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The effect of mastery goal-complexes on mathematics grades and engagement: The case of Low-SES Peruvian students

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ABSTRACT

Recent research anchored in achievement goal theory suggests mastery goals are more adaptive when endorsed for autonomous rather than controlled reasons. We report on two studies (N = 622) in which we explored whether the combined effects of goals and reasons on academic outcomes were different for a sample of low-SES youth than for other older higher-SES samples in the literature. Participants were low-SES high-school students in Lima, Peru. The results show that autonomous reasons for endorsing mastery goals positively predicted students' collective engagement and mathematics grades above the effect of mastery goals as such. Second, controlled reasons negatively predicted end-of-the year math grades. Finally, mastery goals' relations with mathematics grades and behavioral engagement were attenuated when endorsed for low autonomous reasons. The findings extend the knowledge on mastery goal-complexes and show they apply to low-SES students.

1. Introduction

Research anchored in the achievement goal framework has long demonstrated that mastery goals predict such optimal learning outcomes as student engagement and achievement (e.g., Huang, 2011, 2012; Van Yperen, Blaga, & Postmes, 2015; Wirthwein, Sparfeldt, Pinquart, Wegerer, & Steinmayr, 2013). Over the past decade, researchers have looked more closely at the underlying motivations or reasons for endorsing mastery goals. They have discovered that the reasons for their endorsement also have an effect on learning outcomes (Vansteenkiste, Lens, Elliot, Soenens, & Mouratidis, 2014) and suggested people can endorse mastery goals for autonomous (i.e., with a sense of choice and volition) or controlled (i.e., with a sense of compulsion) reasons. These combinations of goals and reasons for those goals are termed goal-complexes (Elliot & Thrash, 2001).

An important question emerging from the research on mastery goal-complexes is whether the reason and the goal are equally responsible for the observed effects on learning outcomes. A related question is whether mastery goals *per se* predict optimal learning outcomes at all. The first question can be addressed by examining the additive effects of mastery goals and their underlying reasons on learning outcomes. The second can be explored by probing interactions of goals and reasons. Both approaches have been implemented in previous research (e.g., Gaudreau, 2012; Gillet et al., 2017; Michou, Vansteenkiste, Mouratidis, & Lens, 2014; Sommet & Elliot, 2017).

The present research takes this line of research one step forward by examining similar questions at a unique and unexplored sample of low-SES high-school students in Peru. Children from low-SES families are likely to attain lower grades and be less engaged than their counterparts in a higher social class (Paschall, Gershoff, & Kuhfeld, 2018). This effect, known as the SES achievement gap, is increasing (Chmielewski, 2019), especially in developing countries such as Peru (OECD Development Centre, 2017). Since motivation to learn is critical to academic success (Koenka, 2020), these gaps have prompted researchers to examine the motivational factors that influence optimal learning outcomes in underprivileged youth (e.g., Crouzevialle & Darnon, 2019). The present research's goal was to explore whether the endorsement of mastery goals for autonomous or non-controlled reasons can predict low-SES Peruvian students' optimal mathematics engagement and performance.

1.1. *Achievement goals and their relations to academic engagement and achievements*

Achievement goal theory has been extensively used to study students' motivation and academic achievement (for recent reviews, see Senko, 2016; Urdan & Kaplan, 2020). The theory distinguishes two

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types of achievement goals students endorse in the classroom: mastery goals and performance goals. Students endorsing mastery goals focus on learning and gaining knowledge and understanding (Dweck, 1986; Heyman & Dweck, 1992). They use self-referential or task-based standards to evaluate their competence (Elliot, Murayama, & Pekrun, 2011; Elliot & Thrash, 2001). In contrast, those endorsing performance goals focus on demonstrating competence and feel successful if they manage to outperform their peers (Dweck, 1986; Elliot & Thrash, 2001). They use normative standards (e.g., test scores, norm tables) to estimate how successful they are.[1]

Although both mastery and performance goals are related to academic achievements (Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002; Hulleman, Schrager, Bodmann, & Harackiewicz, 2010; Wolters, 2004), only the former are also consistently related to adaptive learning outcomes, such as curiosity and challenge seeking (e.g., Mouratidis, Michou, Demircioğlu, & Sayil, 2018). Endorsing mastery goals may be important particularly for low-SES students, who face negative stereotypes of their abilities (Spencer & Castano, 2007), leading them to develop lower expectancies of success and a reduced sense of self-efficacy and self-esteem (Gibbons & Borders, 2010; Twenge & Campbell, 2002). Whereas the endorsement of performance goals is likely to activate threatening and disruptive thoughts among low-SES students, thereby jeopardizing optimal performance, the endorsement of mastery goals can enable them to focus on the task at hand and strive to develop knowledge, despite external distractions (Crouzevialle & Darnon, 2019; Darnon, Jury, & Aelenei, 2017). Indeed, Gutman (2006) found mastery goals but not performance goals were positively related to low-SES African American youth's self-efficacy and mathematics grades.

We explored the effect of mastery goals on students' mathematics grades and *engagement.* The concept of engagement is a core outcome in school motivation research and refers to the extent of a student's active involvement in a learning activity (Reeve, 2012). It is a multidimensional construct, involving behavioral, cognitive, and emotional components (Ben-Eliyahu, Moore, Dorph, & Schunn, 2018; Skinner, 2016). Behavioral engagement manifests in persistent effort-expenditure (Reeve & Lee, 2014; Skinner, Furrer, Marchand, & Kindermann, 2008). Cognitive engagement manifests in the use of deep and sophisticated learning strategies (Pintrich & Schrauben, 1992). Emotional engagement is characterized by the presence of emotions facilitating the task at hand, such as interest or enjoyment (Skinner et al., 2008). Mastery goals are consistently related to all three types of engagement (Benita, Roth, & Deci., 2014; Lau, Liem, & Nie, 2008; Matos, Lens, Vansteenkiste, & Mouratidis, 2017; Meece, Blumenfeld, & Hoyle, 1988; Pekrun, Elliot, & Maier, 2006).

1.2. Autonomous and controlled reasons for mastery goals

The concept of motivation has been viewed as comprising two fundamental aspects of behavior - its energization and its direction (Elliot & Thrash, 2001). Direction concerns the explicit target or goal of the behavior, whereas energization concerns the reasons why people invest effort in the goal (e.g., Sheldon, Sommet, Corcoran, & Elliot, 2018). Traditional definitions of the achievement goal concept (e.g., Ames, 1992; Dweck, 1986; Nicholls, 1984) were broad and encompassed both direction and energization. For example, the original definition of mastery goals included both the aim of competence development (a direction component) and the reasons of enjoyment in learning and intrinsic motivation (an energization component). Given this combination, mastery goals were seen as inextricably linked to adaptive learning outcomes.

Elliot and colleagues (Elliot & Murayama, 2008; Elliot & Thrash, 2001) critiqued traditional achievement goal models as too inclusive and vague. They claimed that when we define a goal as a combination of direction and energization components (aims and reasons), we cannot tell whether the two are equally responsible for any observed effects. These researchers suggested energy and direction influence behavior in a hierarchical manner, wherein the aim or direction is energized by a reason. In other words, whereas the aim serves as a proximal predictor of behavior, reasons serve a more distal role. In this thinking, the term "goal" is narrow and restricted to the direction component or the aim of behavior. Specifically, mastery goals are represented by two types of aims: improving knowledge and performance and mastering subject material.

Drawing on this shift in the definition of goals, researchers have suggested a given goal can be endorsed for different reasons, thus creating a goal-complex, or combinations of goals and reasons (Elliot & Thrash, 2001; Vansteenkiste et al., 2014). To explore the reasons, most research has employed self-determination theory's (SDT; Ryan & Deci, 2017) distinction between autonomous and controlled reasons for goal pursuit. Goals endorsed for autonomous reasons are fully endorsed and people act on them volitionally. Goals endorsed for controlled reasons are experienced as externally imposed by external agents (e.g., parents, teachers), pursued to please those agents, and driven by feelings such as guilt or shame. As such, autonomous reasons provide goals with an optimal energy source, enabling those who hold them to go through a smooth and uninhibited goal pursuit process (e.g., Werner, Milyavskaya, Foxen-Craft, & Koestner, 2016), while controlled reasons produce conflict over a goal and limit the amount of energy available for its pursuit (Moller, Deci, & Ryan, 2006; Ryan & Deci, 2008).

Researchers who integrate this differentiation within the achievement goal framework (e.g., Vansteenkiste et al., 2014) suggest a given achievement goal, in this case a mastery goal (e.g., "I want to master the material"), can be endorsed for autonomous reasons (e.g., "… because I enjoy learning new things") or controlled reasons (e.g., "… because otherwise I will feel ashamed"). These different combinations form distinct mastery goal-complexes. The autonomous-mastery goal--complex reflects traditional definitions of mastery goals (e.g., Ames, 1992). Indeed, past research has shown the correlations between these mastery goals and autonomous reasons are strong (e.g., Michou et al., 2014; Sommet & Elliot, 2017), so it is also the more prevalent mastery goal-complex and reflects the adaptive nature of striving to develop competence. However, the controlled-mastery goals-complex is also likely and can predict less-than-optimal learning outcomes (e.g., Michou et al., 2014; Sommet & Elliot, 2017).

Such understandings may be relevant to low-SES youth. Many such youth can set themselves mastery goals and strive to develop their competence based on self-referenced standards. Most of these students will endorse the goals for autonomous reasons, understand how improving their skills could be personally meaningful, and see learning as an opportunity for growth and development, not a burden. Yet some may feel pressure from their families and teachers to learn as much as they can. The burden of breaking the poverty cycle may rest on their shoulders. Even if they endorse mastery goals, then, they might feel distracted by their wish to please others and find it hard to make the effort required to get high grades. Based on these ideas, we examined whether autonomous and controlled reasons for mastery goal pursuit are related to low-SES youths' academic performance and engagement.

1.3. Additive and interactive effects of the reasons for mastery goals

The separation of goals and reasons has allowed researchers to

[1] Another important distinction is between goal valences. Both mastery and performance goals can be construed as desirable outcomes students strive to achieve (an approach valence) and as negative outcomes they aim to avoid (an avoidance valence). A 2x2-model intersecting definition of competence (mastery vs. performance) with valence (approach vs. avoidance) has been proposed and extensively studied (Elliot & McGregor, 2001). This distinction is beyond the scope of this paper. Therefore, by "mastery" and "performance" goals, we are referring to approach goals.

explore intriguing new questions. An important advantage of separating reasons and goals is that it allows researchers to explore whether the aim (i.e., a mastery goal) component alone is responsible for the observed effects in learning outcomes, or if its underlying reason is more responsible for such effects. In other words, it can now be explored whether the energizing component of mastery goals supports or undermines engagement and optimal learning beyond the effect of the direction. A related question is whether mastery goals, now defined solely as aims, are at all responsible for changes in learning outcomes, especially when endorsed for the "wrong" (non-autonomous) reasons.

In the past decade, a growing body of research has investigated these questions[2] (Gaudreau, 2012; Gillet et al., 2017; Gillet, Lafrenière, Huyghebaert, & Fouquereau, 2015; Michou, Matos, Gargurevich, Gumus, & Herrera, 2016; Michou et al., 2014; Sommet & Elliot, 2017). Findings have clearly revealed autonomous reasons for endorsing mastery goals predict optimal learning outcomes (e.g., students' engagement, deep level strategies, academic satisfaction, persistence) over and above the goals as such. Controlled reasons predict less optimal outcomes, such as academic anxiety, surface-level processes, and low self-efficacy. In some instances, the goal remains a significant predictor of outcomes after considering the underlying reasons for having the goal (Michou et al., 2016; 2014; Sommet & Elliot, 2017), but in other cases, it does not (Gillet et al., 2015, 2017). In one exception, Gaudreau (2012) found mastery goals, not their underlying reasons, predicted academic performance (grades). Overall, the results suggest that while the reason for having a mastery goal is a more salient predictor of most learning outcomes, specifically engagement, the goal is a better predictor of academic achievement.

A complementary approach is to examine whether mastery goals predict optimal learning outcomes even when the reasons for having them vary. One way to explore this question is by probing interactions between goals and reasons and examining whether mastery goals predict optimal outcomes when students endorse them for low autonomous reasons and/or high controlled ones. Two studies (Gaudreau, 2012; Gillet et al., 2015) have used this approach. Gaudreau (2012) found mastery goals predicted college students' grades and academic satisfaction only when they were endorsed for high self-concordant (high autonomous and low controlled) reasons, and they predicted academic anxiety only when the reasons for having them were non self-concordant (high controlled and low autonomous). Gillet et al. (2015) similarly found the interaction between mastery goals and their underlying autonomous reasons positively predicted learning outcomes. However, these researchers did not interpret the interactions, so it is unclear whether mastery goals predicted the outcome variables even when their underlying autonomous reasons were low. Notably, both investigations were limited in that they were cross-sectional.

Another limitation of the research reviewed above is that the vast majority has focused on college samples. Thus, the findings typically represent the perceptions of middle-class college students, and there is a noticeable dearth of research on school-age students. To the best of our knowledge, the only investigation involving school-age students was Michou et al.'s (2014) Study 1, in which Greek high-school students participated. This study did not explore the interactions of mastery goals and their underlying reasons and was limited in that it was cross-sectional and relied solely on self-reports.

1.4. The present investigation

We report on two studies in which we explored low-SES Peruvian high-school students' motivation for mathematics. We asked whether the combined effects of goals and reasons on academic outcomes were different for our sample of low-SES youth than for other older higher-SES samples in the literature. We focused on mathematics because of its relevance for later college and career choices (Cooper, Cooper, Azmitia, Chavira, & Gullatt, 2002). We asked the following research questions: 1) Do autonomous and controlled reasons for having mastery goals predict low-SES youths' mathematics grades and engagement over and above the goals themselves? 2) Do autonomous and controlled reasons moderate the effect of low-SES youths' mastery goals on mathematics grades and engagement?

Following previous research (e.g., Michou et al., 2014), we hypothesized autonomous reasons for mastery goals would positively predict mathematics engagement and grades over and above the effect of mastery goals alone (Hypothesis 1). Because previous research has found controlled reasons for having mastery goals are related to maladaptive learning indicators but not to adaptive ones (Gaudreau, 2012; Michou et al., 2014), we did not expect controlled reasons to predict engagement or grades. Second, following Gaudreau (2012), we hypothesized autonomous and controlled reasons for having mastery goals would moderate the effect of mastery goals on mathematics grades and engagement. Specifically, we hypothesized that mastery goals would more strongly predict math achievement and engagement when underlying reasons were more autonomous (Hypothesis 2a) and less controlled (Hypothesis 2b).

1.5. Statement of transparency

The data were collected as part of a larger study on achievement goals and learning outcomes among low-SES Peruvian students' goal pursuit. No experimental manipulation was used in the larger study. Related measures not analyzed in the present study included a measure of students' performance goals, autonomous and controlled reasons underlying performance goals, and mathematics anxiety. All study materials and statistical output are available in an open science framework (project link: https://osf.io/kv8c6).

2. Study 1

Study 1 was aimed at providing initial support for our hypotheses. In this study, we used a cross-sectional design and examined the concurrent effects of mastery goals and reasons for the goals on low-SES Peruvian students' mathematics grades and emotional engagement (i.e., mathematics enjoyment).

2.1. Method

2.1.1. Participants and Procedure

The sample comprised 171 students (53% girls, mean age = 15.48, SD = 1.13) from a public school in an urban-marginal district in Lima, Peru. Participants were in the last three grades of secondary education (n = 64, n = 46, n = 71, for 10th, 11th and, 12th grades, respectively). The community is one of the poorest districts in Lima, with nearly one in four living in poverty (National Institute of Statistics and Informatics, 2020). A recent analysis of poverty levels of diverse areas in Lima (National Institute of Statistics and Informatics, 2020) identified 12 groups; this sample belonged to the third poorest group.

We contacted the school principal and explained the purpose of the study. The principal approved students' participation. We sent a letter explaining the purpose of the research to the students' parents, as well as its confidential and voluntary nature. We asked permission to access the grades. Parents could indicate if they did not want their children to participate. Nobody did so. Before filling out the questionnaires, students read an informed consent form, and all agreed to participate. They answered the questionnaires in a 25-min period; they were instructed to think about their mathematics class as they did so. The questionnaires were administered in the last quarter of the academic year (2017). At the

[2] Several studies have examined the goal-complex model in the sports domain (e.g., Delrue et al., 2016; Vansteenkiste, Mouratidis, & Lens, 2010) and in the vocational domain (e.g., Sommet & Elliot, 2017; studies 1–3). We review only studies in the educational domain.

end of the school year, the average final mathematics grades were collected from the school principal. There were no missing values.

2.1.2. Measures

In all questionnaires, we used a Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Descriptive statistics and Cronbach's alpha coefficients are presented in Table 1.

2.1.2.1. Mastery goals. We used the three items measuring mastery goals from the Achievement Goal Questionnaire-Revised (AGQ-R; Elliot & Murayama, 2008). A sample items is "My aim is to completely master the material presented in this class").

2.1.2.2. Underlying reasons for mastery goals. This scale was developed by Vansteenkiste et al. (2010). Immediately after they responded to the AGQ-R, we asked students to indicate to what extent they endorsed a goal for autonomous reasons (four items on the scale tap autonomous reasons; e.g., "Because this is an important goal to me") or controlled reasons (four items tap controlled reasons; e.g., "Because I would feel guilty if I didn't do so").

2.1.2.3. Classroom mathematics achievements. In the Peruvian National Curriculum, a formative assessment approach is used to evaluate learning. In a systematic process, teachers collect and value relevant information about each student's progress in several competencies. In mathematics, at the secondary school level, the assessed competencies are the following: 1) quantity problem-solving, 2) regularity, equivalence, and change problem-solving, 3) data management and uncertainty problem-solving, and 4) form, movement, and location problem-solving. The evaluation modalities for each competency are workbook exercises completed individually or in pairs, and individual evaluations on paper. Teachers evaluate students' acquisition of competencies using a checklist approximately every three evaluation sessions. As mathematics is evaluated by trimester, each competency score includes about five or six grades averaged within a given trimester. Grades for each competency are then averaged and given a final grade on a vigesimal scale (0-20) for each student in each trimester. Each competency has the same weight.

We collected the third trimester's mathematics grades from the school principal and Z-scored the grades within each classroom to control for different levels and grading criteria of teachers, as in prior studies (e.g., Wolters & Pintrich, 1998).

2.1.2.4. Emotional engagement. Eight items from the Achievement Emotions Questionnaire-Mathematics (AEQ-M; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011) assessed mathematics enjoyment (e.g., "I enjoy my mathematics class").

2.1.3. Plan of analysis

We ran a series of regression analyses using Mplus 8.4 (Muthén & Muthén, 2017). Our estimation method was maximum likelihood with robustness to non-normality (MLR). We tested two models, one for each outcome variable (grades and enjoyment). Although our data were clustered (students nested within classes), we were solely interested in individual student (within-classroom) effects on learning outcomes. We also had a small number of clusters (i.e., classes). We therefore did not conduct multilevel analysis (Raudenbush & Bryk, 2002). We adjusted for the hierarchical nature of the data (students nested within classrooms) by using class as the "cluster" variable in the "Type = Complex" method in Mplus. The intraclass correlation coefficients (ICC) of our dependent variables were 0.07 and 0.05 for mathematics grades and emotional engagement, respectively. The design effects (Kish, 1965; Muthén & Satorra, 1995) were 2.13 and 1.81 for grades and emotional engagement, respectively.

We created the interaction terms by multiplying the centered scale of mastery goals with the centered scales of autonomous and controlled reasons for mastery goals. We entered the variables into the regression model in two steps. In the first step, we entered mastery goals and the reasons for mastery goals. In the second step, we added the interaction terms.

We calculated Cohen's f^2 effect size for each variable. According to Cohen (1992), 0.02 indicates a small effect, 0.15 indicates a medium effect, and 0.35 indicates a large effect. To determine whether our sample size was adequate to infer our observed effect sizes, we conducted sensitivity analyses using G*power (Faul, Erdfelder, Buchner, & Lang, 2009). This was done with a desired power of .80 and an alpha level of 0.05. In Step 1, sensitivity analysis indicated our sample was sufficient to detect a small effect of 0.07. In Step 2, we were looking for the contribution of an attenuated interaction effect to our model. In Step 2, sensitivity analysis indicated our sample was large enough to detect an effect size of 0.06. Following Blake and Gangestad's (2020) this effect size corresponds to medium-sized attenuated interaction effect.

2.2. Results

2.2.1. Preliminary analysis

Table 1 presents the intercorrelations of the study variables. As the table shows, mastery goals were positively related with mathematics grades and enjoyment. Unexpectedly, neither autonomous nor controlled reasons for mastery goal endorsement were related with grades. Autonomous reasons were positively associated with enjoyment, and controlled reasons were unrelated. Autonomous and controlled reasons for mastery goals were positively correlated.

2.2.2. Primary analysis

Table 2 presents the results of the regression analysis.

2.2.2.1. Mathematics grades. In Step 1, the results did not support Hypothesis 1, as neither autonomous reasons nor controlled reasons for having mastery goals emerged as a significant predictor of grades, but mastery goals themselves did ($f^2_{mastery\ goals} = 0.03$). However, this model did not explain a significant amount of variance in grades. In Step 2, the results supported Hypothesis 2a but did not support Hypothesis 2b, in that autonomous but not controlled reasons moderated the relations of mastery goals with grades ($f^2_{mastery\ goals} = 0.08$, $f^2_{mastery\ goals\ X\ autonomous}$

Table 1
Study 1. Descriptive Statistics, Reliability Estimates and Intercorrelations between the Studies' Variables.

	Variable	*M (SD)*	alpha	1	2	3	4	5	6	7
1	Mastery goals	3.90 (.67)	.60	–						
2	Autonomous mastery goals	3.67 (.70)	.63	.42**	–					
3	Controlled mastery goals	2.88 (.85)	.64	.03	.26**	–				
4	Mathematics grades (z-score)	–	–	.17*	.07	-.08	–			
5	Emotional engagement	3.58 (.63)	.81	.52**	.65**	.13	.16*	–		
6	Sex	–	–	-.02	-.01	-.06	-.13	-.04	–	
7	Age	15.48 (1.13)	–	.05	.06	-.18*	-.01	-.18*	-.08	–

Note. All variables were assessed at the end of the school year (n = 171).
*$p < .05$, **$p < .01$.

Table 2
Study 1. Results of Regression Analysis.

	Mathematics Grades		Emotional engagement	
	Step 1	Step 2	Step 1	Step 2
Predictors	Estimate (*SE*), [*p* value]			
Mastery goals	.24 (.12), [.050]	.39 (.13), [.003]	.28 (.05), [.000]	.30 (.05), [.000]
Autonomous reasons	.03 (.10), [.769]	.14 (.09), [.126]	.48 (.07), [.000]	.48 (.06), [.000]
Controlled reasons	-.10 (−.10), [.233]	-.10 (.07), [.142]	-.02 (.04), [.720]	-.01 (.04), [.872]
Mastery goals x Autonomous reasons		.55 (.14), [.000]		.04 (.06), [.510]
Mastery goals x Controlled reasons		-.12 (.10), [.218]		-.08 (.04), [.067]
Conditional effects				
Autonomous reasons = −1 SD		.00 (.08), [.985]		
Autonomous reasons = 0 SD		.39 (.13), [.003]		
Autonomous reasons = +1 SD		.77 (.21), [.000]		
R^2	$.036^{ns}$	.153*	.500**	.505**

Note. The variables of mastery goals, autonomous mastery goals, and controlled mastery goals are centered.
Coefficients are unstandardized estimates. n = 171. *$p < .05$, **$p < .01$.

$_{reasons}$ = 0.18). Given the significant interaction, we tested the simple effects of mastery goals on grades at different levels of the autonomous reasons (see Fig. 1 and Table 2). As expected, mastery goals predicted mathematics grades only when levels of autonomous reasons for adopting them were moderate or high.

2.2.2.2. Emotional engagement. In Step 1, the results supported Hypothesis 1, as autonomous reasons for having the goals significantly predicted enjoyment ($f^2_{autonomous\ reasons}$ = 0.39). In this step, mastery goals still significantly predicted enjoyment ($f^2_{mastery\ goals}$ = .10). We entered age as a covariate in Step 1 because it was negatively correlated with emotional engagement. The inclusion of this covariate did not change the effects of mastery goals and autonomous reasons. Since we did not have specific hypotheses about the effect of age on outcomes, we excluded it from the final model. In Step 2, the results did not support Hypothesis 2a or 2b as there were no significant interaction effects on enjoyment.

2.3. Summary of findings

The results showed mixed support for our hypotheses. Hypothesis 1 was supported only for emotional engagement. Both mastery goals and their underlying autonomous reasons predicted emotional engagement, but only the goals predicted grades. Importantly, Step 1 showed that although mastery goals predicted mathematics grades, the model did not explain a significant amount of variance in grades. This model became significant only when we added the interaction terms in Step 2. Hypothesis 2a was supported for grades, but not for emotional engagement. Autonomous reasons moderated the effect of mastery goals on grades, as they only positively predicted mathematics grades when they were endorsed for medium or high autonomous reasons. Because mastery goals did not predict grades when endorsed for low autonomous reasons, this interaction effect was fully attenuated. Hypothesis 2b was not supported, as controlled reasons did not moderate the effect of mastery goals on learning outcomes.

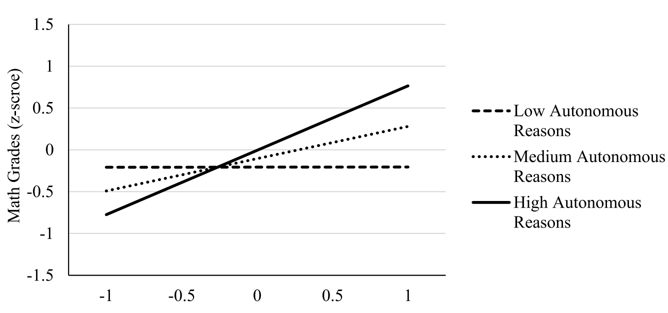

Fig. 1. Study 1. Autonomous reasons for mastery goal endorsement moderate the relations between mastery goals and mathematics grades. Predictor and moderator variables are centered. Low autonomous reasons = −1 SD; medium autonomous reasons = 0 SD; high autonomous reasons are +1 SD.

3. Study 2

The goal of Study 2 was to replicate and extend the findings of Study 1 in several respects. First, in this study, we used a longitudinal design with a larger sample size to explore the prospective effects of mastery goals and their underlying reasons at the beginning of the school year on mathematics grades at the end of the school year. Second, in addition to emotional enjoyment, we explored the outcome variables of behavioral and cognitive engagement, thus capturing the three aspects of engagement (i.e., collective engagement; e.g., Ben-Eliyahu et al., 2018). At the beginning of the school year, engagement measures were also collected, so we controlled for their measurement at Time 1 in predicting their engagement at Time 2. Therefore, our outcome variable was changes in Time 2 engagement. Due to this different design, we examined the same hypotheses as in Study 1.

Finally, Study 2 extended Study 1 by collecting demographic information. In Study 1, the only indication that students belonged to a low-SES group was that their school was located in a poor district (National Institute of Statistics and Informatics, 2020). In Study 2, we collected individual objective indicators of SES to confirm students belonged to a low-SES group. Our focal variables were household density, parents' education level, and quality of health care.

3.1. Method

3.1.1. Participants and Procedure

Participants were students in the last three grades of secondary education in two public schools in an urban-marginal district in Lima, Peru (n = 145, n = 155, n = 151, for 10th, 11th and, 12th grades, respectively). One of the schools was the same as in Study 1. This study was conducted during the 2019 academic year (two years after Study 1). Therefore, some of Study 1's 64 10th grade students participated in Study 2 as 12th grade students. Both schools serve communities representing the third poorest group (in the second lowest quartile) in Lima (National Institute of Statistics and Informatics, 2020). In the first wave of data collection (the first two months of the school year), 452 students (53% girls, mean age = 15.07, SD = 0.96) filled in the questionnaires. In the second wave of data collection (the last month of the school year), the sample was reduced to 342 (53% girls, mean age = 15.43, SD = 1.00). Mathematics grades were available for 436 of the students who participated in the first wave. Those who dropped out at Time 2 did so because they did not attend school during data collection, not because they refused to participate.

Attrition analyses indicated no significant difference between the participants who completed Time 1 and Time 2 (n = 342) and those who dropped out after Time 1 (n = 110) on mastery goals, $F(1, 450) = 0.363$, $p < .547$, autonomous reasons for mastery goals, $F(1, 451) = 1.15$, $p <$ .703, or controlled reasons for mastery goals. However, there was a significant between-group difference in mathematics grades, $F(1, 435)$ = 5.88, $p < .016$, $\eta^2 = 0.01$. Participants who completed both waves had higher standardized mathematics scores than those who completed only the first wave (mean = 0.06, SD = 0.99; mean = −0.21, SD = 0.92, respectively). Nonetheless, given the very small effect size, we considered it did not reflect noticeable differences in mathematics ability. One participant had no variation in his Time 2 responses, so we eliminated him from our analyses. Therefore, our final sample included 451 students, and we used all available data, accounting for the missing data using full-information maximum likelihood (FIML) estimation (Enders, 2001).

3.1.2. Measures

All measures used in Study 1 were included in Study 2, but the second study added scales assessing behavioral and cognitive engagement. Behavioral engagement was assessed using the five-item scale developed by Skinner et al. (2008) (e.g., "When I'm in this class, I listen very carefully"). Cognitive engagement was assessed using four items from Senko and Miles' (2008) scale on deep level learning strategies (e.g., "When studying in this class, I try to explain the key concepts in my own words"). Mastery goals and their underlying reasons were assessed at Time 1. The three engagement types were assessed at both Time 1 and Time 2. Grades were collected only at Time 2. In all questionnaires, we used a Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Descriptive statistics and Cronbach's alpha coefficients are presented in Table 3. A translated version of these instruments had already been used in Peruvian university students with good alpha coefficients (Matos, Reeve, Herrera, & Claux, 2018).

As mentioned above, students reported on several demographic variables. The first was the number of rooms in the home and the number of people living in the household. In research helpful for our study, Meng and Hall (2006) identified four levels of crowding in Lima: households with less than 1.5 persons per room are not considered crowded; households with 1.5–2 persons per room are somewhat crowded; households with 2–2.5 persons per room are overcrowded; households with more than 2.5 persons per room are seriously overcrowded. To calculate household density, we divided number of people per household by number of rooms.

The second demographic variable was parental education (1 = no-education; 2 = pre-school; 3 = elementary school - incomplete; 4 = elementary school - complete; 5 = high school - incomplete; 6 = high school - complete; 7 = technical school (professional diploma) - incomplete; 8 = university - incomplete; 9 = technical school (professional diploma) - complete; 10 = university - complete; 11 = post graduate/PhD).

The third variable was quality of health-care services. The health sector in Peru is fragmented and segmented, consisting of a non-integrated set of subsystems aimed at different sections of the population (Panamericah Health Organization (PAHO), 2007). The Ministry of Health provides the poor with health insurance under the Integral Health Insurance (SIS) plan. Social Security (EsSalud) provides formal insurance to employees and their beneficiaries, and the Armed Forces and the National Police Medical Services both provide insurance to their workers' direct family, i.e., children and spouse. Private sector institutions offer insurance to those who can pay their premiums. Despite the state's claims of assistance, in urban-marginal places, some people do not have any kind of health insurance and cannot afford private medical costs. Such people receive healthcare in medical posts. Given this fragmentation, our student participants were asked the following question: "When you feel ill, where do you go to get medical treatment?" Optional answers were: 1 = medical post; 2 = SIS hospital; 3 = EsSalud hospital; 4 = armed forces hospitals; 5 = private clinic; 6 = private doctor.

Table 3
Study 2. Descriptive Statistics and Frequencies for Demographic Variables.

	Household density	Mothers' education	Fathers' education	Quality of health care
Mean	1.60	5.67	6.16	1.30
SD	.70	1.83	1.86	1.33
Quartiles				
25	1.00	5	5	0
50	1.43	6	6	1
75	2.00	6	7	2

Note. For household density, the number represents the number of persons per rooms in a household.

Table 4 presents descriptive statistics and frequencies of the demographic variables. As can be seen, a little less than 50% of the sample lived in crowded households; for 75% of the sample, mothers' and fathers' highest education level was high-school diploma, and 75% of the sample received low-quality health care services. In our analyses, we treated these as continuous variables. For parents' education, we averaged responses to reports of parents' education across both parents to create a continuous measure of parental education (mean = 5.90, *SD* = 1.57). Then we summed up parents' education and health care quality and reduced household density from this sum to arrive at a global SES variable. Higher values represent higher SES.

3.1.3. Plan of analysis

The analytic plan was the same as in Study 1. We tested four models, one for each outcome variable (mathematics grades, enjoyment, behavioral engagement, cognitive engagement). We adjusted for the hierarchical nature of the data (students nested within classrooms) by using class as the "cluster" variable in the "Type = Complex" method in Mplus. The intraclass correlation coefficients (ICC) of our dependent variables, were 0.16, 0.03, 0.05, and 0.04 for mathematics grades, emotional engagement, behavioral engagement, and cognitive engagement, respectively. The design effects (Kish, 1965; Muthén & Satorra, 1995) were 4.86, 1.72, 2.21, and 1.96 for mathematics grades, emotional engagement, behavioral engagement, and cognitive engagement, respectively. In this study, we controlled for the autoregressive effects of all three engagement types (the Time 1 measurements).

As in Study 1, we calculated Cohen's f^2 effect size. In Step 1, sensitivity analysis indicated our sample was sufficient to detect a small effect of 0.04. In Step 2, sensitivity analysis indicated our sample was large enough to detect an effect size of 0.02. Following Blake and Gangestad's (2020) recommendations this effect size corresponds to small-sized attenuated interaction effect.

3.2. Results

3.2.1. Preliminary Analysis

Table 3 presents the intercorrelations of the study variables. As seen in the table, mastery goals assessed at Time 1 were positively related with Time 2 mathematics grades and also with both concurrent and Time 2 enjoyment and behavioral and cognitive engagement. Unlike Study 1, autonomous reasons for mastery goals at Time 1 were positively related with Time 2 mathematics grades; they were also positively related with concurrent and Time 2 enjoyment and cognitive and behavioral engagement. Controlled reasons for mastery goals at Time 1 were negatively correlated with Time 2 grades but positively correlated with concurrent and Time 2 reports of enjoyment and behavioral and cognitive engagement. As in Study 1, autonomous and controlled reasons for mastery goals were positively correlated. SES was uncorrelated with our outcome variables, so we did not include it as a covariate in out models.

3.2.2. Primary analysis

Table 5 presents the results of the regression analysis.

3.2.2.1. Mathematics grades. In Step 1, the results supported Hypothesis 1. Unlike Study 1, autonomous reasons at Time 1 positively predicted grades at Time 2 ($f^2_{autonomous\ reasons} = 0.02$), and controlled reasons at Time 1 negatively predicted grades at Time 2 ($f^2_{controlled\ reasons} = 0.02$). As in Study 1, mastery goals at Time 1 positively predicted grades at Time 2 ($f^2_{mastery\ goals} = 0.04$). As in Study 1, we entered age as a covariate in Step 1 because it was positively correlated with grades. The inclusion of this

Table 4
Study 2. Descriptive statistics, reliability estimates and intercorrelations between the studies' variables.

	Variable	*M (SD)*	alpha	1	2	3	4	5	6	7	8	9	10	11	12	13
Time 1																
1	Mastery goals	4.09 (.63)	.60	–												
2	Autonomous reasons	3.72 (.71)	.67	.54**	–											
3	Controlled reasons	3.00 (.83)	.69	.18**	.31**	–										
4	Emotional engagement	3.70 (.64)	.83	.47**	.56**	.18**	–									
5	Behavioral engagement	3.82 (.64)	.75	.48**	.47**	.15**	.54**	–								
6	Cognitive engagement	3.79 (.70)	.78	.48**	.47**	.17**	.60**	.66**	–							
Time 2																
7	Mathematics grades (z-score)	–	–	.24**	.20**	-.07*	.15**	.20**	.17**	–						
8	Emotional engagement	3.84 (.57)	.80	.38**	.45**	.22**	.51**	.45**	.44**	.19**	–					
9	Behavioral engagement	3.78 (.63)	.77	.36**	.35**	.15**	.33**	.51**	.38**	.23**	.64**	–				
10	Cognitive engagement	3.79 (.64)	.79	.33**	.39**	.16**	.39**	.44**	.51**	.22**	.63**	.67**	–			
Demographics																
11	Sex	–	–	-.02	.01	-.06	-.03	-.02	-.05	-.04	-.01	.02	.01	–		
12	Age	15.07 (.96)	–	-.02	-.06	.01	-.08	-.06	-.09	.10*	-.03	.02	-.02	-.11**	–	
13	SES	6.45 (2.27)		.14**	.08	.01	.14**	.10	.11*	.01	.02	-.09	-.01	.05	-.05	–

Note. Time 1 variables were assessed at the beginning of the school year, and Time 2 variables were assessed at the end. n = 451. *$p < .05$, **$p < .01$.

Table 5
Study 2. Results of regression analysis.

	Mathematics grades		Emotional engagement		Behavioral engagement		Cognitive engagement	
	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2
Predictors	Estimate (*SE*), [*p* value]							
Mastery goals	.30 (.07), [.000]	.36 (.09), [.000]	.10 (.07), [.143]	.08 (.07), [.254]	.11 (.07), [.139]	.14 (.08), [.075]	.04 (.07), [.634]	.06 (.08), [.440]
Autonomous reasons	.20 (.08), [.010]	.21 (.08), [.008]	.15 (.07), [.049]	.14 (.07), [.063]	.08 (.06), [.182]	.08 (.07), [.206]	.15 (.06), [.011]	.16 (.06), [.006]
Controlled reasons	-.18 (.04) [.000]	-.17 (.05), [.001]	.06 (.04), [.103]	.06 (.04), [.115]	.04 (.04), [.402]	.05 (.04), [.215]	.03 (.05), [.601]	.03 (.05), [.251]
Autoregression (Time 1 outcome)	N/A	N/A	.32 (.06), [.000]	.32 (.06), [.000]	.411 (.07), [.000]	.41 (.06), [.000]	.39 (.07), [.000]	.39 (.07), [.000]
Mastery goals x Autonomous reasons		.17 (.09), [.044]		-.06 (.07), [.361]		.11 (.05), [.036]		.06 (.05), [.251]
Mastery goals x Controlled reasons		-.04 (.08), [.604]		.00 (.07), [.974]		-.08 (.06), [.210]		.01 (.07), [.886]
Conditional effects								
Autonomous reasons = −1 SD		.24 (.06), [.000]				.06 (.06), [.298]		
Autonomous reasons = 0 SD		.36 (.09), [.000]				.14 (.08), [.075]		
Autonomous reasons = +1 SD		.48 (.14), [.001]				.21 (.11), [.042]		
R^2	.087**	.120**	.232**	.236**	.223**	.235**	.233**	.237**

Note. Predictors and covariates were assessed at the beginning of the school year, and outcomes were assessed at the end. The variables of mastery goals, autonomous mastery goals, and controlled mastery goals are centered. All estimates represent unstandardized coefficients. n = 451. *$p < .05$, **$p < .01$.

covariate did not affect the model. Since we did not have specific hypotheses about the effect of age on this outcome, we excluded it from the final model. In Step 2, the results supported Hypothesis 2a but did not support Hypothesis 2b. As in Study 1, autonomous but not controlled reasons moderated the relations of mastery goals with Time 2 mathematics grades ($f^2_{\textit{mastery goals X autonomous reasons}} = 0.02$). Examination of the simple slopes revealed mastery goals positively predicted grades at all levels of autonomous motivation. The more participants endorsed the goals for autonomous reasons, the stronger the relations (Fig. 2, upper panel, and Table 5).

3.2.2.2. Emotional engagement. In Step 1, the results supported Hypothesis 1. As in Study 1, autonomous reasons at Time 1 but not controlled reasons or the goals as such predicted changes in emotional engagement at Time 2 ($f^2_{\textit{autonomous reasons}} = 0.02$). In Step 2, the results did not support Hypotheses 2a and 2b, as goals and reasons did not interact to predict changes in Time 2 emotional engagement.

3.2.2.3. Behavioral engagement. In Step 1, the results did not support Hypothesis 1. In Step 1, neither Time 1 mastery goals nor their underlying reasons predicted changes in Time 2 behavioral engagement. In Step 2, the results supported Hypothesis 2a but did not support Hypothesis 2b, in that autonomous but not controlled reasons moderated the relations of mastery goals with changes in Time 2 behavioral engagement ($f^2_{\textit{mastery goals X autonomous reasons}} = 0.02$). Given the significant interaction, we tested the simple effects of mastery goals on grades at different levels of the autonomous reasons (see Fig. 2, lower panel, and Table 5). As expected, mastery goals predicted changes in behavioral engagement only when levels of autonomous reasons for adopting them were high, not when they were low or medium.

3.2.2.4. Cognitive engagement. In Step 1, the results supported Hypothesis 1, as only autonomous reasons at Time 1, not controlled reasons or the goals as such, predicted changes in cognitive engagement at Time 2 ($f^2_{\textit{autonomous reasons}} = 0.03$). In Step 2, the results did not support Hypotheses 2a and 2b, as goals and reasons did not interact to predict changes in Time 2 cognitive engagement.

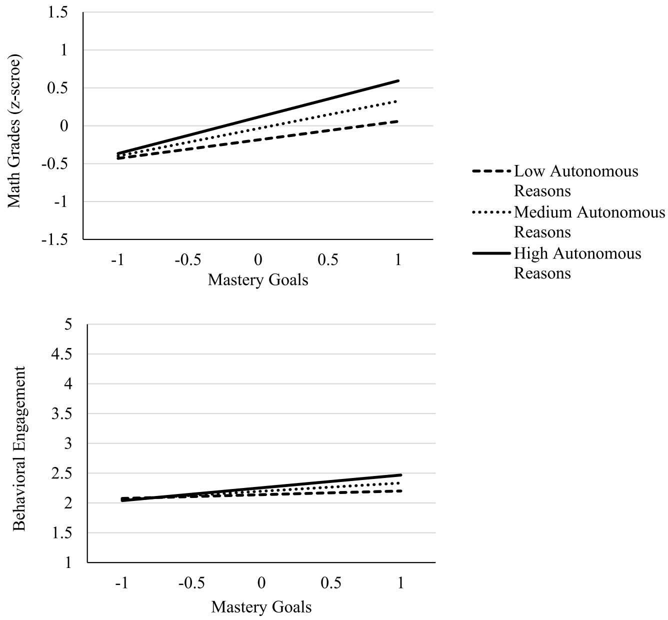

Fig. 2. Study 2. Autonomous reasons for mastery goal endorsement moderate the relations between mastery goals and mathematics grades (upper panel) and between mastery goals and changes in Time 2 behavioral engagement (lower panel). The results on predictor and moderator variables are centered. Low autonomous reasons = −1 SD; medium autonomous reasons = 0 SD; high autonomous reasons = +1 SD.

3.3. Summary of findings

The results of Study 2 showed mixed support for our hypotheses. Hypothesis 1 was fully supported for grades, emotional engagement, and cognitive engagement. Autonomous reasons at the beginning of the school year (Time 1) positively predicted Time 2 grades. They also predicted changes in Time 2 cognitive and emotional engagement. Controlled reasons at Time 1 negatively predicted Time 2 mathematics grades. Mastery goals as such at Time 1 only predicted Time 2 mathematics grades and did not predict changes in any of the engagement measures. Unlike Study 1, the model predicting grades predicted a significant amount of variance already in Step 1.

Hypothesis 2a was supported only for grades and behavioral engagement. As in Study 1, autonomous reasons for having mastery goals moderated the effect of the goals on Time 2 grades. This effect was partially attenuated, as mastery goals positively predicted grades at all levels of autonomous reasons, but this effect was stronger the more students endorsed the goals for autonomous reasons. Autonomous reasons also moderated the effect of the goals on changes in Time 2 behavioral engagement. This effect was fully attenuated, as only when autonomous reasons were high did mastery goals predict changes in Time 2 behavioral engagement. As in Study 1, Hypothesis 2b was not supported, as controlled reasons did not moderate the effect of mastery goals and the outcome variables.

4. General discussion

In both studies, autonomous reasons for endorsing mastery goals emerged as important determinants of most learning outcomes beyond the role of the goals alone. In Study 2, controlled reasons emerged as negative predictors of mathematics grades. In addition, autonomous reasons for endorsing mastery goals moderated the goals' relations with mathematics grades and changes in Time 2 behavioral engagement.

Our results are in line with previous research showing autonomous reasons predict optimal learning outcomes above the effect of the goals *per se* (e.g., Gaudreau, 2012; Gillet et al., 2017; Michou et al., 2014). Ours is the first research to show the effect of autonomous reasons for mastery goals projects to long-term mathematics engagement and grades among school-age participants. Moreover, the fact that we replicated this pattern of results among low-SES students supports the premises of the goal-complex model for achievement goals.

4.1. Theoretical implications

We found mastery goals predicted grades beyond the reasons for having them, and autonomous reasons moderated the relations of the goals with grades. This agrees with Gaudreau's (2012) earlier findings. Importantly, Study 2 revealed a similar interaction effect for changes in Time 2 behavioral engagement. Both grades and behavioral engagement represent *quantitative* indicators of learning, standing for the *amount of effort* a student invests in learning (Skinner et al., 2008). Our results suggest autonomous reasons for having mastery goals alone cannot account for changes in effort expenditure in learning; mastery goals alone can unless they are endorsed for low-autonomous reasons.

Autonomous reasons for having mastery goals emerged as much more salient predictors of changes in Time 2 emotional and cognitive engagement than the goals *per se*. This finding is in line with previous research using cognitive engagement (Michou et al., 2014; Sommet & Elliot, 2017) and positive affective experience (Gillet et al., 2015) as outcome variables. Emotional and cognitive engagement are indicators of the *quality* of involvement in learning. Emotional engagement (enjoyment) is the hallmark of intrinsic motivation (Ryan & Deci, 2000), and cognitive engagement is an aspect of self-regulated learning (Zimmerman, 2002). Thus, the results suggest endorsing mastery goals for autonomous reasons is essential for high quality engagement. Importantly, this does not mean the "reason" or *energization alone* can account for year-long changes in high-quality engagement. This is because in our measurement approach, a given reason was measured by reference to an aim; thus, the aim was embedded in its operationalization (see also Sommet & Elliot, 2017). Rather, our results suggest the *optimal energization of a mastery goal* predicts optimal engagement quality beyond the effect of the goal *per se*.

From a broader achievement goal perspective, inspired by Elliot and Thrash's (2001) critique of traditional achievement goal theory, our results suggest the "aim" or "direction" component of mastery goals can be responsible for high effort expenditure or motivation, unless the "energization" component that underlies them is non-optimal (non-autonomous reasons). Thus, even though the "aim" component in mastery goals can predict some optimal learning outcomes by itself, without an optimal energizing force at its core, its positive effect is less than optimal. This supports the findings of traditional achievement goal models (e.g., Heyman & Dweck, 1992), wherein for most outcomes, a mastery-autonomy goal-complex predicts the most optimal outcomes. Indeed, the strong correlations between mastery goals and autonomous reasons suggest the combination of mastery goals with autonomous reasons is the most likely scenario. Yet, because the endorsement of mastery goals for non-autonomous reasons predicts less-than-optimal outcomes, our results suggest mastery goals and autonomous reasons are not intertwined. Endorsing a mastery goal for non-autonomous reasons attenuates its optimal effect on most learning outcomes.

Importantly, in our student sample, controlled reasons for having mastery goals did not moderate relations with learning outcomes. In addition, although controlled reasons negatively predicted grades in Study 2, they did not negatively predict engagement in either study. There might be several reasons for this non-significant result. First, it is likely that controlled reasons play only a marginal energizing role in mastery goals. Mastery goals are less likely to be endorsed for high controlled reasons, and even if they are endorsed for low controlled reasons, this is not sufficient to predict optimal learning outcomes. They should be endorsed for high autonomy reasons. Second, because as we mentioned above, in our measurement approach, a reason component also included an aim, the pursuit of mastery goals may overshadow the effect of being controlled and contribute to adaptive learning outcomes. Third, we explored the concept of engagement but ignored its opposite – disaffection (Skinner et al., 2008). Previous research (e.g., Gaudreau, 2012; Gillet et al., 2015; Michou et al., 2014) has found that pursuing mastery goals for controlled reasons predicts maladaptive learning outcomes, such as academic anxiety and academic cheating. Future research should explore the relations of mastery goals and their underlying reasons with disaffection.

In line with previous research (e.g., Michou et al., 2014), we found that autonomous and controlled reasons were positively correlated, so some students had both reasons for endorsing mastery goals. Thus, it is likely that the optimal energization provided by autonomous reasons cancels the deleterious effect of controlled reasons on outcomes. An important question is whether students endorsing the goals for both types of reasons show distinct learning patterns from those pursuing the goals for a single reason. To explore this question, future research should adopt a person-centered approach.

Overall, Study 1 and Study 2 had similar results, but there were several differences. First, in Study 1's Step 1, only mastery goals but not their underlying reasons predicted grades. In Study 2, however, both the goals and their underlying autonomous and controlled reasons predicted grades, and this model explained a significant amount of variance. Second, whereas in Study 1, mastery goals predicted enjoyment over and above the autonomous reasons for having them, in Study 2, they did not. In fact, in Study 2 mastery goals alone did not predict any of the engagement measures.

These differences can shed light on how mastery goals and their underlying reasons affect students' learning over time. Recall that in Study 1, both predictors (goals and reasons) were assessed at the end of the school year, whereas in Study 2, the predictors were assessed at the beginning of the school year and grades at the end of it. Second, when predicting engagement in Study 2, we controlled for Time 1 levels of engagement. These results are in line with the assumption that the reasons are distal predictors of learning outcomes (e.g., Elliot & Thrash, 2001). Such predictors exert their effect over longer time periods than the goals themselves; the goals play a proximal role and predict learning outcomes in the short term (when energized by optimal reasons). Future research should explore this assumption using a fine-grained research design, such as an intensive longitudinal study.

4.2. Practical implications

The low-vs. high-SES achievement gap is increasing worldwide (Chmielewski, 2019), causing serious concern among educationalists and policy makers alike (OECD, 2015). Formal policy documents (OECD, 2019) have recently emphasized mastery learning, for example, by cultivating a growth mindset (Yeager & Dweck, 2020), as way to address this gap. Our results suggest that for low-SES students, endorsing mastery goals alone may be not enough. Such goals should also be endorsed for autonomous reasons. Given that our results echo previous findings among higher-SES students (Gaudreau, 2012; Michou et al., 2014), we suggest the same reasoning applies to students from different socioeconomic backgrounds.

4.3. Limitations and future directions

This study has several limitations that should be acknowledged. First, we only examined the reasons underlying mastery goals; we did not include the reasons underlying performance goals. Despite the findings linking performance goals with less-than-optimal outcomes, students often endorse these goals (Lee & Bong, 2015), and they are, in fact, positively related with mastery goals. Moreover, past research has shown that endorsing performance goals for autonomous reasons yields more optimal outcomes than their endorsement for controlled reasons (e.g., Vansteenkiste et al., 2010). Future research should explore whether similar findings apply to low-SES students.

A related question pertains to performance-avoidance goals, which are considered harmful, specifically for low-SES students, who are more likely to endorse such goals than their higher-SES counterparts (Jury, Smeding, Court, & Darnon, 2015). Świątkowski and Dompnier (2021) have recently shown the effect of these goals is less deleterious when they are endorsed for high social utility reasons. Yet to the best of our knowledge, no research has explored whether autonomous and controlled reasons also moderate the detrimental effect of performance-avoidance goals on learning outcomes, specifically among low-SES students. Future research should do so.

Second, despite Study 2's prospective design, we cannot make causal inferences, specifically for grades, as we did not control for their initial levels. In addition, although we controlled for initial levels of collective engagement in Study 2, there were not enough measurement points to justify causal inferences. Experimental or long-term longitudinal studies with a random intercept cross-lagged design (Hamaker, Kuiper, & Grasman, 2015) are required to establish causality.

Third, a strength of the research was its use of students' objective grades at the end of the year as an outcome measure, but engagement was measured solely by self-reports. This raises the possibility of shared-method bias. Future research should use more objective measures of engagement, such as teacher reports and observations.

5. Summary

In sum, these interconnected studies have extended the research on achievement goals by examining the relative importance of mastery goals and their underlying reasons to student achievement, looking specifically at mathematics grades and student engagement in a low-SES population in an understudied cultural sample. The findings suggest that for students to thrive, they should endorse mastery goals for autonomous reasons.

Author statement

Moti Benita: Conceptualization, Methodology, Formal analysis, Writing- Original draft preparation, Visualization. Lennia Matos: Investigation, Resources, Methodology, Writing- Reviewing and Editing, Supervision. Yasmin N. Cerna: Investigation, Methodology.

Declaration of competing interest

None.

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