a combination of some of the aspects highlighted here ($n = 9$; e.g., López-López et al., 2020; Motie et al., 2019).

The search identified a total of 1,320 articles, out of which 1,173 were excluded for not being relevant to the research question, leaving 147 articles. We then removed duplicates ($n = 54$) leaving 93 articles. We then screened the titles and abstracts to exclude irrelevant articles based on our exclusion criteria ($n = 46$) leaving 47 articles. Finally, the first author read the full text of each article, excluding those that did not meet our eligibility criteria ($n = 25$), leaving 22 articles. During the review process, we became aware that one of these 22 articles was retracted. This is why, our final set included 21 articles.

Results

The search process identified 21 empirical studies that met all the eligibility criteria. These studies, together with their key characteristics and outcomes investigated, are listed in the online supplemental material (OSM). As indicated in its Table of Contents, the OSM comprises seven parts. Part 1 of the OSM includes summary information on 10 articles in which the interventions focused on a general student sample and examined self-reports of procrastination. Part 2 of the OSM includes information on five articles in which the interventions focused on a student sample that had one or more specific characteristics (e.g., students having high levels of procrastination) and examined self-reported academic procrastination. Parts 3 (six articles) and 4 of the OSM (one article) group studies focusing on general and specific samples, respectively, and used behavioral measures of procrastination. One article included both types of measures (i.e., self-report and behavioral measures of procrastination) and was, thus, included twice in the OSM (i.e., Koppenborg & Klingsieck, 2022a). Within each of the first four parts of the OSM, interventions that manipulated students' physical or social environment are listed first (i.e., situational

strategies), followed by interventions that both manipulated students' environment and altered their mental representations (i.e., situational and cognitive strategies; Duckworth et al., 2018). Interventions that only focused on altering students' mental representations (i.e., cognitive strategies; Duckworth et al., 2018) are listed last. Part 5 of the OSM describes how each article was coded. Part 6 includes information on the aspects that were considered when evaluating the ease of implementation of each intervention. Part 7 explains our rationale for not retaining for this review articles with a sample size of less than 20 participants per condition.

To assess the threat of publication bias, we conducted a p-curve analysis (Simonsohn et al., 2014). Unfortunately, the p-curve analysis could not capture all the interventions included in our review because for five studies we were unable to find or calculate the information needed to be entered in the p-curve analysis app; for example, one article estimated a complex model, and we could not map the test statistics reported in the article to the type of data that could be entered in the p-curve app. For this p-curve analysis, the p-value for the binomial test regarding evidential value was $p = 0.0112$. For evidential value pertaining to the continuous test, for full p-curve, $z = 13.6$, $p < 0.0001$; for half p-curve, $z = 14.08$, $p < 0.0001$. The power of tests included in the p-curve was 99%. This analysis did not indicate that evidential value is inadequate or absent: $p = 0.9266$ for the binomial test; the p-values for continuous test (both for the full-curve and the half-curve) were bigger than 0.9999. Thus, the findings of this incomplete p-curve analysis suggest that there is some evidence of publication bias.

Of the 21 studies included in our review, three (14.3%) used a randomised-control trial design, nine (42.9%) used an experimental design, four (19.0%) employed a field experimental design, three (14.3%) used a quasi-experimental design, one study (4.8%) implemented a longitudinal quasi-randomised control trial design, and one study used a quasi-experimental interrupted time series design; Table 1, column 2 provides information on the research design for each of the 21 studies. The studies reviewed included three types of control groups: business as usual (BAU; that is, no treatment), waitlist, or active waitlist. We found that 14 studies (66.7%) used a BAU control group, six (28.6%) used a waitlist control group, and one study used an active waitlist control group; Table 1, column 3, provides information on the type of control group employed in each intervention.

RQ1: Types of Interventions

Our review of this recent literature identified that many different types of interventions were conducted (e.g., mindfulness, corrective feedback, social norms, deadline reminders, etc.; for a full account, see Table 1 column 6). Ten interventions (47.6%) were offered in person, eight (38.1%) were offered online, and one was administered both in person and online. Two studies in which the interventions involved policy changes in examination practices interventions were labelled as N/A (see Table 1, column 8). The intervention lengths ranged from one day (Koppenborg & Klingsieck, 2022b) to one year (Gershoni & Stryjan, 2023). The total sample sizes of the interventions considered ranged from 50 to 29,468 students. Twenty articles (95.2%)

Table 1 Characteristics of the studies included in our systematic review

Article	Research Design	Control Group	Total Sample Size	Sample Characteristics	Intervention Type	Intervention Length	Format	Relevant Theories	Outcome Measure	Follow Up Length	Key Findings	Ease of Implementation
Abuhmaid and Abood (2020)	Quasi-Experiment	BAU	80	Jordan, university students, all female	Flipped Learning	A semester	In Person	N/A	Self-Report	N/A	Adopting a flipped learning model produced no significant reductions in academic procrastination	Low
Eckert et al. (2018)	RCT	Wait-List	161	Germany, university students, aged between 19–62 years, mean age of 28.4 years, 73.9% female	Emotion Regulation Training	4 × 30 min sessions over 2 weeks	Online	Temporal Motivation Theory and Short-Term Mood Repair Theory	Self-Report	8 weeks post-intervention	Online emotion regulation training with SMS reminders successfully reduced academic procrastination and this effect persisted up to eight weeks post-intervention ($d = 0.57$ post-intervention; $d = 0.87$ follow-up)	Moderate
Gershoni and Stryjan (2023)	Field Experiment	BAU	11,130	Israel, university students, cohort 2017–2019, mean age 27 years, 36% female	Policy Changes in Examination Practices	A year	N/A	Temporal Motivation Theory	Behavioral	N/A	Introducing a deadline for students' submission of their final project had no effect on the likelihood that students would complete their defense project or graduate (i.e., academic procrastination)	High
Gray (2021)	Quasi-Experiment	BAU	104	USA, upper class university students, 86% female	Mindfulness	Three credit hour course over 14 weeks	In Person and Online	Temporal Motivation Theory	Self-Report	N/A	Only when mindfulness training was administered in person rather than online there was a significant reduction in academic procrastination	Low

Table 1 (continued)

Article	Research Design	Control Group	Total Sample Size	Sample Characteristics	Intervention Type	Intervention Length	Format	Relevant Theories	Outcome Measure	Follow Up Length	Key Findings	Ease of Implementation
Grunschel et al. (2018)	Experiment	Wait-List	106	Germany, university students, high procrastinators, 54.7% female, mean age was 25 years	Self-Regulation Training	5×90 min sessions over 5 weeks	In Person	Temporal Motivation Theory	Self-Report	5 weeks post intervention	The intervention significantly reduced students' academic procrastination and increased their self-regulated learning skills relative to controls. These benefits were sustained up to five weeks post-intervention. The effect sizes were medium to large: academic procrastination ($\eta2 = 0.14$ and $d = -0.89$ post-intervention; $d = -0.40$ follow-up), goal setting and planning ($\eta2 = 0.10$ and $d = 0.64$ post-intervention), time management ($\eta2 = 0.11$ and $d = 0.64$ post-intervention), learning environment ($\eta2 = 0.13$ and $d = 0.85$ post-intervention), and concentration ($\eta2 = 0.14$ and $d = 1.09$ post-intervention)	Moderate

Table 1 (continued)

Article	Research Design	Control Group	Total Sample Size	Sample Characteristics	Intervention Type	Intervention Length	Format	Relevant Theories	Outcome Measure	Follow Up Length	Key Findings	Ease of Implementation
Himmler et al. (2019)	Field Experiment	BAU	392	Germany, university students, 45–50% female, mean age was 21 years	Intervention 1: Pure Reminder, Intervention 2: Deadline Reminder & Soft Commitment Device	A semester	In Person	Temporal Motivation Theory	Behavioral	N/A	Only pure reminders paired with a soft commitment device significantly increased the number of exams students signed up for, sat, and passed. Soft commitment devices were more effective at reducing academic procrastination for high procrastinators compared to low procrastinators	High
Huang et al. (2021)	Field Experiment	BAU	7,844	China, university students enrolled in online courses, age ranged between 18–54 years, mean age was 26.1 years	Optimal Calls to Action	3 weeks	Online	Temporal Motivation Theory	Behavioral	N/A	High descriptive norms increased the probability of assignment completion by 8.2% and financial incentives increased the probability of assignment completion by 3.4% relative to controls (simple call to action—CTA). Deadline reminders had a counterproductive effect and led to longer delays and reduced probability of submission relative to controls (simple CTA)	High

Table 1 (continued)

Article	Research Design	Control Group	Total Sample Size	Sample Characteristics	Intervention Type	Intervention Length	Format	Relevant Theories	Outcome Measure	Follow Up Length	Key Findings	Ease of Implementation
Kaur et al. (2021)	Experiment	BAU	150	India, secondary school students, high procrastination, high fear of failure, high task aversion, age ranged between 16–19 years, and 58% were female	Biofeedback Training	8 × 45 min sessions over 3 weeks	In Person	Temporal Motivation Theory and Short-Term Mood Repair Theory	Self-Report	N/A	Biofeedback training effectively reduced students' fear of failure, task aversion, and procrastination. The effect sizes were large for fear of failure (η2 = 0.77), task aversion (η2 = 0.51), and procrastination (η2 = 0.64)	Low
Koppenborg and Klingsieck (2022a)	Field Experiment	BAU	58	Germany, university students, high procrastinators, aged between 18–28 years, 63% female	Interdependence	10 days	In Person	Temporal Motivation Theory and Short-Term Mood Repair Theory	Self-Report and Behavioral	N/A	Students who believed they were a part of a group (interdependence) submitted more assignments on time (Cohen's $d = 0.62$), took less time to submit the assignment after they were given the materials (Cohen's $d = 0.57$), and started working on the assignment earlier than controls (Cohen's $d = 0.57$)	High

Table 1 (continued)

Article	Research Design	Control Group	Total Sample Size	Sample Characteristics	Intervention Type	Intervention Length	Format	Relevant Theories	Outcome Measure	Follow Up Length	Key Findings	Ease of Implementation
Koppenborg and Klingsieck (2022b)	Experiment	BAU	Study 1: 320 Study 2: 193	Germany, university students, 72–81% female, mean age ranged between 21.5 and 23.0 years	Study 1: Interdependence Study 2: Interdependence & Commitment Device	1 day	In Person	Temporal Motivation Theory and Short-Term Mood Repair Theory	Self-Report	N/A	In both studies, students reported lower state procrastination when they were assigned group work (interdependence) than when they worked independently; $beta = -0.34$ in Study 1; $\eta 2 = 0.07$ in Study 2 The intervention was most effective for students with high trait level procrastination and who made a public commitment to their peers to hand their assignment in on time; $\eta 2 = 0.67$ in Study 2 Students reported greater positive affect (large effect size) and lower negative affect (medium effect size) when working in groups rather than on their own	High

Table 1 (continued)

Article	Research Design	Control Group	Total Sample Size	Sample Characteristics	Intervention Type	Intervention Length	Format	Relevant Theories	Outcome Measure	Follow Up Length	Key Findings	Ease of Implementation
Krispenz et al. (2019)	Longitudinal Quasi-Randomized Control Trial	Active Wait-List	71	Germany, university students, high procrastination and test anxiety, 63.1% female, aged between 18–36 years	Emotion Regulation Training	2 × 3 h seminars over a two week period	In Person	Short-Term Mood Repair Theory	Self-Report	3 weeks post-intervention	Inquiry-Based Stress Reduction (IBSR) significantly increased students' self-efficacy ($\eta 2 = 0.08$), reduced test anxiety ($\eta 2 = 0.09$), and academic procrastination ($\eta 2 = 0.09$) immediately after the intervention and endured till the end of the term Mediation analysis revealed that reductions in academic procrastination were due to the direct effects of IBSR (time 1) that persisted till the end of term (time 2–3) and not because of the indirect effects of increased self-efficacy or reduced test anxiety	Moderate
Loeffler et al. (2019)	Experiment	Wait-List	89	Germany, university students, 82% male, mean age ranged between 22.1 and 23.7 years	Self-Regulation Training	Duration ranged between 5—88 days. The mean duration was 18 days	Online	Temporal Motivation Theory and Short-Term Mood Repair Theory	Self-Report	2 months post-intervention	Students in the intervention condition had significantly reduced academic procrastination and completed more planned course work relative to controls. These effects were sustained up to two months post-intervention	High

Table 1 (continued)

Article	Research Design	Control Group	Total Sample Size	Sample Characteristics	Intervention Type	Intervention Length	Format	Relevant Theories	Outcome Measure	Follow Up Length	Key Findings	Ease of Implementation
Luo et al. (2022)	Experiment	BAU	71	China, university students, 60% female, mean age was 19.2 years	Psychological Well-Being	30 min daily over a 4 week period	Online	Temporal Motivation Theory and Short-Term Mood Repair Theory	Self-Report	N/A	Listening to nature sounds whilst studying significantly improved students' engagement in deeper learning (Cohen's $f=0.55$), enhanced their academic self-efficacy (Cohen's $f=0.31$), and reduced academic procrastination (Cohen's $f=0.29$)	High
Nicholls (2023)	Experiment	BAU	Study 1: 145 Study 2: 192	South Africa, university students, mean age ranged between 21.1—21.6 years, 46–54% female	Study 1: Social Norm Nudge & Information Nudge Study 2: Information Nudge	9 tutorials completed over 9 weeks	Onlin	Temporal Motivation Theory	Behavioral	N/A	In both studies, the nudges (information nudge and social norms) were ineffective at reducing academic procrastination and failed to motivate students to hand in their assignments earlier (12 h before the deadline)	High
Nourinezhad et al. (2021)	Experiment	BAU	50	Iran, university students, English as second language learners, 50% female, mean age 20–24 years	Audio-Visual Feedback	3 unit course completed during a semester	Online	Temporal Motivation Theory	Self-Report	N/A	Students who received audio-visual feedback on their written assignments procrastinated significantly less than students who received traditional feedback	High

Table 1 (continued)

Article	Research Design	Control Group	Total Sample Size	Sample Characteristics	Intervention Type	Intervention Length	Format	Relevant Theories	Outcome Measure	Follow Up Length	Key Findings	Ease of Implementation
Oram et al. (2022)	Experiment	Wait-List	223	Canada, university students, 78% female, age ranged between 18–25 years	Motivational Interviewing	2 × 60 min workshops held over 3 weeks	In Person	Temporal Motivation Theory	Self-Report	N/A	Motivational interviewing significantly increased students' basic psychological neesds statisfaction ($\eta p2 = 0.03$) but failed to significantly increase academic motivation or reduce academic procrastination	Low
Oermin-Cristeta and Hautzinger (2018)	Quasi-Experiment	Wait-List	161	Germany, university students, 53% female, age range between 20 – 43 years	Workshop A: Commitment Device Workshop B: Multidimensional Intervention & Commitment Device	6 workshops, the duration ranged between 90–120 min, held over six weeks	In Person	Temporal Motivation Theory and Short-Term Mood Repair Theory	Self-Report	3 months post-intervention	Both workshops caused large reductions in academic procrastination. The effects were sustained up to three months post-intervention Students who attended workshop A had lower procrastination scores post-intervention relative to those who participated in workshop B. However, students in workshop B had lower procrastination scores than their counterparts in workshop A three months post-intervention	Low

Table 1 (continued)

Article	Research Design	Control Group	Total Sample Size	Sample Characteristics	Intervention Type	Intervention Length	Format	Relevant Theories	Outcome Measure	Follow Up Length	Key Findings	Ease of Implementation
Schmidt et al. (2021)	Quasi-Experimental Interrupted Time Series	BAU	29, 468	Netherlands, three cohorts of university students between 2009 – 2015, 46% female	Policy Changes in Examination Practices	1 year	N/A	Temporal Motivation Theory	Behavioral	N/A	Comparing the percentage of students who successfully passed their first year, delayed their studies, and dropped out of the program following the implementation of three changes in examination practices, the authors found that the number of successful students increased by 23%, the number of students who delayed their studies decreased by 25%, and dropout rates were unchanged. A chi-square test was conducted to show that these were statistically significant reductions in academic procrastination (p < .0001). Thus, the authors concluded that the intervention was successful at reducing academic procrastination	Low

Table 1 (continued)

Article	Research Design	Control Group	Total Sample Size	Sample Characteristics	Intervention Type	Intervention Length	Format	Relevant Theories	Outcome Measure	Follow Up Length	Key Findings	Ease of Implementation
Schuenemann et al. (2022)	RCT	Wait-List	148	Germany, university students, 75% female, age range between 18 – 43 years	Emotion Regulation Training	9 × 90 min sessions held over 9 weeks	Online	Short-Term Mood Repair Theory	Self-Report	N/A	Strengthening emotion regulation skills significantly reduced students' procrastination (η2 = 0.48). Mediation analyses confirmed that increased general emotion regulation skills caused students to procrastinate less	Moderate
Ugwuanyi et al. (2020)	RCT	BAU	64	Nigeria, university students, 46% female, mean age ranged between 20–30 years	Cognitive Behaviour Therapy (CBT)	12 × 90 min sessions held over 6 weeks	In Person	Temporal Motivation Theory and Short-Term Mood Repair Theory	Self-Report	2 months post-intervention	Group-based CBT successfully reduced academic procrastination in university students (η2 = 0.82). The benefits of the intervention persisted up to two months post-intervention (η2 = 0.78)	Low
Wessel et al. (2020)	Experiment	BAU	107	Australia, university students, 69% female, age range between 17 – 55 years	Self-Reflection Intervention	SMS messages twice daily over 2 weeks	Online	Temporal Motivation Theory	Behavioral	N/A	The intervention was only effective for low trait procrastinators (Cohen's d = .51). The intervention successfully motivated low trait procrastinators to start working on their assignment earlier than their counterparts in the control group. However, interdependence had no effect on students' assignment submission date or their grade	High

BAU Bussiness as usual, *RCT* randomised control trial, The key findings column includes measures of effect sizes whenever these measures were reported in the article. No other demographic information about the participants was reported by Abuhmaid and Abood (2020), Gray (2021), and Schmidt et al. (2021) articles. Ease of implementation (high, average, low) was evaluated based on the relative effort required to administer the intervention, physical limitations of the environment, finanical costs, and time costs associated with implementing the intervention; for more information about the ease of implementation see Part 6 of the OSM

collected data from university students; only one intervention was conducted with secondary school students (i.e., Kaur et al., 2021). In terms of age, the narrowest reported age range in these studies was 16 – 19 years (Kaur et al., 2021), whereas the broadest age range was 19 – 62 years (Eckert et al., 2018). In regard to gender, seven studies (33.3%) collected data from a predominantly female sample and one from a predominantly male student sample; gender distribution was relatively balanced for the remaining articles.

RQ2: Conceptual Frameworks Informing the Interventions

The theoretical foundations of the interventions reviewed in this article included both the Temporal Motivation Theory (Steel, 2007) and the Short-Term Mood Repair Theory (Sirois & Pychyl, 2013). Specifically, 10 studies (47.6%) were informed by the tenets of the former theory and two studies (9.5%) by those of the latter theory. Eight studies (38.1%) drew from both theories, whereas one intervention was not clearly linked to either of the two major theories of academic procrastination (see Table 1 column 9).

RQ3: Effectiveness of Interventions

Investigating RQ3, we found that 17 interventions (80.9%) were effective; that is, these interventions were associated with statistically significant reductions in academic procrastination. Four interventions (19.0%) failed to cause significant reductions in academic procrastination (i.e., Abuhmaid & Abood, 2020; Gershoni & Stryjan, 2023; Nicholls, 2023; Oram et al., 2022).

RQ4: Follow-Up Measures Assesing Long-Term Effects of Interventions

With regard to RQ4, our review found that six studies (28.6%) in our sample included a follow-up measure of academic procrastination (see Table 1 column 11). The follow-up time frame ranged from five weeks (Grunschel et al., 2018) to three months post-intervention (Krispenz et al., 2019; Otermin-Cristeta & Hautzinger, 2018).

RQ5: Moderation/Mediation Factors/Processes

Regarding this research question, our investigation found that four articles (19.0%) examined moderating factors. Three of these studies examined whether the effectiveness of the intervention was moderated by trait procrastination (Himmler et al., 2019; Koppenborg & Klingsieck, 2022b; Wessel et al., 2020); one study examined the moderating effect of workload (Huang et al., 2021). Only two articles (9.5%) undertook mediation analyses; one of these studies tested whether the intervention reduced academic procrastination via strengthening students' emotion regulation skills (Schuenemann et al., 2022), whereas the other investigated whether the effects

of the intervention were mediated by improvements in self-efficacy (Krispenz et al., 2019).

RQ6: Conscientiousness and Procrastination Interventions

When we examined RQ6 we found that, contrary to our expectations, no interventions aimed to reduce academic procrastination by increasing students' conscientiousness.

RQ7: Ease of Implementation and Suitability to Classroom Use

Investigating RQ7, we found that among the interventions we identified there was a balanced mixture of studies that tested the effects of situational strategies, which aimed to change some aspects of students' contexts/environments, and cognitive strategies, which tried to strengthen some parts of students' self-regulation (Duckworth et al., 2018). In engaging with RQ7, we evaluated whether each intervention could realistically be applied in classrooms by rating its relative ease of implementation as high, moderate, or low. In so doing, we considered four factors: (a) the amount of effort required for the teachers and students to participate in the intervention; (b) characteristics of the learning environment that may make it difficult to implement the intervention in classrooms; (c) the financial costs associated with intervention materials and training staff; and (d) the time costs associated with students participating in the intervention and teachers administering the intervention in the classroom; for more detail about the ratings for each article refer to Part 6 in the OSM. We found that 10 interventions (47.6%) could be (relatively) easily implemented into classrooms (see in the last column of Table 1 the entries where the ease of implementation was rated as 'high') and four interventions (19.0%) would be moderately difficult to implement in classrooms. Seven interventions (33.3%) are likely to involve significant effort, time, and financial costs that severely constrain their implementation in classrooms; hence, for these interventions, the ease of implementation was rated as 'low' (see Table 1).

Discussion

We conducted this systematic review to undertake an in-depth examination of recent interventions designed to reduce academic procrastination. In addition, we set out to use the results of this examination to uncover commonalities and differences among the interventions, identify the boundaries of current knowledge on procrastination interventions, and map a set of recommendations for effective interventions that can be feasibly administered by teachers/instructors. Below, we discuss the implications of our findings pertaining to the first six research questions. The significance of the seventh research question is addressed in the subsection titled "Recommendations for Instructional Practice".

Types of Interventions and their Conceptual Grounding

About half of the interventions examined in this review were offered in person. This percentage is comparable to the corresponding figure reported in Malouff and Schutte's (2019) review (i.e., 58%). Likewise, the percentage of interventions offered online was comparable in our and Malouff and Schutte's (2019) review (i.e., 38.1% and 33%, respectively). Both our review and that of Malouff and Schutte (2019) found that one intervention was delivered in a format that included both in person and online components. In terms of control groups used in the interventions, our study found a larger percentage of no-treatment groups (i.e., 66.7%) and a smaller percentage of waitlist groups (i.e., 28.6%) than Rozental et al. (2018) did (i.e., 50% in each category).

Similar to results reported by van Eerde and Klingsieck (2018), our study found a wide range of types of interventions, which included calls to action, policy changes in the examination process, and CBT, to mention just a few; see Table 1 for more details. Interestingly, the percentage of CBT in our review (4.8%) was markedly smaller than the corresponding percentage in Rozental et al. (2018) (i.e., 33%). As it was the case in the van Eerde and Klingsieck (2018) review, several of the interventions we examined focused on enhancing participants' strengths and resources (e.g., mindfulness, psychological well-being, self-reflection, self-regulation).

Some of the interventions examined in our review used apps to send daily reminders prompting students to reflect on their study habits and complete online self-regulation training modules (e.g., Eckert et al., 2018; Loeffler et al., 2019; Schuenemann et al., 2022; Wessel et al., 2020)[1]. Findings from the studies reviewed suggest that there are four important benefits linked to using app-based interventions. First, they reduce the demand on instructors, thus enabling them to focus their resources on implementing intervention strategies that students would struggle to initiate themselves (i.e., other-deployed cognitive and situational strategies; Duckworth et al., 2018). This may involve social norm interventions where teachers send out reminders to students about the due date for an assignment and highlight the percentage of the class that have already submitted this assignment (i.e., Huang et al., 2021).

Second, when the app-based interventions include sending regular SMS reminders to students, this is likely to increase student engagement with the intervention and may even strengthen its effectiveness (Eckert et al., 2018). Third, they encourage students to engage with the intervention in stable environments (e.g., studying at the same time of day, in the same place, and with the same people); in turn, this facilitates the development of productive study habits (Galla & Duckworth, 2015; Verplanken & Orbell, 2022; Fiorella, 2020), which further reduce the likelihood of procrastination. Finally, app-based interventions can be customised to target each students' unique reasons for procrastinating. This is a key aspect, as some researchers have theorised that customised interventions are more effective than undifferentiated ones (Klingsieck, 2013; Rozental et al., 2015; Steel & Klingsieck, 2016; Svartdal & Løkke, 2022; van Eerde, 2015; Wessel et al., 2020).

Several studies included in this review personalised their interventions to target each student's reasons for procrastinating. An analysis of these studies uncovered five main ways researchers customised their interventions. First, they asked

students to sign a personalised behavioral contract where they agree to hand in their assignment before a self-imposed deadline (Himmler et al., 2019; Otermin-Cristeta & Hautzinger, 2018). Second, they provided students with multiple techniques to reduce procrastination and encouraged them to select the ones that work best for them (Luo et al., 2022; Schuenemann et al., 2022). Third, they used app-based interventions that offered students personalised recommendations about self-regulation training modules to complete based on students' self-reported reasons for procrastinating (Loeffler et al., 2019). Fourth, they provided personalised feedback on students' work (Nourinezhad et al., 2021). Finally, they created one-on-one training sessions (Kaur et al., 2021). Notably, the first four types of strategies are relatively low-cost ways to customise interventions that may heighten students' engagement and subsequently increase the likelihood that students will benefit from the intervention (Eckert et al., 2016, 2018). In contrast, the final strategy highlighted above would be resource intensive as many instructors (as well as institutions) might struggle to provide one-on-one training sessions to all their students.

Notwithstanding the aspects highlighted in the above paragraph, most interventions reviewed in this study were administered to all students without any customisation. It is unlikely that undifferentiated interventions are effective for all students when learners may procrastinate for multiple reasons (Miyake & Kane, 2022). Notably, research suggests that reasons for procrastinating vary depending on the person, academic task, and their environment/context (Klingsieck, 2013; Miyake & Kane, 2022; Nordby et al., 2017; Steel, 2007; Svartdal et al., 2020; Yan & Zhang, 2022). For example, students have different personal resources; therefore, the strategies they find valuable and easier to implement might differ across students.

When examining the conceptual grounding of the interventions we reviewed, we found that only one of the 21 interventions analyzed could not be clearly linked to any of the major theoretical frameworks informing procrastination research. This finding is encouraging, and it suggests that recent calls to undertake theory- or empirically-based procrastination interventions (van Eerde & Klingsieck, 2018) did not go unheard.

Effectiveness of Interventions

Our review identified 17 interventions that successfully reduced academic procrastination. Consistent with previous reviews (Malouff & Schutte, 2019; Rozental et al., 2018; van Eerde & Klingsieck, 2018), we found significant variability in effect sizes. Specifically, of the 10 studies that reported effect sizes, four reported medium effect sizes (Koppenborg & Klingsieck, 2022a; Krispenz et al., 2019; Luo et al., 2022; Wessel et al., 2020) and six reported large effect sizes (Eckert et al., 2018; Grunschel et al., 2018; Kaur et al., 2021; Koppenborg & Klingsieck, 2022b; Schuenemann et al., 2022; Ugwuanyi et al., 2020). Following, we discuss some overarching aspects characterizing successful and unsuccessful interventions that we uncovered in the present study.

The successful interventions identified in this review focused on building students' self-regulation abilities by developing time management and emotion

regulation skills, increasing their motivation, self-efficacy, and meta-cognitive awareness (e.g., Eckert et al., 2018; Grunschel et al., 2018; Wessel et al., 2020). Notably, eight of the reviewed interventions involved aspects that are conceptually consistent with both major theories informing procrastination research (i.e., Temporal Motivation Theory; Steel, 2007; Short-Term Mood Repair Theory; Sirois & Pychyl, 2013). This is important because interventions that target factors that address (to some extent) both theoretically posited sets of pathways leading to procrastination (i.e., emotion regulation and expectancy-value-impulsiveness-delay) and encourage students to try multiple strategies to reduce their procrastination might go a long way toward ensuring that all students benefit from the same intervention. In addition, interventions that target multiple antecedents of procrastination are likely to be more effective than interventions that focus on a single antecedent (Miyake & Kane, 2022).

Overviewing some of the characteristics of the four unsuccessful interventions pinpoints three important aspects. First, the intervention reported by Abuhmaid and Abood (2020), which neither focused on developing students' emotion regulation skills nor attempted to enhance expectancy/value, was ineffective. Second, the study authored by Gershoni and Stryjan (2023) found that precommitment devices in the form of students setting self-imposed deadlines for their final project were ineffective at reducing academic procrastination (e.g., reducing delayed graduation rates). The authors' findings are consistent with previous literature showing mixed results on commitment devices' effects on academic procrastination (Anderberg et al., 2017; Ariely & Wertenbroch, 2002; Baker et al., 2016; Bisin & Hyndman, 2014; Burger et al., 2011; Patterson, 2018; Robinson et al., 2018).

Third, the intervention reported by Nicholls (2023), which enhanced students' intentions to change their behaviour but did not teach them strategies to reduce academic procrastination, was also ineffective. This finding is consistent with both theory and research on effective self-regulated learning (McDaniel & Einstein, 2020; McDaniel et al., 2021). Specifically, McDaniel and Einstein (2020) theorised that effective interventions that teach self-regulated learning skills require targeting four dimensions (knowledge, belief, commitment, and planning). Applying this conceptual framework to procrastination interventions suggests that successful interventions need to help students learn about what procrastination is, its antecedents, and consequences. In addition, as part of these interventions, teachers (or other individuals involved with the intervention) have to demonstrate effective interventions for reducing procrastination and provide students opportunities to practice them and receive feedback. Consistent with McDaniel and Einstein's (2020) framework, other key features of effective procrastination interventions involve developing/strengthening students' beliefs that they can effectively implement strategies targeting procrastination in their daily lives and that doing this will improve their well-being and academic performance (i.e., self-efficacy). Finally, effective interventions must prompt (and assist) students to plan in detail how they will use these strategies, when, and where, and how they will respond to obstacles/temptations that could fuel the tendency to procrastinate.

Long-Term Effects of Interventions

Our review found that only six articles included a follow-up measure of academic procrastination. This finding is consistent with that of Malouff and Schutte (2019) who reported that most studies in their review only measured academic procrastination immediately after the intervention ended. The length of the follow-up measures in our review ranged between 0–13 weeks, with the longest follow-up measure being three months post-intervention (Otermin-Cristeta & Hautzinger, 2018). Considering this aspect, the corpus of studies reviewed here cannot provide insights on how long the benefits of successful interventions are sustained over time and on whether refresher sessions are needed to prolong their effects and lead to improvements in key student outcomes (e.g., learning, academic achievement, well-being).

Moderation and Mediation Factors/Processes

As we previously highlighted, moderation and mediation mechanisms were rarely examined in the studies we reviewed, despite their pivotal conceptual and practical significance (Koppenborg & Klingsieck, 2022a; MacKinnon et al., 2007; van Eerde, 2003; Windgassen et al., 2016). Case in point, only three articles in our review compared their intervention's efficacy for *high and low trait procrastinators* (i.e., Himmler et al., 2019; Koppenborg & Klingsieck, 2022b; Wessel et al., 2020). This is unexpected because such comparisons could help shed light on the mechanisms underpinning the interventions effects and assist with the identification of their boundary conditions (e.g., for whom the intervention is, or is not, effective).

Results from a subset of studies we reviewed provide some indications of possible differential effects between high and low procrastinators. Specifically, Himmler et al. (2019) found that their intervention was more effective for high (trait) procrastinators than for low procrastinators (see their p. 136). Results from the two studies reported by Koppenborg and Klingsieck (2022b) lead to the same conclusion, namely that the effects of the intervention were stronger for high trait procrastinators than for low trait procrastinators (for Study 1, see their Table 2, p. 260; for Study 2, see their pp. 264 – 266). In a similar vein, findings reported by Li and colleagues (2021) indicate that for male (but not for female) students, the intervention effect was stronger for participants who had procrastinated on the previous assignment than for those who did not (see their p. 176); for this analysis, past procrastination was conceptualized as starting work on the previous assignment "later than at least half of the other students" (p. 177). In contrast with findings from Himmler et al. (2019), Koppenborg and Klingsieck (2022b), and Li et al. (2021), Wessel et al. (2020) reported that the intervention was effective in significantly reducing students' behavioral delay only for low procrastinators but not for high procrastinators (see their pages 1681 and 1684). Overall, regarding moderation factors, our review found that only a few of the interventions reviewed examined potential moderating effects on intervention effectiveness. In addition, their findings were not always consistent. Consequently, it is currently not well understood for whom effective interventions

work well and for whom they do not work at all. This is an important concern because, for example, Huang et al. (2021) found that deadline reminders backfired and increased academic procrastination when students' course load was low.

As far as mediation processes are concerned – and as it was the case for moderation – a dearth of evidence characterized the corpus of interventions we reviewed. That is, our review identified only two studies that conducted mediation analyses. This finding of the present study is consistent with previous meta-analyses that reported no or very few results from mediation analyses (Malouff & Schutte, 2019; Rozental et al., 2018; van Eerde & Klingsieck, 2018).

Conscientiousness and Procrastination Interventions

This review did not identify any intervention that attempted to strengthen students' conscientiousness to reduce their academic procrastination. This is surprising because conscientiousness has been found to be a key (and consistent) predictor of pivotal student outcomes, including but not limited to procrastination (Spielmann et al., 2022; Steel, 2007). Thus, interventions that target procrastination by means of strengthening students' conscientiousness are likely to have multiple benefits that go beyond procrastination itself.

Limitations of the Corpus of Studies Investigated

Our review identified five limitations of the corpus of studies reviewed here, which should be considered when evaluating their findings. First, gender was unequally distributed in many of the interventions we identified; this, in turn, raises questions about whether the findings generalise beyond the respective samples. Nonetheless, this may not be a major concern considering that a recent meta-analysis found that gender composition was unrelated to the effect sizes associated with procrastination interventions (van Eerde & Klingsieck, 2018).

Second, five articles collected data from specific student samples (i.e., non-general student samples). This includes studies with English as a foreign language learners (e.g., Nourinezhad et al., 2021), students with high trait procrastination (e.g., Grunschel et al., 2018; Kaur et al., 2021; Koppenborg & Klingsieck, 2022a; Krispenz et al., 2019), and learners having high test anxiety (e.g., Krispenz et al., 2019). This aspect may constrain the generalisability of the findings of these interventions.

Third, behavioral measures of academic procrastination, which were employed in seven studies, may underestimate the effects of the intervention because they do not differentiate between irrational, strategic, and unexpected delays (Miyake & Kane, 2022). In addition, behavioral measures also make it difficult to capture longitudinal trends and are not likely to be a reliable measure of academic procrastination for some students (e.g., for learners who strategically delay handing in their assignment to ensure they can get the highest mark possible or avoid feeling that they rushed their submission; Higgins, 2012; Kruglanski et al., 2000). In our review, 15 studies used self-report measures of academic procrastination. This finding reflects a trend

in procrastination literature, which predominantly relies on self-report measures of academic procrastination. There are several limitations with self-report measures, which need to be considered in conjunction with intervention studies relying on these types of measures. Specifically, (a) effect sizes are larger with behavioral measures of academic procrastination compared to self-reports of procrastination (Kim & Seo, 2015); (b) there has been significant variability in the predictive utility of different self-report measures of academic procrastination (Krause & Freund, 2014); (c) behavioral measures of academic procrastination can have stronger predictive validity than self-reports (Imhof et al., 2021); and (d) more generally, people do not always provide accurate retrospective self-reports on their mental processes (Kim & Seo, 2015; Nisbett & Wilson, 1977; Steel et al., 2001).

Fourth, findings from (an admittedly incomplete) p-curve analysis conducted in conjunction with this research suggest that there is some evidence of publication bias. This result is not congruent with previous reviews, which, by and large, concluded that "publication bias was not a severe threat" (Van Eerde & Klingsieck, 2018, p. 79; Malouff & Schutte, 2019; Rozental et al., 2018). Our decision to exclude grey literature might have contributed to this discrepancy about publication bias between the current review and previous meta-analyses (Alexander, 2020). Finally, our review found that the overwhelming majority of the interventions were not pre-registered and did not publicly share data and data-analytic codes/scripts.

Future Directions of Research and Intervention Work

Our review identified important gaps in current knowledge that could be productively addressed in future research. Although most interventions reviewed here were effective at reducing academic procrastination, our review highlighted that very few studies investigated whether the interventions were equally effective for all participants (i.e., moderation effects). This is critical because extensive information on moderating factors will help determine if low-cost interventions can be implemented on a large-scale to reduce high rates of procrastination in the student population and prevent it from becoming habitual (Steel, 2007). For example, earlier in the Discussion section, we highlighted that this review found some inconsistent results regarding the effectiveness of interventiuon for high and low procrastinators (e.g., Himmler et al., 2019; Koppenborg & Klingsieck, 2022b; Li et al., 2021; Wessel et al., 2020). Hence, additional research is needed to clarify whether (trait) procrastination moderates the effects of procrastination interventions (and, if true, in which ways). If this hypothesis receives strong support from future studies, then subsequent procrastination interventions might benefit from taking into consideration that compared to low procrastinators high trait procrastinators are more sensitive to task-induced negative moods (Koppenborg et al., 2023; Sirois & Pychyl, 2013), procrastination-friendly environments (Nordby et al., 2017; Svartdal et al., 2020), and struggle with translating their intentions into behaviour (Koppenborg et al., 2023; Pierro et al., 2011; Steel, 2007).

In addition, future intervention work must amass information on mediators and mediation processes to shed fresh light upon the specific way(s) in which effective

interventions influence academic procrastination (i.e., what makes them effective). Importantly, filling this gap in the extant knowledge will allow researchers to devise ways to modify existing interventions to enhance their benefits as well as help stakeholders identify cost-effective interventions to be implemented in their own contexts/settings[2]. Thus, future research examining theoretically relevant mediators and mediation mechanisms is urgently needed.

This review did not identify any intervention that tried to reduce academic procrastination by mean of intervening on one its strongest and most consistent predictors, namely conscientiousness (Spielmann et al., 2022; Steel, 2007). Thus, an important direction for future research would involve examining the effectiveness of interventions that strengthen conscientiousness on academic procrastination. To this end, researchers could focus, for example, on a motivation orientation that is both malleable and occupies a key role in the nomological network of conscientiousness (i.e., promotion; Costantini & Perugini, 2016).

Briefly, promotion guides self-regulation by focusing people's attention on future outcomes, gains, and own aspirations (Higgins, 1997, 2012). Costantini and Perugini (2016) found that promotion provided strong and direct connections between facets of conscientiousness (industriousness, orderliness, and impulse control) and constructs that contribute to changes in procrastination (e.g., responsiveness to reward, having a positive orientation). Consistent with these findings, Costantini and Perugini (2016) proposed that "an interesting task for future research could be inspecting the short-term consequences of an experimental manipulation of promotion focus … on the network of conscientiousness" (p. 85). Hence, with regard to academic procrastination, future research could empirically test whether priming promotion enhances students' (state level of) conscientiousness and, subsequently, reduces their tendency to procrastinate with regard to a given (aversive) learning task. If successful, these types of interventions would involve negligible costs and could be easily implemented by teachers. For example, instructors could often prompt students to engage in short written reflections of times when they were successful in acting in a promotion-oriented manner (Higgins, 1997, 2012). Similarly, when assignments are described as an opportunity for growing and advancing knowledge, this could prime promotion (Molden & Rosenzweig, 2016). In addition, providing feedback that highlights the strengths of a student's assignment brings about a promotion focus (Molden & Rosenzweig, 2016). Notably, a strong promotion-focus is likely to be associated with higher levels of expectancies of success and utility value (Hodis, 2018, 2020; Hodis & Hodis, 2015), which, in turn, could themselves help reduce students' tendency to procrastinate on academic tasks in addition to any beneficial effects associated with strengthening conscientiousness (Steel, 2007).

Findings from our review indicate that within a study, most of the interventions we assessed targeted either individual difference factors (e.g., self-regulation) or contextual factors (e.g., examination schedule) but not both; for notable exceptions, see Grunschel et al. (2018) and Loeffler et al. (2019). Of note, theorists have proposed that suboptimal self-regulation, which is at the center of procrastination, "is amplified by common aspects of the student environment" (Svartdal et al., 2020, p. 8). Considering these aspects, future intervention research could target both individual difference factors and contextual factors (e.g., in a fully-crossed factorial design),

examine their interactions, and assess whether these interactions significantly influence the effects of the intervention. For instance, future research could assess the extent to which the benefits of an intervention to reduce procrastination via increasing students' conscientiousness are magnified when this intervention is combined with an initiative that changes key aspects of students' learning environments (e.g., replaces all large assignments with many smaller assignments).

Future research could examine whether incorporating the tenets of McDaniel and Einstein's (2020) framework when designing procrastination interventions might strengthen their effectiveness. For example, future studies could assess whether a concerted focus to provide key knowledge about how to reduce procrastination and strengthen students' beliefs that they can apply this knowledge to their learning routines could strengthen the effectiveness of procrastination interventions. Similarly, future research could examine the extent to which developing (and then supporting) students' commitment to reduce their procrastination and providing them with scaffolds to plan and implement actions targeting procrastination have significant implications for the effectiveness of procrastination interventions. Finally, our research identified that an important limitation of the corpus of studies reviewed here is the lack of pre-registrations of interventions and the absence of publicly available data/data analytic codes pertaining to these interventions. To strengthen the extent to which future work is informative and contributes to a unified, reliable, and valid corpus of knowledge, it is important for future procrastination interventions to engage in open-science practices, pre-register interventions, and publicly share detailed protocols, data, and data analytic codes.

Recommendations for Instructional Practice

In this section, we use the findings from this review to highlight key aspects teachers/instructors could use in practice to reduce academic procrastination. Consistent with Miyake and Kane's (2022) warning that "the field currently lacks effective intervention methods that can be easily adopted and implemented by instructors" (p. 296), we focus our recommendations on strategies we believe are less resource intensive and instructors could implement in their classrooms; for more extensive information on the ease of implementation of each intervention reviewed in this article see Part 6 of the OSM.

Our review included a variety of interventions that used situational (i.e., contextual- or environmental-level) and/or cognitive (i.e., individual-level) strategies (e.g., active choice and emotion regulation training; Eckert et al., 2018). When designing interventions to reduce academic procrastination, it is important to note that cognitive strategies require metacognitive awareness to use and are more taxing on students (Duckworth et al., 2018). In contrast, situational strategies are easier to implement (e.g., removing tempting objects from one's study space) and can be used to reduce the number of self-control dilemmas students face (Duckworth et al., 2016). Nevertheless, situational strategies may not strengthen students' confidence in their ability to reduce impulsiveness (e.g., by means of exerting self-control) and are unlikely to be effective if low academic self-efficacy is among students' primary

reasons for procrastinating (Duckworth et al., 2018). Therefore, instructors may find it beneficial to use a mixture of situational and cognitive strategies. When students acquire a variety of strategies to reduce their academic procrastination, this may increase the likelihood that they implement some of them into their own studying. In turn, self-managed successful use of strategies that reduce procrastination may make learning more effective and pleasant and, hence, build a strong foundation for the development of productive learning habits; for a recent innovative account pertaining to the roles of habit in learning, interested readers could see Fiorella (2020).

Several potentially productive strategies to reduce procrastination (requiring minimal training for teachers and low resources to implement) can be gleaned from the successful interventions reviewed here. First, teachers could use (parts of) app-based interventions to (i) prompt students to reflect on their study habits and (ii) recommend students to complete online self-regulated training modules (Loeffler et al., 2019; Schuenemann et al., 2022; Wessel et al., 2020). Second, teachers could provide feedback on students' work in written or audio-visual formats (Nourinezhad et al., 2021) and use this tailored feedback to guide students toward resources pertaining to mindfulness interventions (Gray, 2021), emotion regulation training (Eckert et al., 2018), and self-regulation training (Grunschel et al., 2018); these resources help both reduce procrastination and strengthen other productive study habits. Third, teachers could help their students manipulate their physical or social environments to their advantage; for example, they could encourage students to remove from view objects that tempt them to delay a planned study session (e.g., smart phones; Duckworth et al., 2018). Finally, findings from this review indicate that teachers should only use deadline reminders when students' course load is high (Huang et al., 2021).

Conclusion

Academic procrastination is theorised to be a self-regulation failure (Steel, 2007). Notably, in addition to the well-documented drawbacks of procrastination on exam scores and GPA, frequent procrastination is associated with experiencing higher levels of stress and engaging in fewer positive health behaviours, which, together contribute to poorer physical health and mental well-being (Sirois, 2016; Sirois & Pychyl, 2013; Sirois et al., 2003; Steel, 2007). Thus, it is important to intervene to prevent academic procrastination or mitigate its consequences. This review found that many different types of interventions effectively reduced academic procrastination. Yet, attention on what interventions instructors can reliably administer in their classroom to reduce student procrastination has not been a key concern of extant research. To overcome this important drawback, in this article, we provided a set of recommendations rooted in evidence-based techniques currently available that teachers/instructors could adopt in their teaching to reduce students' tendency to irrationally delay their academic work, improve their academic performance, well-being, and life satisfaction. Another important contribution of this review is that it outlined new critical aspects that were not highlighted in previous reviews of academic procrastination. These are the lack of procrastination interventions focused on conscientiousness, the upward trend in the development of app-based interventions, the key

benefits of designing customizable interventions, and the largely missing analyses of mediation and moderation effects that could help pinpoint how interventions work to reduce academic procrastination and for whom they are (most) effective. Finally, we outlined several avenues for future research that we believe could further inform the development and implementation of effective procrastination interventions.

Declarations

Competing Interests The authors are not aware of any conflict of interest pertaining to the authorship or publication of this article.

References

Abuhmaid, A., & Abood, M. (2020). The impact of flipped learning on procrastination and students' attitudes toward it. *Universal Journal of Educational Research, 8*(2), 566–573. https://doi.org/10.13189/ujer.2020.080228

Akpur, U. (2020). Critical, reflective, creative thinking and their reflections on academic achievement. *Thinking Skills and Creativity, 37*, 100683. https://doi.org/10.1016/j.tsc.2020.100683

Alexander, P. A. (2020). Methodological guidance paper: The art and science of quality systematic reviews. *Review of Educational Research, 90*(1), 6–23. https://doi.org/10.3102/0034654319854352

Allemand, M., & Flückiger, C. (2022). Personality change through digital-coaching interventions. *Current Directions in Psychological Science, 31*(1), 41–48. https://doi.org/10.1177/09637214211067782

Amoke, C. V., Ede, M. O., Umeano, C. E., Okeke, C. I., Onah, S. O., Ezeah, M. A., & Nwaogaidu, J. C. (2021). Interaction effect of gender on academic procrastination and achievement orientation among in-school adolescents. *International Journal of Higher Education, 10*(6), 202. https://doi.org/10.5430/ijhe.v10n6p202

Anderberg, D., Cerrone, C., & Chevalier, A. (2017). Soft commitment: A study on demand and compliance. *Applied Economics Letters, 25*(16), 1140–1146. https://doi.org/10.1080/13504851.2017.1400648

Ariely, D., & Wertenbroch, K. (2002). Procrastination, deadlines, and performance: Self-control by pre-commitment. *Psychological Science, 13*(3), 219–224. https://doi.org/10.1111/1467-9280.00441

Armani Kian, A., Rostami, B., Moosavi, S. E., Maghbooli, M., & Fakoor, E. (2020). The effectiveness of acceptance and commitment therapy on academic procrastination in medical sciences students of Zanjan University. *Iranian Journal of Psychiatry and Clinical Psychology, 26*(2), 142–153. https://doi.org/10.32598/ijpcp.26.2.2817.1

Baker, R., Evans, B., & Dee, T. (2016). A randomized experiment testing the efficacy of a scheduling nudge in a massive open online course (MOOC). *AERA Open, 2*(4), 233285841667400. https://doi.org/10.1177/2332858416674007

Baker, R., Evans, B., Li, Q., & Cung, B. (2018). Does inducing students to schedule lecture watching in online classes improve their academic performance? An experimental analysis of a time management intervention. *Research in Higher Education, 60*(4), 521–552. https://doi.org/10.1007/s11162-018-9521-3

Bisin, A., & Hyndman, K. (2014). *Present-bias, procrastination and deadlines in a* field *experiment*(working paper 19874). National Bureau of Economic Research. https://doi.org/10.3386/w19874

Burger, N., Charness, G., & Lynham, J. (2011). Field and online experiments on self-control. *Journal of Economic Behavior & Organization, 77*(3), 393–404. https://doi.org/10.1016/j.jebo.2010.11.010

Cheng, S., Chang, J., Quilantan-Garza, K., & Gutierrez, M. L. (2023). Conscientiousness, prior experience, achievement emotions and academic procrastination in online learning environments. *British Journal of Educational Technology, 54*(4), 898–923. https://doi.org/10.1111/bjet.13302

Costantini, G., & Perugini, M. (2016). The network of conscientiousness. *Journal of Research in Personality, 65*, 68–88. https://doi.org/10.1016/j.jrp.2016.10.003

Davis, D. R., & Abbitt, J. T. (2013). An investigation of the impact of an intervention to reduce academic procrastination using short message service (SMS) technology. *Journal of Interactive Online Learning, 12*, 78–102.

Day, V., Mensink, D., & O'Sullivan, M. (2000). Patterns of academic procrastination. *Journal of College Reading and Learning, 30*(2), 120–134. https://doi.org/10.1080/10790195.2000.10850090

Dinç, S., & Ekşi, H. (2019). A psychological counseling study on fear of failure and academic procrastination with a spiritually oriented cognitive behavioral group. *Spiritual Psychology and Counseling, 4*(3), 219–235. https://doi.org/10.37898/spc.2019.4.3.85

Duckworth, A. L., Milkman, K. L., & Laibson, D. (2018). Beyond willpower: Strategies for reducing failures of self-control. *Psychological Science in the Public Interest, 19*(3), 102–129. https://doi.org/10.1177/1529100618821893

Duckworth, A. L., White, R. E., Matteucci, A. J., Shearer, A., & Gross, J. J. (2016). A stitch in time: Strategic selfcontrol in high school and college students. *Journal of Educational Psychology, 108*(3), 329–341. https://doi.org/10.1037/edu0000062

Eckert, M., Ebert, D. D., Lehr, D., Sieland, B., & Berking, M. (2018). Does SMS-support make a difference? effectiveness of a two-week online-training to overcome procrastination. A randomized controlled trial. *Frontiers in Psychology, 9*, 1103. https://doi.org/10.3389/fpsyg.2018.01103

Eckert, M., Ebert, D. D., Lehr, D., Sieland, B., & Berking, M. (2016). Overcome procrastination: Enhancing emotion regulation skills reduce procrastination. *Learning and Individual Differences, 52*, 10–18. https://doi.org/10.1016/j.lindif.2016.10.001

Ellis, A., & Knaus, W. J. (1979). *Overcoming procrastination: Or how to think and act rationally in spite of life's inevitable hassles*. Signet.

Fentaw, Y., Moges, B. T., & Ismail, S. M. (2022). Academic procrastination behavior among public university students. *Education Research International, 2022*, 1277866. https://doi.org/10.1155/2022/1277866

Fiorella, L. (2020). The science of habit and its implications for student learning and well-being. *Educational Psychology Review, 32*(3), 603–625. https://doi.org/10.1007/s10648-020-09525-1

Gading, I. K. (2020). Group counseling with the gestalt technique to reduce academic procrastination. *International Journal of Emerging Technologies in Learning (IJET), 15*(14), 262–268. https://doi.org/10.3991/ijet.v15i14.14465

Gagnon, J., Dionne, F., Raymond, G., & Grégoire, S. (2018). Pilot study of a web-based acceptance and commitment therapy intervention for university students to reduce academic procrastination. *Journal of American College Health, 67*(4), 374–382. https://doi.org/10.1080/07448481.2018.1484361

Galla, B. M., & Duckworth, A. L. (2015). More than resisting temptation: Beneficial habits mediate the relationship between self-control and positive life outcomes. *Journal of Personality and Social Psychology, 109*(3), 508–525. https://doi.org/10.1037/pspp0000026

Gershoni, N., & Stryjan, M. (2023). Do deadlines affect project completion? Experimental evidence from Israeli vocational colleges. *Journal of Economic Behavior & Organization, 205*, 359–375. https://doi.org/10.1016/j.jebo.2022.10.034

Gonda, D., Pavlovičová, G., Tirpáková, A., & Ďuriš, V. (2021). Setting up a flipped classroom design to reduce student academic procrastination. *Sustainability, 13*(15), 8668. https://doi.org/10.3390/su13158668

Goroshit, M., & Hen, M. (2019). Academic procrastination and academic performance: Do learning disabilities matter? *Current Psychology, 40*(5), 2490–2498. https://doi.org/10.1007/s12144-019-00183-3

Gray, L. (2021). Mindfulness in the college classroom and wellness promotion: The impact of mindfulness curriculum on self-reported health and well-being in university students. *The*

International Journal of Learning in Higher Education, 28(2), 99–109. https://doi.org/10.18848/2327-7955/cgp/v28i02/99-109

Grunschel, C., Patrzek, J., & Fries, S. (2013). Exploring reasons and consequences of academic procrastination: An interview study. *European Journal of Psychology of Education, 28*(3), 841–861. https://doi.org/10.1007/s10212-012-0143-4

Grunschel, C., Patrzek, J., Klingsieck, K. B., & Fries, S. (2018). "I'll stop procrastinating now!" Fostering specific processes of self-regulated learning to reduce academic procrastination. *Journal of Prevention & Intervention in the Community, 46*(2), 143–157. https://doi.org/10.1080/10852352.2016.1198166

Haycock, L. A. (1993). *The cognitive mediation of procrastination: An investigation of the relationship between procrastination and self-efficacy beliefs* (Publication No. 304058431) [Doctoral thesis, University of Minnesota]. ProQuest Dissertations Publishing.

Hen, M., & Goroshit, M. (2018). Prevention and intervention for academic procrastination in academic communities. *Journal of Prevention & Intervention in the Community, 46*(2), 113–116. https://doi.org/10.1080/10852352.2016.1198149

Hensley, L. C., & Munn, K. J. (2020). The power of writing about procrastination: Journaling as a tool for change. *Journal of Further and Higher Education, 44*(10), 1450–1465. https://doi.org/10.1080/0309877x.2019.1702154

Higgins, E. T. (1997). Beyond pleasure and pain. *American Psychologist, 52*(12), 1280–1300. https://doi.org/10.1037/0003-066x.52.12.1280

Higgins, E. T. (2012). *Beyond pleasure and pain: How motivation works*. Oxford University Press.

Himmler, O., Jäckle, R., & Weinschenk, P. (2019). Soft commitments, reminders, and academic performance. *American Economic Journal: Applied Economics, 11*(2), 114–142. https://doi.org/10.1257/app.20170288

Hodis, F. A. (2018). Underpinnings of expectancies of success in mathematics: An analysis of general, school-related, and domain-specific motivation antecedents. *Journal of Educational Psychology, 110*(3), 407–430. https://doi.org/10.1037/edu0000218

Hodis, F. A. (2020). Studying for autonomous reasons and having a promotion orientation: Key predictors of individual differences in expectancies of success in English. *Social Psychology of Education: An International Journal, 23*(2), 359–383. https://doi.org/10.1007/s11218-019-09537-y

Hodis, F., & Hodis, G. M. (2015). Expectancy, value, promotion, and prevention: An integrative account of regulatory fit vs. non-fit with student satisfaction in communicating with teachers. *Annals of the International Communication Association, 39*(1), 339–370. https://doi.org/10.1080/23808985.2015.11679180

Huang, N., Zhang, J., Burtch, G., Li, X., & Chen, P. (2021). Combating procrastination on massive online open courses via optimal calls to action. *Information Systems Research, 32*(2), 301–317. https://doi.org/10.1287/isre.2020.0974

Imhof, C., Bergamin, P., & McGarrity, S. (2021). Prediction of dilatory behaviour in online assignments. *Learning and Individual Differences, 88*, 102014. https://doi.org/10.1016/j.lindif.2021.102014

Kang, X., & Zhang, W. (2020). An experimental case study on forum-based online teaching to improve student's engagement and motivation in higher education. *Interactive Learning Environments*, 1–12. https://doi.org/10.1080/10494820.2020.1817758

Kaur, S., Kaur, S., & Kaur, R. (2021). Efficacy of biofeedback training in overcoming academic procrastination. *International Journal of Education and Management Studies, 11*(4), 250–256.

Kim, K. R., & Seo, E. H. (2015). The relationship between procrastination and academic performance: A meta-analysis. *Personality and Individual Differences, 82*, 26–33. https://doi.org/10.1016/j.paid.2015.02.038

Kim, S., Fernandez, S., & Terrier, L. (2017). Procrastination, personality traits, and academic performance: When active and passive procrastination tell a different story. *Personality and Individual Differences, 108*, 154–157. https://doi.org/10.1016/j.paid.2016.12.021

Klassen, R. M., Krawchuk, L. L., & Rajani, S. (2008). Academic procrastination of undergraduates: Low self-efficacy to self-regulate predicts higher levels of procrastination. *Contemporary Educational Psychology, 33*(4), 915–931. https://doi.org/10.1016/j.cedpsych.2007.07.001

Klingsieck, K. B. (2013). Procrastination: When good things don't come to those who wait. *European Psychologist, 18*(1), 24–34. https://doi.org/10.1027/1016-9040/a000138

Koppenborg, M., & Klingsieck, K. B. (2022a). Group work and student procrastination. *Learning and Individual Differences, 94*, 102117. https://doi.org/10.1016/j.lindif.2022.102117

Koppenborg, M., & Klingsieck, K. B. (2022b). Social factors of procrastination: Group work can reduce procrastination among students. *Social Psychology of Education, 25*(1), 249–274. https://doi.org/10.1007/s11218-021-09682-3

Koppenborg, M., Klingsieck, K. B., & Hüffmeier, J. (2023). Conjunctive and additive group work reduce academic procrastination: Insights from a vignette study. *Current Psychology*. https://doi.org/10.1007/s12144-023-04294-w

Krause, K., & Freund, A. M. (2014). Delay or procrastination – A comparison of self-report and behavioral measures of procrastination and their impact on affective well-being. *Personality and Individual Differences, 63*, 75–80. https://doi.org/10.1016/j.paid.2014.01.050

Krispenz, A., Gort, C., Schültke, L., & Dickhäuser, O. (2019). How to reduce test anxiety and academic procrastination through inquiry of cognitive appraisals: A pilot study investigating the role of academic self-efficacy. *Frontiers in Psychology, 10*, 1917. https://doi.org/10.3389/fpsyg.2019.01917

Kruglanski, A. W., Thompson, E. P., Higgins, E. T., Atash, M. N., Pierro, A., Shah, J. Y., & Spiegel, S. (2000). To "do the right thing" or to "just do it": Locomotion and assessment as distinct self-regulatory imperatives. *Journal of Personality and Social Psychology, 79*(5), 793–815. https://doi.org/10.1037/0022-3514.79.5.793

Li, Z., Wang, G., & Wang, H. (2021). Peer effects in competitive environments: Field experiments on information provision and interventions. *MIS Quarterly, 45*(1), 163–191. https://doi.org/10.25300/MISQ/2021/16085/

Loeffler, S. N., Stumpp, J., Grund, S., Limberger, M. F., & Ebner-Priemer, U. W. (2019). Fostering self-regulation to overcome academic procrastination using interactive ambulatory assessment. *Learning and Individual Differences, 75*, 101760. https://doi.org/10.1016/j.lindif.2019.101760

López-López, A., Pérez, L. T., Gutiérrez, J. L., Pompa, B. M., & Fernández, M. A. (2020). Reducción de la Procrastinación Académica mediante la terapia de aceptación y compromiso: Un estudio piloto. *Clínica Contemporánea*, 11(1). https://doi.org/10.5093/cc2020a3

Luo, J., Wang, M., Chen, B., & Sun, M. (2022). Exposure to nature sounds through a mobile application in daily life: Effects on learning performance among university students. *International Journal of Environmental Research and Public Health, 19*(21), 14583. https://doi.org/10.3390/ijerph192114583

MacKinnon, D. P., Fairchild, A. J., & Fritz, M. S. (2007). Mediation analysis. *Annual Review of Psychology, 58*(1), 593–614. https://doi.org/10.1146/annurev.psych.58.110405.085542

Magidson, J. F., Roberts, B. W., Collado-Rodriguez, A., & Lejuez, C. W. (2014). Theory-driven intervention for changing personality: Expectancy value theory, behavioral activation, and conscientiousness. *Developmental Psychology, 50*(5), 1442–1450. https://doi.org/10.1037/a0030583

Malouff, J. M., & Schutte, N. S. (2019). The efficacy of interventions aimed at reducing procrastination: A meta-analysis of randomized controlled trials. *Journal of Counseling & Development, 97*(2), 117–127. https://doi.org/10.1002/jcad.12243

McDaniel, M. A., & Einstein, G. O. (2020). Training learning strategies to promote self-regulation and transfer: The knowledge, belief, commitment, and planning framework. *Perspectives on Psychological Science, 15*(6), 1363–1381. https://doi.org/10.1177/1745691620920723

McDaniel, M. A., Einstein, G. O., & Een, E. (2021). Training college students to use learning strategies: A framework and pilot course. *Psychology Learning & Teaching, 20*(3), 364–382. https://doi.org/10.1177/1475725721989489

Miyake, A., & Kane, M. J. (2022). Toward a holistic approach to reducing academic procrastination with classroom interventions. *Current Directions in Psychological ScieNce, 31*(4), 291–304. https://doi.org/10.1177/09637214211070814

Molden, D. C., & Rosenzweig, E. Q. (2016). The origins and educational implications of promotion-focused and prevention-focused achievement motivations. In K. R. Wentzel & D. B. Miele (Eds.), *Handbook of motivation at school* (2nd ed., pp. 477–503). Routledge.

Motie, H., Heidari, M., Bagherian, F., & Zarani, F. (2019). Providing mindfulness-based educational package for evaluating academic procrastination. *Iranian Journal of Psychiatry and Clinical Psychology, 25*(1), 26–41. https://doi.org/10.32598/ijpcp.25.1.25

Motz, B. A., Canning, E. A., Green, D. J., Mallon, M. G., & Quick, J. D. (2021a). The influence of automated praise on behavior and performance. *Technology, Mind, and Behavior, 2*(3), 1–12. https://doi.org/10.1037/tmb0000042

Motz, B. A., Mallon, M. G., & Quick, J. D. (2021b). Automated educative nudges to reduce missed assignments in college. *IEEE Transactions on Learning Technologies, 14*(2), 189–200. https://doi.org/10.1109/tlt.2021.3064613

Nicholls, N. (2023). Procrastination and grades: Can students be nudged towards better outcomes? *International Review of Economics Education, 42*, 100256. https://doi.org/10.1016/j.iree.2022.100256

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84*(3), 231–259. https://doi.org/10.1037/0033-295x.84.3.231

Nordby, K., Klingsieck, K. B., & Svartdal, F. (2017). Do procrastination-friendly environments make students delay unnecessarily? *Social Psychology of Education, 20*(3), 491–512. https://doi.org/10.1007/s11218-017-9386-x

Nourinezhad, S., Hadipourfard, E., & Bavali, M. (2021). The impact of audio-visual feedback on academic writing task procrastination. *Teaching English Language, 15*(2), 173–200. https://doi.org/10.22132/tel.2021.142155

O'Brien, W. K. (2000). *Applying the transtheoretical model to academic procrastination* (Order No. 3032320). Available from ProQuest One Academic. (252260618).

Onwuegbuzie, A. (2000). Academic procrastinators and perfectionistic tendencies among graduate students. *Journal of Social Behavior and Personality, 15*(5), 103–109.

Oram, R., Dou, A., & Rogers, M. (2022). Pilot study of self-determination theory and motivational interviewing intervention targeting need satisfaction, motivation, and procrastination. *Scholarship of Teaching and Learning in Psychology*. Advance online publication. https://doi.org/10.1037/stl0000331

Otermin-Cristeta, S., & Hautzinger, M. (2018). Developing an intervention to overcome procrastination. *Journal of Prevention & Intervention in the Community, 46*(2), 171–183. https://doi.org/10.1080/10852352.2016.1198169

Özer, B. U., Demir, A., & Ferrari, J. R. (2009). Exploring academic procrastination among Turkish students: Possible gender differences in prevalence and reasons. *The Journal of Social Psychology, 149*(2), 241–257. https://doi.org/10.3200/socp.149.2.241-257

Patterson, R. W. (2018). Can behavioral tools improve online student outcomes? Experimental evidence from a massive open online course. *Journal of Economic Behavior & Organization, 153*, 293–321. https://doi.org/10.1016/j.jebo.2018.06.017

Pierro, A., Giacomantonio, M., Pica, G., Kruglanski, A. W., & Higgins, E. T. (2011). On the psychology of time in action: Regulatory mode orientations and procrastination. *Journal of Personality and Social Psychology, 101*(6), 1317–1331. https://doi.org/10.1037/a0025943

Rahimi, S., & Hall, N. C. (2021). Why are you waiting? Procrastination on academic tasks among undergraduate and graduate students. *Innovative Higher Education, 46*(6), 759–776. https://doi.org/10.1007/s10755-021-09563-9

Reeve, J., Ryan, R., Deci, E. L., & Jang, H. (2008). Understanding and promoting autonomous self-regulation: A self-determination theory perspective. In D. H. Schunk & B. J. Zimmerman (Eds.), *Motivation and self-regulated learning: Theory, research, and application* (pp. 223–244). Lawrence Erlbaum Associates.

Roberts, B. W., Hill, P. L., & Davis, J. P. (2017). How to change conscientiousness: The sociogenomic trait intervention model. *Personality Disorders: Theory, Research, and Treatment, 8*(3), 199–205. https://doi.org/10.1037/per0000242

Roberts, B. W., Lejuez, C., Krueger, R. F., Richards, J. M., & Hill, P. L. (2014). What is conscientiousness and how can it be assessed? *Developmental Psychology, 50*(5), 1315–1330. https://doi.org/10.1037/a0031109

Robinson, C. D., Pons, G. A., Duckworth, A. L., & Rogers, T. (2018). Some middle school students want behavior commitment devices (but take-up does not affect their behavior). *Frontiers in Psychology*, *9*. https://doi.org/10.3389/fpsyg.2018.00206

Rozental, A., Bennett, S., Forsström, D., Ebert, D. D., Shafran, R., Andersson, G., & Carlbring, P. (2018). Targeting procrastination using psychological treatments: A systematic review and meta-analysis. *Frontiers in Psychology*, *9*. https://doi.org/10.3389/fpsyg.2018.01588

Rozental, A., Forsström, D., Hussoon, A., & Klingsieck, K. B. (2022). Procrastination among university students: Differentiating severe cases in need of support from less severe cases. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.783570

Rozental, A., Forsström, D., Tangen, J. A., & Carlbring, P. (2015). Experiences of undergoing internet-based cognitive behavior therapy for procrastination: A qualitative study. *Internet Interventions, 2*(3), 314–322. https://doi.org/10.1016/j.invent.2015.05.001

Sanchez-Ruiz, M.-J., & El Khoury, J. (2019). A model of academic, personality, and emotion-related predictors of university academic performance. *Frontiers in Psychology*, *10*. https://doi.org/10.3389/fpsyg.2019.02435

Schmidt, H. G., Baars, G. J., Hermus, P., van der Molen, H. T., Arnold, I. J., & Smeets, G. (2021). Changes in examination practices reduce procrastination in university students. *European Journal of Higher Education, 12*(1), 56–71. https://doi.org/10.1080/21568235.2021.1875857

Schuenemann, L., Scherenberg, V., von Salisch, M., & Eckert, M. (2022). "I'll worry about it tomorrow" – Fostering emotion regulation skills to overcome procrastination. *Frontiers in Psychology, 13*, 780675. https://doi.org/10.3389/fpsyg.2022.780675

Simonsohn, U., Nelson, L., & Simmons, J. (2014). P-curve: A key to the file drawer. *Journal of Experimental Psychology. General, 143*(2), 534–547. https://doi.org/10.1037/a0033242

Sirois, F. M. (2016). Procrastination, stress, and chronic health conditions: A temporal perspective. In F. M. Sirois & T. A. Pychyl (Eds.), *Procrastination, health, and well-being* (pp. 67–92). Academic Press. https://doi.org/10.1016/B978-0-12-802862-9.00004-9

Sirois, F. M., Melia-Gordon, M. L., & Pychyl, T. A. (2003). "I'll look after my health, later": An investigation of procrastination and health. *Personality and Individual Differences, 35*(5), 1167–1184. https://doi.org/10.1016/s0191-8869(02)00326-4

Sirois, F., & Pychyl, T. (2013). Procrastination and the priority of short-term mood regulation: Consequences for future self. *Social and Personality Psychology Compass, 7*(2), 115–127. https://doi.org/10.1111/spc3.12011

Solomon, L. J., & Rothblum, E. D. (1984). Academic procrastination: Frequency and cognitive-behavioral correlates. *Journal of Counseling Psychology, 31*(4), 503–509. https://doi.org/10.1037/0022-0167.31.4.503

Spielmann, J., Yoon, H. J., Ayoub, M., Chen, Y., Eckland, N. S., Trautwein, U., Zheng, A., & Roberts, B. W. (2022). An in-depth review of conscientiousness and educational issues. *Educational Psychology Review, 34*(4), 2745–2781. https://doi.org/10.1007/s10648-022-09693-2

Steel, P. (2007). The nature of procrastination: A meta-analytic and theoretical review of quintessential self-regulatory failure. *Psychological Bulletin, 133*(1), 65–94. https://doi.org/10.1037/0033-2909.133.1.65

Steel, P., & Klingsieck, K. B. (2016). Academic procrastination: Psychological antecedents revisited. *Australian Psychologist, 51*(1), 36–46. https://doi.org/10.1111/ap.12173

Steel, P., Brothen, T., & Wambach, C. (2001). Procrastination and personality, performance, and mood. *Personality and Individual Differences, 30*(1), 95–106. https://doi.org/10.1016/s0191-8869(00)00013-1

Svartdal, F., & Løkke, J. A. (2022). The ABC of academic procrastination: Functional analysis of a detrimental habit. *Frontiers in Psychology, 13*, 1019261. https://doi.org/10.3389/fpsyg.2022.1019261

Svartdal, F., Dahl, T. I., Gamst-Klaussen, T., Koppenborg, M., & Klingsieck, K. B. (2020). How study environments foster academic procrastination: Overview and recommendations. *Frontiers in Psychology, 11*, 540910. https://doi.org/10.3389/fpsyg.2020.540910

Tao, X., Hanif, H., Ahmed, H. H., & Ebrahim, N. A. (2021). Bibliometric analysis and visualization of academic procrastination. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.722332

Tian, J., Zhao, J., Xu, J., Li, Q., Sun, T., Zhao, C., Gao, R., Zhu, L., Guo, H., Yang, L., Cao, D., & Zhang, S. (2021). Mobile phone addiction and academic procrastination negatively impact academic achievement among Chinese medical students. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.758303

Tice, D. M., & Baumeister, R. F. (1997). Longitudinal study of procrastination, performance, stress, and health: The costs and benefits of dawdling. *Psychological Science, 8*(6), 454–458. https://doi.org/10.1111/j.1467-9280.1997.tb00460.x

Tice, D. M., & Bratslavsky, E. (2000). Giving in to feel good: The place of emotion regulation in the context of general self-control. *Psychological Inquiry, 11*(3), 149–159. https://doi.org/10.1207/s15327965pli1103_03

Ugwuanyi, C. S., Gana, C. S., Ugwuanyi, C. C., Ezenwa, D. N., Eya, N. M., Ene, C. U., Nwoye, N. M., Ncheke, D. C., Adene, F. M., Ede, M. O., Onyishi, C. N., & Ossai, V. O. (2020). Efficacy of cognitive behaviour therapy on academic procrastination behaviours among students enrolled in physics, chemistry and mathematics education (PCME). *Journal of Rational-Emotive and Cognitive-Behavior Therapy, 38*(4), 522–539. https://doi.org/10.1007/s10942-020-00350-7

van Eerde, W. (2003). A meta-analytically derived nomological network of procrastination. *Personality and Individual Differences, 35*(6), 1401–1418. https://doi.org/10.1016/s0191-8869(02)00358-6

van Eerde, W. (2015). Time management and procrastination. In M. D. Mumford & M. Frese (Eds.), *The psychology of planning in organizations: Research and applications* (pp. 312–333). Routledge.

van Eerde, W., & Klingsieck, K. B. (2018). Overcoming procrastination? A meta-analysis of intervention studies. *Educational Research Review, 25*, 73–85. https://doi.org/10.1016/j.edurev.2018.09.002

Verplanken, B., & Orbell, S. (2022). Attitudes, habits, and behavior change. *Annual Review of Psychology, 73*(1), 327–352. https://doi.org/10.1146/annurev-psych-020821-011744

Wessel, J., Bradley, G. L., & Hood, M. (2020). A low-intensity, high-frequency intervention to reduce procrastination. *Applied Psychology, 70*(4), 1669–1690. https://doi.org/10.1111/apps.12293

Wilson Van Voorhis, C. R., & Morgan, B. L. (2007). Understanding power and rules of thumb for determining sample sizes. *Tutorials in Quantitative Methods for Psychology, 3*(2), 43–50. https://doi.org/10.20982/tqmp.03.2.p043

Windgassen, S., Goldsmith, K., Moss-Morris, R., & Chalder, T. (2016). Establishing how psychological therapies work: The importance of mediation analysis. *Journal of Mental Health, 25*(2), 93–99. https://doi.org/10.3109/09638237.2015.1124400

Yan, B., & Zhang, X. (2022). What research has been conducted on procrastination? Evidence from a systematical bibliometric analysis. *Frontiers in Psychology, 13*, 809044. https://doi.org/10.3389/fpsyg.2022.809044

Zacks, S., & Hen, M. (2018). Academic interventions for academic procrastination: A review of the literature. *Journal of Prevention & Intervention in the Community, 46*(2), 117–130. https://doi.org/10.1080/10852352.2016.1198154

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Notes 1. For an earlier example of an app-based intervention, interested readers are referred to Davis & Abbitt (2013).

2. Consistent with theoretical accounts of procrastination (e.g., Sirois & Pychyl, 2013; Steel, 2007), the effects of an intervention might be mediated by several factors (e.g., impulsivity, length of deadlines, ability to regulate task-related aversive emotions, etc.). If no (reliable) information is available regarding the differential effectiveness of interventions targeting procrastination via different mediators, a natural first step would be to intervene on the mediator(s) that would be the cheapest to alter.