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How do perceived teacher beliefs and classroom goal structures relate to motivations and enrollments in secondary school mathematics and English?

Helen M. G. Watt[1] · **Nir Madjar**[2] · **Liam Dacosta**[1]

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Abstract

Our study examined how students' perceived teacher beliefs and classroom goal structures, gender (of teachers and students) and own perceived talent, controlling for prior achievements, together explained motivational outcomes of students' achievement goals, intrinsic value and enrollment choices in mathematics and English. Participants were 1086 grades 9–11 students (respective *N*s = 380, 369, 337) from 3 coeducational middle-class schools in metropolitan Sydney, Australia. Hierarchical linear modeling revealed student-perceived teacher beliefs as the most consistent predictor of motivational outcomes in mathematics and English, over and above the effects of other measured influences. Perceived teacher beliefs moderated the effects of classroom goal structures, as well as relationships of gender with motivational outcomes in English. Grade-level effects were more positive among older students which coincided with the grade 11 transition.

Keywords Mathematics motivations · English motivations · Perceived teacher beliefs · Achievement goals · Expectancy-value

✉ Helen M. G. Watt
helen.watt@sydney.edu.au

Nir Madjar
nir.madjar@biu.ac.il

Liam Dacosta
ldac4537@uni.sydney.edu.au

[1] School of Education and Social Work, Faculty of Arts and Social Sciences, The University of Sydney, Sydney, NSW 2006, Australia

[2] School of Education, Bar-Ilan University, Max and Anna Webb St., 5290002 Ramat-Gan, Israel

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1 Introduction

The seminal Pygmalion study about the impact of teachers' expectancies on students' performance (Rosenthal & Jacobson, 1968) prompted studies of causes and consequences of teacher beliefs for students' academic development and success (see Jussim & Harber, 2005). A special issue on Pygmalion's 50th anniversary in the journal 'Educational Research and Evaluation' in 2018 demonstrated that teacher expectancy research has continued to establish an association between teacher beliefs and students' outcomes (see Wang et al., 2018). This year, a large German study (Bergold & Steinmayr, 2023) documented unique direct effects of teachers' judgments relative to students' achievements on motivational dimensions in each of mathematics and reading over one year, arguing the importance of examining associations with multiple outcomes beyond achievements.

Various methods to assess teachers' beliefs have included their ratings for individual students' abilities (Friedrich et al., 2015; Kuklinski & Weinstein, 2001; Rubie-Davies, 2010), recommendations for students' secondary track level (de Boer et al., 2010), rankings of students relative to their classmates (McKown & Weinstein, 2008), perceptions of students' ability and talent (Bergold & Steinmayr, 2023) and student-reported perceptions of their teachers' beliefs (Lazarides & Watt, 2015; Wang, 2012). The latter have been argued to better predict student outcomes than teachers' actual perceptions (see Goodnow, 1988; Kaplan et al., 2002), as the way students perceive events may amount to reality for them. Our study set out to examine the role of student-perceived teacher beliefs on dimensions of girls' and boys' motivation in the two core curriculum domains of mathematics and English during upper secondary school; taking into account key classroom-related and individual-level factors from the dominant achievement-goal and expectancy-value motivation theories developed to explain students' motivational outcomes. Key examined predictors of dimensions of student motivation and enrollments within each of mathematics and English were student-perceived teacher beliefs, mastery and performance classroom goal structures and teacher gender; student gender, own perceived talent, prior achievement and grade level were included covariates.

1.1 Classroom-related influences

1.1.1 Student-perceived teacher beliefs

Teachers are key socializers of students' achievement motivations in the Eccles et al. (1983; Eccles & Wigfield, 2020) expectancy-value model. In mathematics, perceived teacher beliefs about students' own abilities have been found to affect students' achievement goals and value for mathematics (Lazarides & Watt, 2015). Being identified as a member of a particular social group may prompt stigmatic teacher beliefs; for example, teachers overestimated girls' and underestimated boys' competence in reading, but underestimated the mathematics ability of minority group girls (Hinnant et al., 2009). Nearly four decades ago, a meta-analysis established student characteristics including positive behavior in class, physical attractiveness, race (lower for African American vs. Caucasians) and socioeconomic status as significant predictors of teachers' expectations (Dusek & Joseph, 1983). Since then, studies revealed that student gender (Auwarter & Aruguete, 2008; Hinnant et al., 2009), race (Rubie-Davies et al., 2006) and socioeconomic status (Auwarter & Aruguete, 2008) played an important role in shaping teachers' beliefs and may influence the classroom environments they create. Because the secondary school core subjects of mathematics and English are both gender-typed, but in opposite directions (male-typed for mathematics; female-typed for English), we expected gender to play a prominent role.

Despite similar achievement (Lindberg et al., 2010), girls have been found to perceive lower teachers' beliefs about their mathematical abilities than boys, even when their objective achievement was similar (Dickhauser & Meyer, 2006; Lazarides & Watt, 2015). Teachers' beliefs predict students' subsequent performance (Mistry et al., 2009) especially when they underestimate students' abilities (Sorhagen, 2013), with enduring effects on achievements and aspirations through the school year (Rubie-Davies et al., 2014; Zhu et al., 2018), three years later (Gut et al., 2013), and even up to 14 years (Alvidrez & Weinstein, 1999). Exploring the explanatory mechanisms, Rubie-Davies et al. (2014) found that teachers' beliefs affected the expectations of the following teacher, thereby indirectly affecting students' achievements several years after.

1.1.2 Classroom goal structure

Research on classroom goal structures—that is, the goals teachers emphasize in their teaching practice (Ames, 1992; Midgley et al., 2000), consistently supports the premise that teachers who promote a "mastery" classroom goal environment, by encouraging student collaboration, providing constructive feedback based on effort (vs. performance), emphasizing and demonstrating learning as process rather than outcome, and enabling students with a range of choices, are more likely to promote mastery goals and positive engagement among their students (see Ames, 1992; Bardach et al., 2020; Fokkens-Bruinsma et al., 2020; Patrick et al., 2001; Skaalvik & Skaalvik, 2013; Wolters, 2004). In contrast, teachers who promote a "performance" classroom goal orientation, emphasizing performance and encouraging social comparison and competition, predict students' performance goal adoption (Bardach et al., 2020; Kaplan & Maehr, 2007; Meece et al., 2006; Urdan, 2010). Domain-specific goals have been found to better explain students' achievements compared with general goal orientations (Sparfeldt et al., 2015). Domain-specific effects of teacher beliefs have also been identified, such as with achievements in mathematics, but not reading performance in a comparative study (Hinnant et al., 2009).

Interaction effects of perceived teacher beliefs with classroom goal structures on student engagement may occur, as performance-oriented environments may heighten the impact of teachers' beliefs (McKown et al., 2010, p. 267). We consequently anticipated that student-perceived teacher's ability beliefs (cf. Jussim et al., 2009) and classroom goal structure would interact to predict dimensions of student motivation. We expect that the effects of student-perceived teacher beliefs would

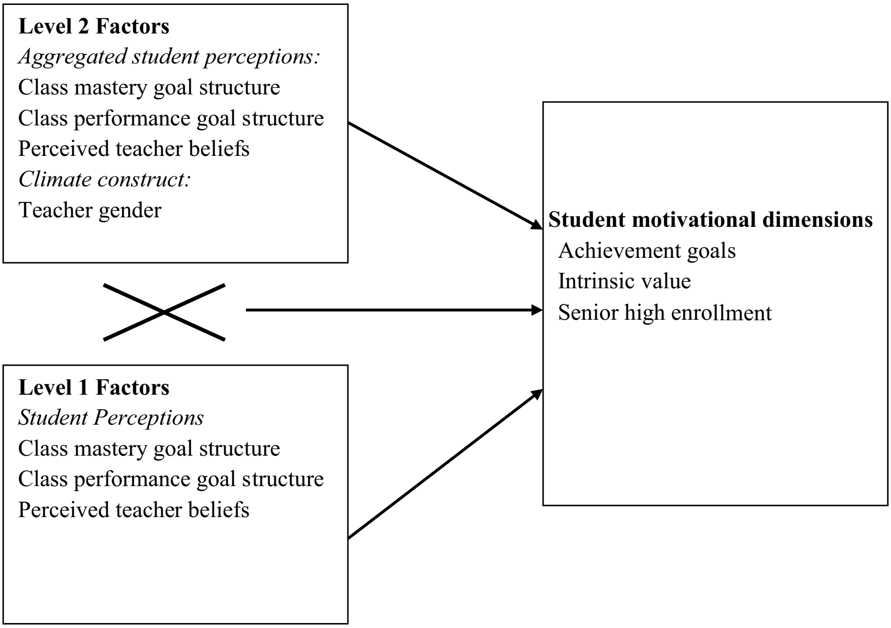

Fig. 1 Schema of the hypothesized model. *Note*. Covariates include student gender, grade, perceived talent and prior achievement

be stronger in the context of classrooms which emphasize performance goal structures as a result of the heightened salience of ability to students. Other interaction effects between student-level perception and classroom-level indicators were tested with a systematic exploratory approach in which we searched for similar interactions within a domain (same interaction for several outcomes), or between domains (same interaction for a specific outcome across mathematics and English), to identify interactions which replicated either within or across domains (see Fig. 1).

1.1.3 Teacher gender

It is common among popular media and some researchers to advocate for male teacher recruitment (e.g., Ponte, 2012) based on the perceived importance of male role models for boys, especially during younger years. Other researchers highlight the importance of female role models for girls in masculine-stereotyped domains such as mathematics (Jansen & Joukes, 2013). Interactions between teacher and student gender were tested for 16 mathematical outcomes including mastery goals, anxiety, and self-efficacy in a study by Martin and Marsh (2005). Of all interactions, one was significant: girls established better relationships with women mathematics teachers, whereas teacher gender was unrelated to relationship quality for boys. This may be important, given findings that girls are more sensitive to social cues (Eisenberg & Lennon, 1983; Hoffman, 1977) and their lesser participation in mathematics than boys. Our study examined potential interactions of teacher and student gender, as well as interactions between teacher gender and other measured factors, on students' motivational outcomes in the opposing gender-typed domains of mathematics and English.

1.1.4 Domain

Including two commonly studied core domains allows for identifying domain-general versus potentially domain-specific patterns of effect. Relatively few studies incorporated multiple domains to explore this question. In their recent large German study of teacher judgments and students' motivational outcomes, Bergold and Steinmayr (2023) found similar longitudinal effects in mathematics and reading on self-concepts and educational aspirations, and null effects on intrinsic motivation, controlling for student gender and prior achievements. We might therefore expect similar effects on similar outcomes; although, our study additionally included achievement goal outcomes and incorporated classroom goal structure influences. As mentioned, the selected domains are gender-stereotyped, but in opposite directions of mathematics for boys and English for girls. This may make teacher beliefs more important to promote positive motivation outcomes for girls in mathematics and boys in English; on the other hand, girls' greater sensitivity to social cues (Eisenberg & Lennon, 1983; Hoffman, 1977) may mean that girls are more impacted across domains. Mathematics is also typically considered a high-status and high-stakes domain, in which students who achieve are highly regarded and their achievements are considered important by society. This may attune students more to teachers' beliefs and classroom influences in mathematics than English. On the other hand, given the more structured, hierarchical organization of mathematics curriculum and instruction, including differentiated curricula for students of different ability levels in the context for the present study, such influences may play a lesser role as students receive multiple objective ability indicators in mathematics already, such as ability-tracking assignments and quite unambiguous assessment feedbacks.

1.2 Individual influences (covariates)

1.2.1 Student gender

The study of gender difference in mathematics and English/Language Arts engagement has long been associated with the Eccles et al. (1983; Eccles & Wigfield, 2020) expectancy-value model, initially developed to explain gendered enrollment in high-school mathematics (see Eccles, 1987). Studies have also focused on differences between boys and girls in their developmental trajectories for motivational dimensions, demonstrating robust gender differences through adolescence: girls reported higher intrinsic value than boys in English (Watt, 2004) and lower in mathematics, across longitudinal samples from the U.S. (Fredricks & Eccles, 2002), Australia (Watt, 2004) and Germany (Frenzel et al., 2010). Girls also tend to choose less advanced mathematics courses when given the option to do so (Watt et al., 2006), explained in part by lower talent perceptions and intrinsic value, when prior achievements were controlled (Watt, 2005).

Gender has been less examined in relation to achievement goal orientations. In a longitudinal study of grades 5–9 students' general achievement goals in Germany (i.e., not in relation to specific learning domains), girls reported higher mastery goals but there were no significant gender differences on either performance approach or avoidance goals. All goals declined through middle school, and more so for boys than girls (Theis & Fischer, 2017). Studies that examined specific learning domains found that students' perceptions of classroom goal structure predicted their (gendered) success expectancies and task values in Australian secondary school mathematics (Lazarides & Watt, 2015). In U.S. secondary schools, boys had higher performance-approach goals in mathematics when previous achievement was controlled (Middleton & Midgley, 1997), resonating with boys' reported greater confidence in mathematics. In middle school writing classes in the U.S., girls reported higher mastery goals than boys, whereas boys were higher on performance approach goals than girls (Pajares et al., 2000); such findings are consistent with girls' greater interest in English and similar self-concept to boys despite higher measured achievements (e.g., Watt, 2004). It therefore seems that whether the domain under investigation is gender-stereotyped as more suited to men (e.g., mathematics) or women (e.g., English) is relevant to girls' goal adoption.

1.2.2 Grade level

Several studies have found teachers of lower grade levels to be more likely to create more mastery, and less performance-oriented, goal structures in their classrooms (e.g., Midgley et al., 2002). Concordantly, age-related changes have been identified in students' declining mastery goals (Chouinard & Roy, 2008; Theis & Fischer, 2017), performance approach and avoidance goals (Theis & Fischer, 2017), intrinsic value (Fredricks & Eccles, 2002; Frenzel et al., 2010; Watt, 2004), and perceived ability (Fredricks & Eccles, 2002; Jacobs et al., 2002; Nagy et al., 2010) or talent (Watt, 2004). Grade level differences were expected particularly for grade 11 students, who select their senior secondary school mathematics and English course levels at this curricular transition, potentially optimizing fit (see also Watt, 2004).

1.2.3 Perceived talent

Students' perceived talents in mathematics and English were included, given their importance alongside different kinds of values in predicting outcomes including mathematical enrollments (Watt et al., 2012) within the Eccles et al. (1983; Eccles & Wigfield, 2020) expectancy-value framework. Perceived talent has been considered to represent students' notion of natural abilities distinct from their evaluations of past performance (Bornholt et al., 1994; Watt, 2004).

1.2.4 Prior achievement

It is important to control for prior domain-specific achievements in analyzing students' motivational and perceived classroom dimensions (see also Bergold & Steinmayr, 2023). In mathematics, high achieving students tend to possess higher perceptions of their talent (Watt, 2005) or ability (Hyde & Durik, 2005; Marsh & Martin, 2011), to report more positive classroom contexts in terms of mastery goal structure (Urdan, 2010), and perceived teacher beliefs (mathematics and reading; Roeser et al., 1993). In English, high-achievers perceived lower classroom performance-avoidance structure, and higher mastery goal structure (Urdan, 2004). We included both prior domain-specific achievements as well as students' own talent perceptions, alongside other predictors, to determine unique effects of student-perceived teacher beliefs on dimensions of motivational outcomes.

1.3 Motivational outcomes

Student motivation is both an essential factor for success in school (e.g., Caraway et al., 2003; Finn & Rock, 1997) and, an important educational outcome in its own right. It is of concern that previous studies have documented a decrease in mathematics and English/Language Arts motivations through school years (e.g., Alspaugh, 1998; Chouinard & Roy, 2008; Fredricks & Eccles, 2002; Frenzel et al., 2010; Jacobs et al., 2002; Nagy et al., 2010; Otis et al., 2005; Watt, 2004). Fredricks et al. (2004) conceptualized motivational variables across three aspects of cognition, emotion and behavior. Our study includes indicators which relate to each.

1.4 Achievement goal orientations

Achievement goal orientations refer to the goals that underpin pursuit of academic achievement (Ames, 1987; Dweck, 1986; Elliot, 2005). Three goals were classically studied: (a) Mastery, in which the purpose is to learn new knowledge or a skill; (b) Performance-approach, where the purpose is to demonstrate superior abilities relative to others; and (c) Performance-avoidance, concerned with avoiding demonstrating a lack of abilities (e.g., Kaplan & Maehr, 2007; Midgley et al., 2000). Mastery-avoidance was a subsequently proposed fourth goal in which the purpose is to avoid losing knowledge or skills that had been previously acquired; however, the meaning and measurement of this goal is debated (e.g., Baranik et al., 2010a, 2010b; Madjar et al., 2011).

Scholars have studied achievement goals as antecedent to outcomes including implicit theories of intelligence (Dweck, 1986), fear of failure (Elliot & Church, 1997), perfectionism (Madjar et al., 2015), personal epistemological beliefs (Bråten & Strømsø, 2005; Buehl & Alexander, 2005), self-concept (Nicholls, 1984), self-regulated learning strategies (Pintrich, 2000; Zimmerman, 2008), help-seeking (Karabenick, 2004), achievement (e.g., Wang & Holcombe, 2010), and wellbeing and emotions (Kaplan & Maehr, 1999; Pekrun et al., 2009). Although performance-approach goals can produce positive effects, especially for achievement outcomes (see Harackiewicz et al., 2002a, 2002b; Luo et al., 2011), it has been often suggested that a mastery goal orientation is generally more adaptive within educational environments (Kaplan & Maehr, 2007).

Others have argued that the combination of different achievement goals is important, referred to as the multiple-goals approach (Barron & Harackiewicz, 2001; Harackiewicz et al., 2002a, 2002b; Pintrich, 2000). People may hold multiple goals at the same time: a student can strive to improve skills and at the same time to outperform others; this combination of mastery and performance-approach goals has been argued to be adaptive (Harackiewicz et al., 2002a, 2002b). Different measurements and methods of analysis have yielded different goal profiles from study to study and identified profiles which are most adaptive depending on the outcome under investigation (e.g., Daniels et al., 2008; Levy-Tossman et al., 2007; Luo et al., 2011; Pastor et al., 2007). A meta-analysis (Wormington & Linnenbrink-Garcia, 2017) established that types characterized by high mastery ("High Mastery") or high mastery together with high performance-approach ("High Approach") were the most common, and similarly adaptive across a range of motivational, achievement and wellbeing outcomes. However, the High Mastery profile were more likely than the High Approach to be significantly more positive than students from other less adaptive profiles. Overall, the authors concluded that there was greater support for the mastery goal perspective.

1.4.1 Intrinsic value

Intrinsic (or interest) value taps the emotional dimension of engagement according to Fredricks and her colleagues' framework (2004; see Watt et al., 2017a, 2017b). Intrinsic value is informed by sense of competence; students who believe in their talent or ability to perform a task successfully are more likely to report interest in that area (Meece et al., 1990). The expectancy-value model highlights other antecedents including gender and perceptions of key socializers' beliefs (Eccles & Wigfield, 2020). Intrinsic value is central to several motivation theories including expectancy-value and self-determination, and studied by achievement goal researchers who have linked personal mastery goals to subsequent intrinsic value or interest (e.g., Harackiewicz & Hulleman, 2010; Liem et al., 2008). Expectancy-value researchers have established links to outcomes including achievement (Liem et al., 2008; Meece et al., 1990), learning strategies and peer interactions (Liem et al., 2008), course enrollments (Harackiewicz et al., 2002a, 2002b; Renninger & Hidi, 2011; Watt, 2005) and career aspirations (Watt et al., 2012, 2017a, 2017b).

1.4.2 Aspired and actual senior high enrollments

In Sydney, Australia, at the time data were collected, students selected which level of mathematics to study for upper secondary school (grades 11 and 12) for the Higher School Certificate (HSC), out of 5 mathematics and 4 English courses, ordered from least to most advanced. English was compulsory, and, although mathematics was not, almost all students undertook it. Students' choices of mathematics and English course level thus constitute indicators of behavioral engagement in each domain. In grades 9 and 10, students had not yet selected their upper secondary school courses, and reported their aspired course enrollments; the eldest cohort (grade 11) reported actual enrollments.

1.5 Hypotheses

Based on the preceding review we formulated four main hypotheses: two concerning effects of student-perceived teacher beliefs and other classroom-related influences, two concerning potential classroom domain and student demographic differences.

Perceived teacher's beliefs would:

H1a associate with dimensions of students' motivational outcomes even when other key predictors were included in the models; and.

H1b interact with other classroom-related influences to buffer negative effects, and be more salient in performance-oriented environments.

Classroom-related influences would:

H2a be more salient for girls (especially in mathematics) and younger students (prior to the grade 11 transition); and.

H2b entail both domain-general and domain-specific effects, due to opposite gender-typing and mathematics being a more structured and high-stakes domain.

2 Method

2.1 Participants

Participants were 1086 Australian secondary school students from the Study of Transitions and Educations Pathways (STEPS; www.stepsstudy.org). In the present study, participating student Ns = 380, 369, 337 were in each of grades 9, 10, and 11 (44% female), within 60 mathematics and 61 English classes during the first term of the 1998 school year (see Watt, 2004). Previous publications from STEPS utilized longitudinal data and none analyzed students' perceived classroom environments or hierarchically nested them within their classes. This was the latest timepoint of assessment, when measures of achievement goals were administered. Participants were from 3 coeducational secondary schools in metropolitan Sydney, matched for middle-class socioeconomic status. The sample was predominantly English-speaking background (68–78% in each school; Asian backgrounds were the largest ethnic subgroup at 15–21%). Missing data (less than 3%) were pairwise deleted during data analysis.

2.2 Procedure

Participants completed self-report surveys during class time, administered by the first author and a trained assistant over two separated class periods, the first for mathematics and the second for English. The study had formal university and departmental ethical approval, consent from school principals, and informed student and parent consent.

2.3 Measures

The full set of items used to assess latent constructs is included as an Appendix.

2.3.1 Achievement goal orientations and classroom goal structures

Items assessing individual achievement goal orientations and perceived classroom goal structures were from the Patterns of Adaptive Learning Survey for each of mathematics and English (PALS; Midgley et al., 1998), with minor modifications to the Australian context (e.g., *maths* instead of *math*). Individual goals were assessed using 5 items for mastery (sample item: "An important reason why I do my maths/English work in school is because I want to get better at it"), 5 items for performance-approach (sample item: "Doing better than other students in this class is important to me"), and 6 items for performance-avoidance (sample item: "One of my main goals is to avoid looking like I can't do my maths/English work"). Classroom mastery goal structure was assessed using the 5 items subscale (sample item: "Our maths/English teacher really wants us to enjoy learning new things"), and 6 items for classroom performance goal structure (sample item: "Our maths/English teacher lets us know which students get the highest scores on tests"). All items were rated from 1 = *not at all true* to 5 = *very true* (see Table 1 for all descriptive statistics).

2.3.2 Intrinsic value

Items for intrinsic value were based on those by Eccles and colleagues (see Eccles & Wigfield, 1995; Wigfield & Eccles, 2000), adapted to the Australian context (see Watt, 2004) (3 items; sample item: "How enjoyable do you find maths/English, compared with your other school subjects?"), rated from 1 = *not at all* to 7 = *very*.

2.3.3 Perceived teacher beliefs

Student-perceived teacher beliefs about students' abilities were assessed by asking, "How talented does your teacher think you are at maths/English?", rated from 1 = *not at all* to 7 = *very talented*.

Table 1 Descriptive statistics for mathematics and English

Variable	*N* items	Possible range	*M* (*SD*)		Cronbach's α		Skewness		Kurtosis	
			Math	English	Math	English	Math	English	Math	English
Dependent variables										
Mastery	5	1–5	3.22 (0.85)	3.38 (0.82)	.82	.82	− .17	− .18	− .10	.12
Performance-approach	5	1–5	3.53 (0.86)	3.43 (0.87)	.80	.83	− .43	− .29	− .09	− .12
Performance-avoidance	6	1–5	2.39 (0.88)	2.46 (0.86)	.84	.86	.45	.27	− .14	− .24
Intrinsic value	3	1–7	3.52 (1.54)	4.45 (1.21)	.91	.80	.11	− .33	− .73	.12
HSC enrollment	1	0–5[a]	3.15 (1.03)	2.35 (0.87)	N/A	N/A	− .26	.33	.26	− .52
Predictor variables										
Mastery goal structure	5	1–5	3.54 (0.84)	3.66 (0.79)	.79	.80	− .52	− .45	.11	.35
Perform. goal structure	6	1–5	2.81 (0.71)	2.92 (0.78)	.59	.69	.09	.07	.08	.09
Tpertal	1	1–7	4.54 (1.25)	4.62 (1.27)	N/A	N/A	− .56	− .49	.84	.70
Talent	7	1–7	4.44 (1.03)	4.57 (1.01)	.89	.90	− .43	− .31	.91	.83

Math—mathematics; Intrinsic—intrinsic value; HSC—aspired high school certificate enrollment; Tpertal—student-perceived teacher beliefs; Talent—perceived talent; N/A—not applicable for single-item indicators

[a]1–4 for English

2.3.4 Perceived talent

Perceived talent was assessed by participants' ratings of how talented they thought they were compared with: others of their same age and gender, same age and opposite gender, class, grade, friends, family, as well as how much talent students believed they had in general, for each of mathematics and English (Watt, 2004; sample item: "Compared with other students in your class, how talented do you consider yourself to be at maths/English?"), rated from 1 = *not at all* to 7 = *very*.

2.3.5 Prior achievement

Performance in mathematics had been assessed in the preceding year, using age-appropriate standardized Progressive Achievement Tests (PAT) developed by the Australian Council for Educational Research (ACER, 1984). English comprehension was also assessed in the preceding year, using the Tests of Reading Comprehension (TORCH) developed by the ACER (see Mossenson et al., 1987).

2.4 Analytic strategy

As the sample consisted of students nested within each of 60 mathematics and 61 English classes, with one teacher for each class, hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002) enabled differentiation of the variance explained at the individual student-level from that at the classroom-level, and identification of predictive factors at each level. Contextual factors refer to aggregate classroom-level variables (level-2) above the effect of the measured individual student-level (level-1; Marsh et al., 2012). In this study, aggregated classroom mastery and performance and perceived teacher beliefs were contextual factors, measured at the student-level and aggregated to formulate classroom-level variables. Teacher gender was a climate construct, measured directly at the classroom-level.

For each outcome in mathematics and English (i.e., students' achievement goals, intrinsic value and HSC enrollment choice), level-1 group-centered predictor variables (except for dummy variables) were entered in the following order: perceived mastery classroom goal structure (MGS), performance goal structure (PGS), student gender (S-gender; coded 0 = boys, 1 = girls), perceived talent (Talent), perceived teacher beliefs (Tpertal), and standardized previous achievement in mathematics/English (PreAch). The same equations were used for each of mathematics and English (see Eq. 1).

$$\textbf{Level 1}: [outcome]_{0j} = \beta_{0j} + \beta_{1j}[MGS] + \beta_{2j}[PGS] + \beta_{3j}\left[S - gender\right] + \beta_{4j}[Talent] + \beta_{5j}\left[Tpertal\right] + \beta_{6j}[PreAch] + r \quad (1)$$

Predictor variables of the intercept (β_0) for outcome variables were: perceived classroom mastery structure (MGS), classroom performance structure (PGS), class-aggregated perceived teacher beliefs (Tpertal), teacher gender (T-gender; coded

0 = male, 1 = female), and two dummy variables for each of grades 9 and 10 (using grade 11 as the reference group). Level-2 predictors were calculated as aggregates of student responses within each classroom, for each of mathematics and English (Eq. 2). Reliabilities of each variable at level-2 are indicated by the ICC(2); values were 79.9% for mathematics and 61.3% for English MGS, 66.7% for mathematics and 60.6% for English PGS, and 52.8% for mathematics and 55.7% for English perceived teacher beliefs.

$$\textbf{Level 2}: [\beta_{0j}] = \gamma_{00} + \gamma_{01}[MGS] + \gamma_{02}[PGS] + \gamma_{03}[Tpertal] + \gamma_{04}[T - gender] + \gamma_{05}[9\,grade] + \gamma_{06}[10\,grade] + u_0 \tag{2}$$

In order to test cross-level interactions, the following variables were additionally entered as predictors for each slope for each outcome variable at level-1 (β_X): perceived classroom mastery goal structure (MGS), performance goal structure (PGS), class-aggregated perceived teacher beliefs (Tpertal), teacher gender (T-gender), and dummy variables for grades 9 and 10 (Eq. 3).

$$\textbf{Level 2}: [\beta_{Xj}] = \gamma_{X0} + \gamma_{X1}[MGS] + \gamma_{X2}[PGS] + \gamma_{X3}[Tpertal] + \gamma_{X4}[T - gender] + \gamma_{X5}[9\,grade] + \gamma_{X6}[10\,grade] + u_X \tag{3}$$

The unconditional model with no predictor variables was used to first calculate the proportion of within- and between-class variances for the motivation factors. The intraclass correlation coefficient ICC(1) estimates the proportion of the variance in an outcome variable explained by level-2 differences, by calculating the ratio of variance explained at level-1 (individual ratings) to the total variance (individual and class levels 1 and 2; Raudenbush & Bryk, 2002). For student mastery goals 8.5% of the total variance in mathematics (χ^2 (59, $N = 1086$) = 156.4, $p < .001$) and 5.4% of the total variance in English (χ^2 (60, $N = 1054$) = 115.9, $p < .001$) was explained by between-classroom differences. For performance-approach goals ICC(1) was 3.7% in mathematics (χ^2 (59, $N = 1086$) = 99.72, $p < .001$) and 1.2% in English (χ^2 (60, $N = 1054$) = 42.19, $p = ns$); for performance-avoidance goals it was 2.6% (χ^2 (59, $N = 1086$) = 87.15, $p < .001$) and 5.4% (χ^2 (60, $N = 1054$) = 116.23, $p < .001$); for intrinsic value 19.0% (χ^2 (59, $N = 1086$) = 290.70, $p < .001$) and 10.7% (χ^2 (60, $N = 1054$) = 184.90, $p < .001$).

For senior high enrollment choices, the ICC(1) was 49.9% in mathematics (χ^2 (59, $N = 1086$) = 982.00, $p < .001$) and 39.3% in English (χ^2 (60, $N = 1054$) = 682.90, $p < .001$). Because students were actually enrolled in their chosen mathematics level at grade 11, the ICC(1) was recalculated excluding the grade 11 students, still revealing high values (41.5% in mathematics; 20.3% in English) presumably due to ability-tracked classes in grades 9 and 10. The quantity of variance explained at level-2 in the outcome variables supported the need to conduct HLM analyses; ICC(1) values approximately 5% and above are considered to provide evidence of a group effect (LeBreton & Senter, 2008). ICC(1) values for context variables at level-2 were 17.9% for mathematics and 8.4% for English MGS, 10.0% for mathematics and 8.2% for English PGS, and 5.8% for mathematics and 6.8% for English student-perceived teacher beliefs.

Table 2 Latent correlations for mathematics and English

	MAS	P-AP	P-AV	Intrinsic	HSC	MGS	PGS	Tpertal	Talent
MAS	1.00								
P-AP	.50[c]/.52[c]	1.00							
P-AV	.16[c]/.10[b]	.44[c]/.47[c]	1.00						
Intrinsic	.77[c]/.75[c]	.31[c]/.30[c]	.08[a]/-.06	1.00					
HSC	.36[c]/.29[c]	.26[c]/.12[c]	.00/-.08[a]	.41[c]/.32[c]	1.00				
MGS	.45[c]/.61[c]	.29[c]/.35[c]	.01/-.05	.42[c]/.47[c]	.14[c]/.14[c]	1.00			
PGS	.15[a]/.11[a]	.27[c]/.38[c]	.25[c]/.34[c]	.05/-.05	.07/-.05	.12[b]/.07	1.00		
Tpertal	.31[c]/.46[c]	.25[c]/.29[c]	-.08[a]/-.03	.34[c]/.50[c]	.22[c]/.24[c]	.38[c]/.39[c]	.04/.02	1.00	
Talent	.50[c]/.51[c]	.44[c]/.32[c]	.06/-.05	.46[c]/.63[c]	.35[c]/.32[c]	.30[c]/.30[c]	.11[b]/ .05	.47[c]/ .55[c]	1.00
PreAch	.16[c]/.03	.08[a]/.07	-.08[a]/-.03	.16[c]/-.02	.50[c]/.15[c]	.05/.10[b]	.11[b]/.03	.13[c]/.02	.27[c]/.02

Correlations are for mathematics/English

MAS—Mastery goal; P-AP—performance-approach goal; P-AV—performance-avoidance goal; Intrinsic—intrinsic value; HSC—Higher School Certificate enrollment choices; MGS—mastery goal structure; PGS—performance goals structure; Tpertal—student-perceived teacher beliefs; Talent—perceived talent; PreAch.—Student prior achievement on standardized tests

[a]$p<.05$

[b]$p<.01$

[c]$p<.001$; two-tailed

3 Results

3.1 Preliminary analysis

Confirmatory factor analyses supported the 7 latent factors of student-reported classroom mastery goal structure, performance goal structure, perceived talent, intrinsic value, and personal mastery, performance-approach, and performance-avoidance goals, in each of mathematics (χ^2 (535, N = 1086) = 1971.63, CFI = 0.91, TLI = 0.89, RMSEA = 0.05, SRMR = 0.06) and English (χ^2 (535, N = 1054) = 1583.54, TLI = 0.93, NFI = 0.92, RMSEA = 0.04, SRMR = 0.05). Substantive variables were calculated as the mean of participants' responses which were normally distributed, and internal reliability was satisfactory (Cronbach's α ranged from .79 to .91), except for classroom performance goal structure which showed marginal reliability in mathematics (α = .59), with more acceptable reliability in English (α = .69). Corresponding with findings from previous studies, students' reports of mastery and performance-approach goals were significantly higher than their performance-avoidance goals in mathematics (t(1059) = 23.38, $p<.001$; t(1058) = 39.01, $p<.001$; respectively for mastery and performance-approach), and English (t(1047) = 26.14, $p<.001$; t(1047) = 33.43, $p<.001$). Mastery classroom goal structure was significantly higher than performance classroom goal structure in mathematics (t(1049) = 20.65, $p<.001$) and English (t(1040) = 21.50, $p<.001$).

Latent correlations from the confirmatory factor analysis (Table 2) provide further support for construct validity of the measurements, and for the basic hypotheses.

In each of mathematics and English, students' mastery goals were positively moderately associated with their perceived mastery classroom goal structure, whereas only weakly with performance classroom goal structure. Students' performance-approach goals positively associated with both perceived performance and mastery classroom ; performance-avoidance goals positively associated with perceived performance classroom goal structure, and were unassociated with mastery structure. Performance-avoidance goals were negatively, although weakly associated with perceived teacher beliefs only in mathematics; but unassociated with own perceived talent. Students' senior high enrollment choices positively associated with mastery goals, more weakly with performance-approach goals, but were negatively (English) or unassociated (mathematics) with performance-avoidance goals. We speculate that the low correlations between perceived talent and prior achievement may be explained by the use of standardized tests rather than school assessment results that would have greater meaning for students.

3.2 Primary analysis: hierarchical linear modeling

3.2.1 Main effects

The results showed a clear pattern for the main effects, reported in Tables 3 and 4, respectively for mathematics and English. In the text, we report unstandardized coefficients for significant effects (2-tailed $p < .05$), and note effects that approached significance in either mathematics or English (2-tailed $p < .10$) which were statistically significant in the corresponding domain. All coefficients, standard errors and exact *p*-values are reported in Tables 3 and 4; standardized coefficients are additionally presented for statistically significant effects.

3.2.1.1 Perceived teacher beliefs Controlling for prior performances, aggregated perceived teacher beliefs at level-2 were a significant and strong positive predictor of students' intrinsic value ($\gamma_{\text{mathematics}} = 0.69$, $\gamma_{\text{English}} = 0.30$) and senior high enrollment choices ($\gamma_{\text{mathematics}} = 1.06$, $\gamma_{\text{English}} = 0.85$) in both domains. As well, positively perceived teacher beliefs at level-2 associated with students' lower performance-avoidance goals in mathematics ($\gamma = -0.37$; $\gamma = -0.15$ $p = .06$ in English), and higher performance-approach goals in mathematics ($\gamma = 0.21$). Student-perceived teacher beliefs at level-1 also associated with higher intrinsic value in English ($\gamma = 0.24$). Perceived teacher beliefs was the most consistent significant predictor across outcomes, even including classroom mastery and performance , gender, grade level, own perceived talent and prior achievement in the models.

3.2.1.2 Achievement goal orientations and classroom Classroom aggregated mastery goal structure at level-2 was highly associated with intrinsic value in both domains ($\gamma_{\text{mathematics}} = 0.81$, $\gamma_{\text{English}} = 0.67$) and with individual mastery goals in English ($\gamma = 0.42$). Student-perceived classroom mastery goal structure at level-1 associated with individual mastery goals in both domains ($\gamma_{\text{mathematics}} = 0.28$, $\gamma_{\text{English}} = 0.30$), intrinsic value in mathematics ($\gamma = 0.39$; $\gamma = 0.16$ $p = .09$ in English) and individual

Table 3 HLM analysis results for all outcome variables in mathematics

	MAS			P-AP			P-AV			Intrinsic			HSC		
	γ (SE)	Z	*p*	γ (SE)	Z	*p*	γ (SE)	Z	*p*	γ (SE)	Z	*p*	γ (SE)	Z	*p*
β_0															
Intercept	**3.22 (.11)**	**–**	**.000**	**3.69 (.11)**	**–**	**.000**	**2.34 (.09)**	**–**	**.000**	**4.01 (.25)**	**–**	**.000**	**3.01 (.22)**	**–**	**.000**
MGS	.26 (.14)		.072	.05 (.14)		.692	.08 (.12)		.511	**.81 (.35)**	**.27**	**.027**	− .27 (.31)		.390
PGS	.00 (.20)		.999	.26 (.20)		.188	.25 (.14)		.087	− .17 (.40)		.669	.01 (.40)		.979
Tpertal	.24 (.12)	.13	.055	**.21 (.09)**	**.11**	**.018**	**− .37 (.10)**	**− .18**	**.001**	**.69 (.25)**	**.25**	**.008**	**1.06 (.19)**	**.54**	**.000**
T-gender	.03 (.09)		.734	− .05 (.07)		.438	− .03 (.07)		.666	.02 (.22)		.931	.08 (.19)		.678
9th grade	− .02 (.13)		.876	− .01 (.12)		.923	**.27 (.12)**	**.14**	**.026**	**− .63 (.29)**	**− .26**	**.036**	− .02 (.28)		.937
10th grade	.11 (.12)		.665	**− .25 (.11)**	**− .16**	**.031**	.17 (.10)		.106	− .36 (.30)		.231	.21 (.25)		.417
β_1 MGS															
Intercept	**.28 (.12)**	**.28**	**.019**	.01 (.08)		.856	.12 (.10)		.248	**.39 (.15)**	**.27**	**.012**	.11 (.06)		.062
MGS	.24 (.15)		.122	.13 (.14)		.339	.10 (.16)		.532	.23 (.26)		.387	.13 (.10)		.193
PGS	− .07 (.19)		.702	.23 (.19)		.223	**.43 (.21)**	**.13**	**.041**	.13 (.31)		.671	.13 (.16)		.398
Tpertal	**− .21 (.10)**	**− .11**	**.041**	− .13 (.12)		.279	− .18 (.12)		.134	− .18 (.16)		.270	− .16 (.11)		.152
T-gender	.03 (.07)		.641	.04 (.09)		.688	− .14 (.09)		.122	− .14 (.14)		.340	− .11 (.06)		.060
9th grade	.06 (.13)		.659	.11 (.10)		.278	− .02 (.11)		.870	.22 (.20)		.263	− .03 (.07)		.667
10th grade	.05 (.12)		.685	.14 (.10)		.135	− .08 (.10)		.448	.10 (.16)		.526	− .01 (.08)		.901
β_2 PGS															
Intercept	− .01 (.09)		.894	.10 (.08)		.195	**.17 (.08)**	**.14**	**.040**	.11 (.15)		.470	− .00 (.04)		.973
MGS	.02 (.12)		.865	.11 (.11)		.312	**.31 (.13)**	**.14**	**.025**	.09 (.18)		.623	.00 (.14)		.996
PGS	− .27 (.16)		.095	**− .34 (.15)**	**− .11**	**.023**	− .12 (.16)		.453	.28 (.23)		.221	− .18 (.13)		.158
Tpertal	− .15 (.09)		.091	− .07 (.08)		.392	**− .27 (.09)**	**− .13**	**.003**	**− .28 (.12)**	**− .10**	**.024**	− .12 (.08)		.149
T-gender	.07 (.07)		.325	− .01 (.08)		.872	− .01 (.09)		.915	− .14 (.10)		.177	.07 (.05)		.171
9th grade	.09 (.11)		.403	.11 (.11)		.304	.13 (.12)		.259	− .15 (.16)		.340	− .02 (.08)		.773

Table 3 (continued)

	MAS			P-AP			P-AV			Intrinsic			HSC		
	γ (SE)	Z	*p*	γ (SE)	Z	*p*	γ (SE)	Z	*p*	γ (SE)	Z	*p*	γ (SE)	Z	*p*
10th grade	.09 (.11)		.387	**.24 (.08)**	**.14**	**.005**	**.28 (.09)**	**.16**	**.003**	.02 (.16)		.920	− .05 (.05)		.301
β_3 S-gender															
Intercept	− .08 (.15)		.607	− .14 (.16)		.384	.00 (.11)		.974	− .15 (.28)		.587	− .05 (.10)		.574
MGS	− .14 (.20)		.499	.18 (.19)		.346	.06 (.16)		.694	− .39 (.33)		.241	.26 (.19)		.179
PGS	− .26 (.22)		.237	− .24 (.23)		.297	**− .56 (.20)**	**− .17**	**.007**	.20 (.39)		.603	− .05 (.20)		.802
Tpertal	− .05 (.16)		.737	− .23 (.15)		.125	.15 (.13)		.245	− .01 (.26)		.968	**− .45 (.16)**	**− .23**	**.007**
T-gender	.10 (.11)		.367	.19 (.10)		.063	.09 (.09)		.323	− .05 (.20)		.794	− .01 (.10)		.939
9th grade	− .09 (.17)		.591	.01 (.16)		.975	− .26 (.15)		.080	.15 (.34)		.668	.02 (.15)		.908
10th grade	− .01 (.17)		.946	.12 (.16)		.441	**− .30 (.12)**	**− .17**	**.014**	− .17 (.34)		.626	− .12 (.14)		.400
β_4 Talent															
Intercept	.22 (.13)		.086	**.30 (.11)**	**.36**	**.007**	.03 (.12)		.792	**.35 (.15)**	**.30**	**.024**	.08 (.07)		.283
MGS	− .02 (.16)		.913	.15 (.13)		.250	.07 (.14)		.634	− .01 (.19)		.971	− .05 (.11)		.645
PGS	− .01 (.20)		.973	− .02 (.15)		.882	− .14 (.16)		.388	.25 (.32)		.444	− .16 (.15)		.273
Tpertal	− .06 (.13)		.631	**− .20 (.09)**	**− .10**	**.026**	− .13 (.08)		.089	.10 (.16)		.526	**− .23 (.10)**	**− .18**	**.025**
T-gender	.01 (.09)		.902	− .06 (.08)		.441	.06 (.09)		.467	.04 (.13)		.767	− .01 (.07)		.938
9th grade	− .05 (.13)		.724	− .05 (.11)		.673	− .20 (.13)		.126	.04 (.17)		.824	.09 (.09)		.331
10th grade	.03 (.12)		.820	.01 (.10)		.935	− .02 (.12)		.842	− .08 (.16)		.628	.12 (.08)		.151
β_5 Tpertal															
Intercept	− .08 (.05)		.124	.05 (.07)		.434	− .09 (.07)		.161	.05 (.11)		.668	− .05 (.06)		.444
MGS	.02 (.08)		.772	.05 (.08)		.539	− .09 (.10)		.375	− .17 (.17)		.340	− .04 (.06)		.513
PGS	− .05 (.13)		.696	.15 (.12)		.229	− .08 (.13)		.545	− .25 (.27)		.361	.11 (.08)		.153
Tpertal	.04 (.06)		.530	.02 (.08)		.807	.03 (.06)		.561	− .02 (.14)		.902	.03 (.07)		.648
T-gender	**.11 (.05)**	**.07**	**.039**	− .01 (.05)		.770	− .03 (.06)		.643	.06 (.12)		.630	.02 (.04)		.617

Table 3 (continued)

	MAS			P-AP			P-AV			Intrinsic			HSC		
	γ (SE)	Z	*p*	γ (SE)	Z	*p*	γ (SE)	Z	*p*	γ (SE)	Z	*p*	γ (SE)	Z	*p*
9th grade	.01 (.08)		.889	.02 (.09)		.853	.10 (.09)		.275	.04 (.15)		.808	.11 (.08)		.176
10th grade	.07 (.06)		.228	− .08 (.07)		.299	.07 (.07)		.353	.10 (.14)		.444	.05 (.07)		.506
β_6 PreAch															
Intercept	**− .04 (.02)**	**− .29**	**.037**	.01 (.02)		.470	− .00 (.02)		.928	− .06 (.04)		.088	.01 (.02)		.486
MGS	− .03 (.02)		.228	.03 (.02)		.137	.04 (.03)		.093	− .03 (.04)		.428	.01 (.03)		.797
PGS	− .01 (.03)		.607	.02 (.03)		.444	.05 (.03)		.087	− .10 (.05)		.067	.04 (.03)		.152
Tpertal	.03 (.02)		.108	.02 (.01)		.145	**− .04 (.02)**	**− .02**	**.041**	− .01 (.03)		.656	.01 (.03)		.835
T-gender	.02 (.01)		.125	− .01 (.01)		.619	.03 (.02)		.085	**.05 (.02)**	**.02**	**.024**	− .03 (.02)		.108
9th grade	.02 (.02)		.389	− .01 (.02)		.482	− .02 (.02)		.453	.03 (.04)		.434	.03 (.02)		.180
10th grade	.02 (.02)		.241	− .03 (.02)		.181	− .04 (.02)		.093	.03 (.04)		.370	.02 (.02)		.390

Bold denotes significant coefficients ($p \leq .05$; 2-tailed), for which standardized coefficients are also presented

MAS—Mastery goal; P-AP—performance-approach goal; P-AV—performance-avoidance goal; Intrinsic—intrinsic value; HSC—Higher School Certificate enrollment choices; MGS—mastery goal structure; PGS—performance goal structure; Tpertal—student-perceived teacher beliefs; S-gender—student gender; PreAch.—Student prior achievement on standardized tests; Talent—perceived talent; Gender was coded 1 = female and 0 = male; Grade levels were 2 dummy variables coded relative to 0 = grade 11

Table 4 HLM analysis results for all outcome variables in English

	MAS			P-AP			P-AV			Intrinsic			HSC		
	γ (SE)	Z	*p*	γ (SE)	Z	*p*	γ (SE)	Z	*P*	γ (SE)	Z	*p*	γ (SE)	Z	*p*
β_0															
Intercept	**3.16 (.05)**	**–**	**.000**	**3.41 (.07)**	**–**	**.000**	**2.32 (.06)**	**–**	**.000**	**4.24 (.08)**	**–**	**.000**	**1.87 (.09)**	**–**	**.000**
MGS	**.42 (.10)**	**.16**	**.000**	.03 (.15)		.829	– .09 (.11)		.419	**.67 (.14)**	**.17**	**.000**	– .21 (.12)		.084
PGS	.05 (.11)		.670	.22 (.13)		.086	**.30 (.13)**	**.10**	**.022**	– .03 (.16)		.869	.23 (.14)		.111
Tpertal	– .02 (.06)		.722	.15 (.10)		.127	– .15 (.08)		.062	**.30 (.10)**	**.12**	**.004**	**.85 (.09)**	**.46**	**.000**
T-gender	**.14 (.06)**	**.09**	**.022**	.08 (.06)		.188	.12 (.07)		.108	.07 (.08)		.435	.08 (.10)		.420
9th grade	.12 (.06)		.073	– .05 (.08)		.495	**.34 (.08)**	**.18**	**.000**	.07 (.08)		.395	**.50 (.11)**	**.26**	**.000**
10th grade	.12 (.07)		.106	– .00 (.07)		.948	**.23 (.07)**	**.12**	**.002**	.11 (.10)		.276	**.44 (.12)**	**.23**	**.000**
β_1 MGS															
Intercept	**.30 (.07)**	**.29**	**.000**	**.26 (.09)**	**.24**	**.009**	– .09 (.08)		.237	.16 (.09)		.091	– .04 (.05)		.378
MGS	.26 (.13)		.052	– .07 (.17)		.700	– .20 (.16)		.213	– .05 (.15)		.720	– .06 (.17)		.730
PGS	.06 (.12)		.638	.09 (.15)		.535	.22 (.14)		.116	**– .42 (.16)**	**– .11**	**.011**	– .02 (.15)		.878
Tpertal	.01 (.09)		.880	.10 (.10)		.331	.13 (.10)		.215	– .00 (.11)		.990	.05 (.10)		.609
T-gender	.08 (.06)		.142	– .16 (.09)		.074	– .08 (.08)		.320	.11 (.09)		.213	.04 (.07)		.542
9th grade	.08 (.07)		.261	.06 (.11)		.554	**.24 (.10)**	**.13**	**.025**	**.20 (.10)**	**.07**	**.050**	– .05 (.08)		.555
10th grade	.05 (.08)		.483	.13 (.11)		.230	.11 (.08)		.171	.09 (.11)		.401	.09 (.08)		.273
β_2 PGS															
Intercept	.07 (.06)		.274	**.31 (.06)**	**.28**	**.000**	**.18 (.08)**	**.16**	**.032**	.01 (.07)		.879	– .06 (.04)		.109
MGS	**– .29 (.09)**	**– .11**	**.003**	**.27 (.10)**	**.10**	**.010**	.26 (.18)		.144	.09 (.12)		.472	– .07 (.12)		.559
PGS	– .06 (.10)		.557	– .06 (.10)		.581	– .03 (.14)		.844	.08 (.12)		.516	.07 (.10)		.504
Tpertal	– .02 (.07)		.713	**– .18 (.07)**	**– .10**	**.012**	– .16 (.15)		.280	.18 (.10)		.074	.02 (.08)		.805
T-gender	– .01 (.06)		.929	.05 (.07)		.510	.07 (.09)		.417	– .05 (.07)		.517	.11 (.06)		.070
9th grade	– .01 (.08)		.942	– .05 (.07)		.464	.08 (.11)		.473	– .15 (.08)		.080	**– .19 (.05)**	**– .10**	**.001**
10th grade	.04 (.07)		.616	.10 (.09)		.268	**.20 (.09)**	**.11**	**.035**	– .09 (.09)		.344	– .04 (.05)		.456

Table 4 (continued)

	MAS			P-AP			P-AV			Intrinsic			HSC		
	γ (SE)	Z	*p*	γ (SE)	Z	*p*	γ (SE)	Z	*P*	γ (SE)	Z	*p*	γ (SE)	Z	*p*
β_3 S-gender															
Intercept	**.20 (.08)**	**.12**	**.018**	.06 (.12)		.618	.08 (.09)		.356	.12 (.11)		.285	− .02 (.05)		.754
MGS	− .16 (.14)		.258	.10 (.19)		.615	.18 (.21)		.375	− .43 (.23)		.067	**.26 (.13)**	**.15**	**.047**
PGS	− .21 (.15)		.177	− .08 (.18)		.667	− .12 (.17)		.480	− .29 (.20)		.157	.03 (.11)		.801
Tpertal	**.35 (.09)**	**.20**	**.001**	− .11 (.15)		.486	− .08 (.13)		.543	**.58 (.13)**	**.23**	**.000**	− .13 (.09)		.125
T-gender	− .07 (.08)		.377	− .03 (.10)		.759	**− .22 (.11)**	**− .13**	**.049**	.17 (.12)		.160	.07 (.07)		.287
9th grade	− .08 (.10)		.435	.01 (.14)		.947	− .17 (.12)		.177	− .15 (.14)		.288	.05 (.06)		.461
10th grade	− .10 (.12)		.394	− .17 (.11)		.110	**− .24 (.11)**	**− .13**	**.028**	− .02 (.14)		.860	.09 (.07)		.235
β_4 Talent															
Intercept	**.24 (.06)**	**.28**	**.001**	**.19 (.07)**	**.22**	**.012**	.07 (.08)		.387	**.56 (.09)**	**.47**	**.000**	.01 (.03)		.743
MGS	.17 (.11)		.136	− .11 (.11)		.308	.14 (.11)		.195	.18 (.14)		.203	− .14 (.10)		.171
PGS	− .10 (.14)		.484	.03 (.11)		.773	.05 (.12)		.658	− .29 (.16)		.077	.14 (.09)		.138
Tpertal	− .13 (.07)		.078	− .06 (.08)		.418	**− .16 (.07)**	**− .09**	**.029**	− .10 (.12)		.426	.07 (.06)		.234
T-gender	− .07 (.06)		.258	.07 (.07)		.308	**− .14 (.07)**	**− .08**	**.045**	− .00 (.10)		.964	.02 (.05)		.693
9th grade	.13 (.08)		.101	.09 (.09)		.293	.08 (.10)		.395	.06 (.12)		.642	**.36 (.05)**	**.18**	**.000**
10th grade	.02 (.08)		.806	− .12 (.09)		.178	.02 (.09)		.859	− .02 (.12)		.884	**.30 (.05)**	**.16**	**.000**
β_5 Tpertal															
Intercept	.08 (.07)		.261	.02 (.06)		.664	.03 (.06)		.624	**.24 (.06)**	**.25**	**.000**	.03 (.03)		.291
MGS	− .01 (.08)		.888	.09 (.08)		.269	.16 (.09)		.084	− .03 (.08)		.734	.03 (.05)		.617
PGS	.05 (.09)		.629	− .08 (.10)		.440	− .05 (.09)		.609	**.36 (.09)**	**.09**	**.000**	.03 (.06)		.605
Tpertal	.02 (.05)		.657	− .07 (.06)		.271	.04 (.05)		.420	.07 (.08)		.396	− .01 (.04)		.884
T-gender	.06 (.05)		.288	− .06 (.06)		.358	.02 (.06)		.748	− .04 (.06)		.479	− .06 (.05)		.179
9th grade	− .08 (.08)		.310	− .00 (.07)		.950	− .10 (.08)		.204	**− .14 (.07)**	**− .05**	**.044**	− .03 (.05)		.566

Table 4 (continued)

	MAS			P-AP			P-AV			Intrinsic			HSC		
	γ (SE)	Z	*p*	γ (SE)	Z	*p*	γ (SE)	Z	*P*	γ (SE)	Z	*p*	γ (SE)	Z	*p*
10th grade	− .06 (.07)		.396	.14 (.07)		.058	− .02 (.07)		.782	− .13 (.08)		.132	− .04 (.04)		.297
β_6 PreAch															
Intercept	− .07 (.07)		.279	.07 (.06)		.187	**.19 (.04)**	**.34**	**.000**	− .04 (.07)		.526	.01 (.03)		.661
MGS	.04 (.09)		.612	.01 (.08)		.864	.07 (.08)		.414	**.22 (.11)**	**.06**	**.044**	.02 (.07)		.823
PGS	.02 (.09)		.805	.05 (.12)		.666	.03 (.08)		.728	.14 (.09)		.101	**.13 (.07)**	**.04**	**.050**
Tpertal	.03 (.06)		.663	− .05 (.07)		.438	.06 (.06)		.308	− .03 (.07)		.698	.04 (.05)		.428
T-gender	.03 (.04)		.504	− .04 (.05)		.394	**− .13 (.04)**	**− .07**	**.005**	− .02 (.07)		.814	− .01 (.05)		.821
9th grade	.05 (.06)		.407	− .06 (.06)		.340	**− .22 (.05)**	**− .11**	**.000**	− .05 (.08)		.551	.00 (.05)		.976
10th grade	.11 (.06)		.095	.12 (.07)		.098	**− .16 (.07)**	**− .08**	**.022**	.11 (.08)		.179	.05 (.04)		.154

Bold denotes significant coefficients ($p \leq .05$; 2-tailed), for which standardized coefficients are also presented

MAS—Mastery goal; P-AP—performance-approach goal; P-AV—performance-avoidance goal; Intrinsic—intrinsic value; HSC—Higher School Certificate enrollment choices; MGS—mastery goal structure; PGS—performance goal structure; Tpertal—student-perceived teacher beliefs; S-gender—student gender; PreAch.—Student prior achievement on standardized tests; Talent—perceived talent; Gender was coded 1 = female and 0 = male; Grade levels were 2 dummy variables coded relative to 0 = grade 11 performance-approach goals in English ($\gamma = 0.26$). Only in English, classroom aggregated performance goal structure was significantly associated with higher individual performance-avoidance goals ($\gamma = 0.30$; $\gamma = 0.25$ $p = .089$ in mathematics). Level-1 student-perceived classroom performance goal structure associated with higher individual performance-avoidance goals in both domains ($\gamma_{\text{mathematics}} = 0.17$; $\gamma_{\text{English}} = 0.18$), and higher individual performance-approach goals in English ($\gamma = 0.31$).

3.2.1.3 Covariates Although boys reported higher scores on all examined outcomes in mathematics,[1] those differences became not significant when controlling for students' own perceived talent (for performance-approach goals, intrinsic value, and course enrollment choices), and perceived teacher beliefs (for mastery goals). Interestingly, boys in more performance-oriented classrooms reported higher performance-avoidance goals in mathematics ($\gamma = -0.56$). In English, girls reported higher personal mastery goals ($\gamma = 0.20$), and girls in more mastery-oriented classrooms chose more advanced enrollments ($\gamma = 0.26$).

A clear finding was the importance of students' own perceived talent, which positively associated with intrinsic value ($\gamma_{\text{mathematics}} = 0.35$, $\gamma_{\text{English}} = 0.56$) and performance-approach goals in both domains ($\gamma_{\text{mathematics}} = 0.30$, $\gamma_{\text{English}} = 0.19$), and mastery goals in English ($\gamma = 0.24$; $\gamma = 0.22$ $p = .09$ in mathematics). Grade 9 students had higher mathematics performance-avoidance goals than grade 11 students ($\gamma = 0.27$) and lower intrinsic value ($\gamma = -0.63$); grade 11 students had higher performance-approach goals than grade 10 students ($\gamma = -0.25$). Grades 9 and 10 students had higher English performance-avoidance goals than grade 11 students ($\gamma = 0.34$, 0.23), and higher enrollment choices compared with actual chosen enrollments by grade 11 ($\gamma = 0.50$, 0.44).

The interaction between gender and grade was significant for individual performance-avoidance goals in both domains ($\gamma_{\text{mathematics}} = -0.30$, $\gamma_{\text{English}} = -0.24$); girls had lower performance-avoidance goals than boys in grade 10, but not grade 11 after they had self-selected into their chosen courses (lower for girls than boys in mathematics[2]).

[1] Boys reported higher mastery goals in mathematics ($F(1,1059) = 5.74$, $p = .017$, $\eta_p^2 = .007$) as well as performance-approach goals ($F(1,1058) = 7.60$, $p = .006$, $\eta_p^2 = .009$), performance-avoidance goals ($F(1,1059) = 14.68$, $p < .001$, $\eta_p^2 = .026$), intrinsic value ($F(1,1074) = 12.79$, $p < .001$, $\eta_p^2 = .052$) and course enrollment choices ($F(1,1036) = 9.78$, $p = .002$, $\eta_p^2 = .017$).

[2] There were gender differences between girls' and boys' actual mathematics enrollments at grade 11 ($\chi^2(4) = 10.43$, $p < .05$): 10.9% of boys chose the highest (4-unit) mathematics course versus 5.4% of girls; for the second-lowest (mathematics in society [MIS]) the pattern was reversed (23.5% of boys versus 36.2% of girls). The lowest level (mathematics in practice [MIP]) had less than 1% of the sample, all boys, and the middle levels had similar proportions of boys/girls (43.2%/39.6% for 2-unit; 20.8%/18.8% for 3-unit).

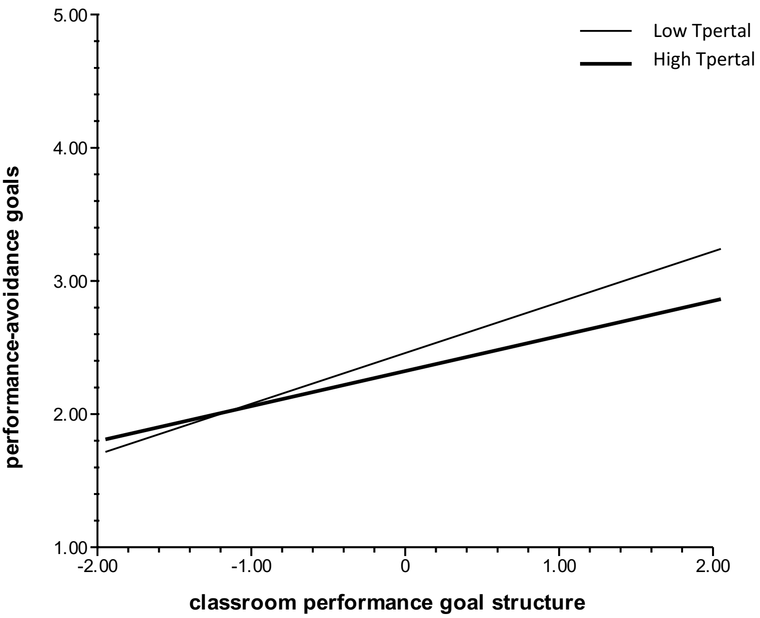

Fig. 2 Interaction between aggregate student-perceived teacher beliefs and individual classroom performance goal structure for students' performance-avoidance goals in mathematics. *Note.* Tpertal—student-perceived teacher beliefs

3.2.2 Cross-level interactions

3.2.2.1 Perceived teacher beliefs Aggregated perceived teacher beliefs at level-2 moderated the effects of classroom performance goal structure, gender and perceived talent on outcomes at level-1. In mathematics, high aggregated perceived teacher beliefs weakened the positive association between students' individually perceived classroom performance goal structure and performance-avoidance goals ($\gamma = -0.27$; see Fig. 2). We utilized simple slopes analysis to test whether each slope for high and low perceived teacher beliefs was significant (Bauer & Curran, 2005). When perceived teacher beliefs were low, the slope was positive and significant ($t(53) = 2.84$, $p = .006$); whereas the slope was not significant when perceived teacher beliefs were high. Thus, students in mathematics classrooms characterized by performance , who perceived their teachers as holding lower beliefs regarding their talent, were more likely to adopt performance-avoidance goals.

The interaction between aggregated perceived teacher beliefs and student-perceived classroom performance goal structure was also significant for the outcomes of student performance-approach goals in English ($\gamma = -0.18$) and intrinsic value in mathematics ($\gamma = -0.28$). Simple slopes analyses revealed that slopes for high and low perceived teacher beliefs were both positive and significant in English ($t(54) = 5.74$, $p < .001$), although not significant in mathematics. Thus, in English, positive perceived teacher beliefs buffered the impact of classroom performance goal structure on students' performance-approach goals. In English, perceived

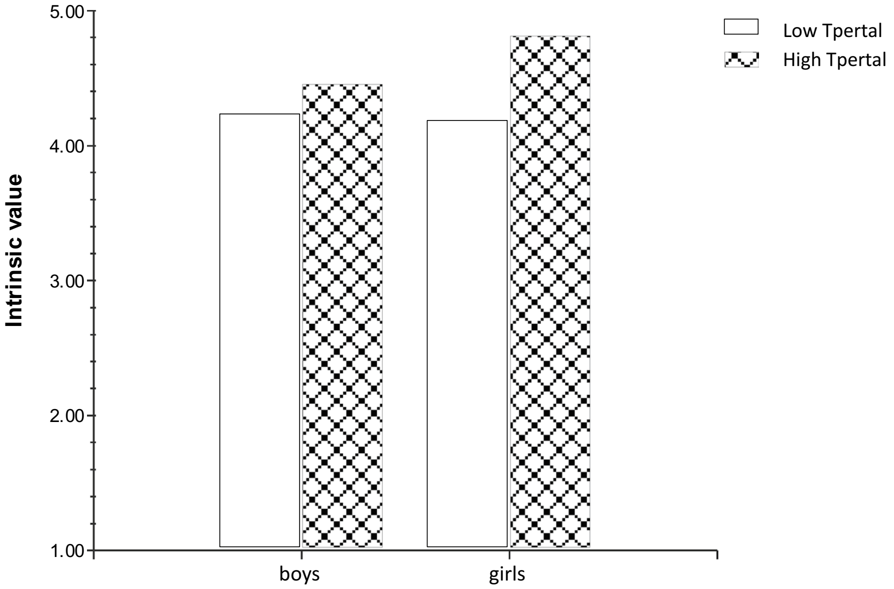

Fig. 3 Interaction between aggregated student-perceived teacher beliefs and student gender for students' intrinsic value in English. *Note*. Student gender coded 0 = boys, 1 = girls; Tpertal—student-perceived teacher beliefs

teacher beliefs also moderated the effect of student gender on personal mastery goals ($\gamma = 0.35$) and intrinsic value ($\gamma = 0.58$). Girls were more affected by perceived teacher beliefs than boys (Fig. 3 illustrates the interaction for intrinsic value, similar for mastery goals).

Perceived teacher beliefs moderated the effect of students' own perceptions of talent, differently across the two domains. In mathematics higher perceived teacher beliefs significantly weakened the association between students' perceived talent and each of their enrollment choices ($\gamma = -0.23$), and performance-approach goals ($\gamma = -0.20$). Both high and low perceived teacher beliefs had significant positive slopes with students' performance-approach goals ($t(53) = 2.27$, $p = .027$; $t(53) = 3.16$, $p = .003$; respectively), whereas none of the simple slopes was significant for enrollment choices. There was an effect of aggregated student-perceived teacher beliefs by prior achievement on performance-avoidance goals in mathematics ($\gamma = -0.04$) indicating that higher achievers in classrooms where students perceived teacher beliefs more positively, had reduced performance-avoidance goals. In English, the interaction between perceived teacher beliefs and students' own perceived talent was significant for student performance-avoidance goals ($\gamma = -0.16$, $\gamma = -0.13$ $p = .089$ in mathematics); although, simple slope analysis showed neither slope for high or low perceived teacher beliefs was significant, meaning that relationships between students' perceived talent and performance-avoidance goals did not change according to different levels of aggregated perceived teacher beliefs. Individually perceived teacher beliefs moderated the effects of English classroom performance goal structure on intrinsic value

($\gamma = 0.36$), such that students in performance-oriented classrooms were more interested in English when they perceived their teacher to hold more positive beliefs.

3.2.2.2 Classroom goal structures In mathematics, the interaction between aggregated classroom mastery goal structure and individual perceptions of classroom performance goal structure at level-1 promoted higher performance-avoidance goals ($\gamma = 0.31$), as did the interaction between aggregated classroom performance goal structure and individual perceptions of classroom mastery goal structure ($\gamma = 0.43$). As well, the interaction between aggregated and individually perceived classroom performance predicted lower performance-approach goals ($\gamma = -0.34$).

In English, there were three significant interaction effects. Aggregated level-2 classroom performance goal structure together with individually perceived level-1 classroom mastery goals, related to students' lower intrinsic value ($\gamma = -0.42$). The other interactions were between aggregated classroom mastery goal structure and individual student perceptions of classroom performance goal structure, on each of students' mastery ($\gamma = -0.29$) and performance approach goal orientations ($\gamma = 0.27$). In English classrooms which had low levels of aggregated mastery goal structure, there was a positive association between classroom performance goal structure at level-1 and student mastery goals ($t(53) = 2.18$, $p = .034$); whereas in classrooms with high levels of aggregated mastery goal structure, the simple slope was not significant (Fig. 5). Low levels of classroom mastery goal structure strengthened the association between classroom performance goal structure and student performance-approach goals. Slopes for both high and low levels of classroom mastery goal structure were significant ($t(53) = 5.70$, $p < .001$; $t(53) = 4.37$, $p < .001$; respectively), and at the low level the slope was steeper.

This means that, given a low classroom mastery goal structure at level-2, the classroom performance goal structure elicited more mastery and less performance-approach goals. Considering the main effect of classroom mastery goal structure this would be most beneficial for student engagement. But, in the absence of a mastery structure, students may benefit from a classroom performance goal structure, rather than classrooms with an absence of either goal. Higher achievers in mastery-oriented English classrooms reported higher intrinsic value ($\gamma = 0.22$), whereas those in performance-oriented classrooms chose higher English enrollments ($\gamma = 0.13$).

3.2.2.3 Teacher gender In English, women teachers promoted higher student mastery goals ($\gamma = 0.14$). In mathematics, there was a significant interaction between teacher gender and student-perceived teacher beliefs on mastery goals ($\gamma = 0.11$), such that women were more likely to promote students' mastery goals when students perceived their teachers to hold more positive beliefs. Teacher gender moderated the effects of students' gender, perceived talent and prior achievement on individual performance-avoidance goals only in English. Simple slope analyses revealed that although the interactions between teacher gender and each of student gender ($\gamma = -0.22$) and perceived talent ($\gamma = -0.14$) on performance avoidance

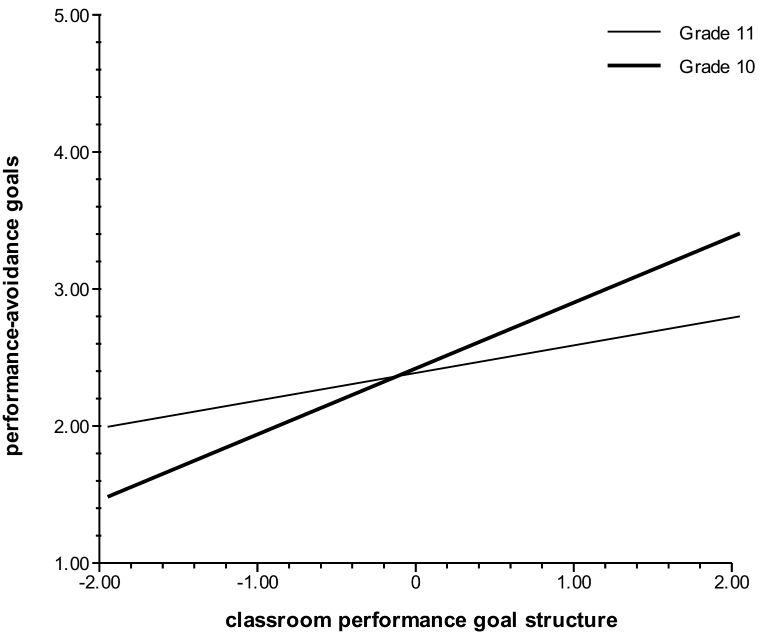

Fig. 4 Interaction between grade level and individual classroom performance goal structure for students' performance-avoidance goals in mathematics

goals was significant, none of the simple slopes was significant. Within the interaction between teacher gender and student achievement on performance-avoidance goals the simple slope was positive and significant only for male teachers ($t(53)=2.89$, $p=.003$), who elicited performance-avoidance goals among higher achieving boys in English. In other words, when learning English with a male teacher, high achieving boys suffered greater performance-avoidance. Despite significant interactions between teacher gender and student achievement when predicting mathematics intrinsic value ($\gamma=0.05$) and English performance-avoidance goals ($\gamma=-0.13$), the slopes for male and female teachers were not significant.

3.2.2.4 Covariates Student grade level moderated the effects of classroom aggregated performance and mastery on students' perceived talent, showing that younger students were more susceptible to contextual factors—negatively for performance and positively for mastery classroom . In mathematics, simple slopes were significant between individually perceived classroom performance goal structure at level-1 and student performance-approach ($\gamma=0.24$; $t(53)=4.90$, $p<.001$) and performance-avoidance goals ($\gamma=0.28$; $t(53)=6.14$, $p<.001$) in grade 10; however, these slopes were not significant at grade 11 (Fig. 4 illustrates the interaction for performance-avoidance goals, similar for performance-approach goals). Similar findings occurred in English, when students' performance-avoidance goals were predicted by level-1 student-perceived classroom performance goal structure, with significant simple slope at grade 9 ($t(54)=3.62$, $p<.001$) but not grade 11. Although the interaction

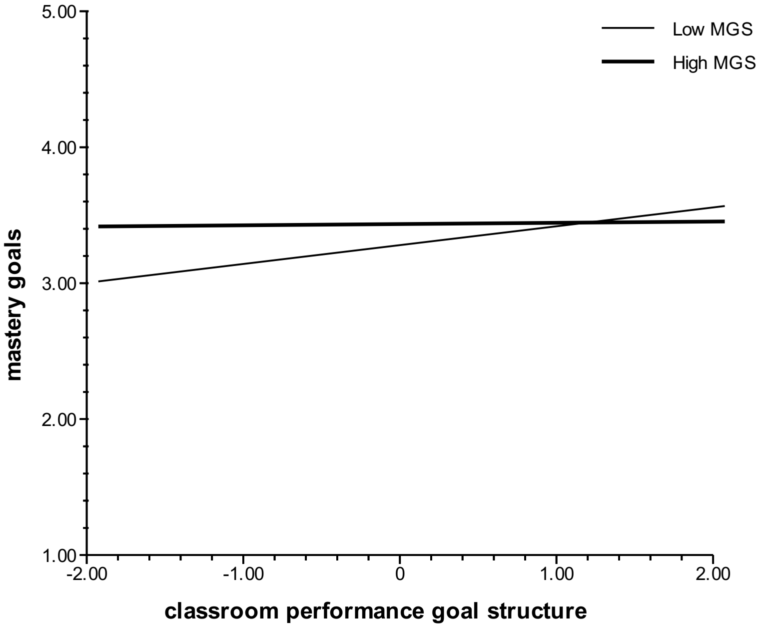

Fig. 5 Interaction between aggregated classroom mastery goal structure and individual classroom performance goal structure for students' mastery goals in English. *Note.* MGS—mastery goal structure

between classroom mastery goal structure and grade 9 was significant for students' performance-avoidance goals ($\gamma = 0.24$) and intrinsic value ($\gamma = 0.20$) in English, the simple slopes were not significant, meaning that the relationships of mastery goal structure with students' performance-avoidance goals did not depend on grade level. Younger students who had higher prior achievement scores in English, held lower performance-avoidance goals than grade 11 students ($\gamma_{\text{grade-9}} = -0.22$, $\gamma_{\text{grade-10}} = -0.16$) (Fig. 4).

Perceived talent was associated with higher English enrollment choices more for younger than grade 11 students ($\gamma_{\text{grade-9}} = 0.36$, $\gamma_{\text{grade-10}} = 0.30$). Conversely, individually perceived classroom performance goal structure reduced English enrollment choices for younger students ($\gamma_{\text{grade-9}} = -0.19$), and promoted performance-avoidance goals ($\gamma_{\text{grade-10}} = 0.20$). Student-perceived teacher beliefs were less associated with English intrinsic value for younger than grade 11 students ($\gamma_{\text{grade-9}} = -0.14$) (Fig. 5).

4 Discussion

Our study examined how perceived teacher beliefs considered at individual and classroom levels can explain multiple dimensions of student motivation in mathematics and English during upper secondary school, taking into account key classroom and individual factors from achievement-goal and expectancy-value theories developed to explain motivational outcomes. Important covariates were controlled in this endeavor: student gender, own perceived talent, prior achievement and grade level. As hypothesized, perceived teacher beliefs uniquely shaped students' motivations within both domains (H1a) and moderated other classroom effects (H1b). The strongest standardized effects (> 0.3) across both examined domains were evidenced by students' perceived teacher beliefs, as well as the covariates of perceived talent and prior achievement. Gender (H2a) and domain similarities and differences were evident (H2b) although, given our exploratory approach, only the stronger effect sizes should be interpreted until further replication studies occur.

4.1 Perceived teacher beliefs

The most consistent contextual predictor of students' motivations across mathematics and English domains was student-perceived teacher beliefs of students' own talent, both as a main effect at the classroom level (H1a), and in moderating the effects of other contextual factors (H1b). At the classroom level, aggregated perceived teacher beliefs had effects beyond those accounted for at the individual level. These teachers' classes reported higher intrinsic value and more advanced high-school course enrollment choices in each of mathematics and English, as well as lower performance-avoidance goals in mathematics (approaching significance in English). Findings support studies of the unique effects of perceived teacher beliefs (cf. McKown & Weinstein, 2008; Rubie-Davies et al., 2006), including multiple dimensions of motivational outcomes (Bergold & Steinmayr, 2023).

Multiple contextual factors affect student motivations, which can function differently across domains (Urdan, 2010). In mathematics, positively perceived teacher beliefs buffered the detrimental effect of classroom performance goal structure on performance-avoidance goals; when students perceived their teachers to hold positive beliefs, the association between classroom performance goal structure and individual performance-avoidance goals became non-significant. This was also the case in English when the outcome was individual performance-approach goals, indicating a compensating mechanism of perceived teacher beliefs in less positive classroom environments.

Previous studies highlighted the domain specificity of students' motivation, with mastery goals more sensitive to domain-specific characteristics, but performance goals more dependent upon personal dispositions (Baranik et al., 2010a, 2010b; Bong, 2001). Our study showed that perceived teacher beliefs moderated the negative effects of performance structure differently across domains. Whereas in mathematics, more positively student-perceived teacher beliefs buffered the detrimental effects of classroom performance goal structure on students' performance-avoidance goals and intrinsic value, in English, there was a small effect only on students' performance-approach goals. We speculate that students are more sensitive to teachers' beliefs about their abilities in a well-structured domain such as mathematics, which may be less prominent in less structured domains such as English. The higher stakes attached to mathematics achievements may also make students more prone to doubts and performance-avoidance goals.

Also, as we had anticipated, the effect of perceived teacher beliefs was more pronounced in performance-oriented classroom environments in mathematics, where students were more likely to adopt performance-avoidance goals if they perceived low teacher beliefs.

4.2 Classroom goal structures

Classroom goal structure effects (Kaplan & Middleton, 2002) were pronounced at the individual rather than classroom level, emphasizing the diverse perceptions of students within same classes (see Spearman & Watt, 2013; Wolters, 2004). Consistent with previous studies suggesting individual goals are shaped by classroom goal structures (see the meta-analysis of Bardach et al., 2020), performance classroom goal structure associated with students' performance-avoidance goals in both domains (and performance-approach in English); mastery classroom goal structure associated with students' mastery goals in mathematics (and approached significance in English). Studies using HLM analysis commonly found small between-classroom variations in classroom goal structure (e.g., Karabenick, 2004), which aligns with our findings and indicates that differences between students are due to other characteristics (see Urdan, 2010 for a review).

Aggregated classroom mastery goal structure moderated the relationships between individually perceived classroom performance goal structure and individual performance-approach goals in both domains, also individual mastery goals in English. The association between level-1 classroom performance goal structure and individual mastery goals was strengthened by level-2 classroom mastery structure, while weakening the association between level-1 perceived classroom performance goal structure and individual performance-approach goals. This means that within classrooms which have a low mastery context, perceived classroom performance goal structure seemed more beneficial than an absence of either type of goal structure. This interesting finding appears to show that performance goal-oriented classrooms are better than "no-goal" classrooms for students' own achievement goals.

4.3 Teacher gender

Teacher gender was not a prominent consistent predictor of student motivations, but favored women teachers when they occurred. There was no support for a "gender-match hypothesis" promulgated by calls from the popular media to recruit more male teachers as role models for boys. Women teachers promoted higher mastery goals in English; moderation effects of teacher gender supported by significant simple slopes were also found for individual performance-avoidance goals in English. The significant effects revealed that women teachers can buffer some negative effects for lower achievers.

4.4 Grade and gender covariates

Consistent with prior research documenting declining motivations in mathematics and English through adolescence, senior high course enrollments were significantly lower among grade 11 than younger students. Interestingly, grade 11 students were also lower on performance-avoidance goals than younger students in both domains, and higher on mathematics performance-approach goals. It seems that once students select their senior high school course levels that they may be less stressed about failing and showing poor performance as they tended to select lower levels than aspired, while feeling the need to demonstrate their relative competence in their chosen level as they are about to graduate from secondary school. Motivational changes at grade 11, following important curricular changes when students elect their final subjects and difficulty levels for senior high matriculation, resonate with previous findings (Watt, 2004).

Main effects of student gender were found in English in which girls had higher mastery goals, even when controlling for prior performance and perceived classroom goal climate (see also Meece et al., 2009). Girls were more susceptible to contextual factors (H2a): their mastery goals and intrinsic value in English, and senior high course enrollment in mathematics, were more associated with their perceived teacher beliefs. This is consistent with previous findings that girls are more sensitive to social cues (Eisenberg & Lennon, 1983; Hoffman, 1977). The moderating effects of perceived teacher beliefs may help explain boys' overrepresentation in particular STEM fields (e.g., Corbett et al., 2008; Fisher et al., 2020; Hinnant et al., 2009; Ivie & Ray, 2005; Kirkham & Chapman, 2022; Natural Sciences & Engineering Research Council of Canada, 2010); teachers should take all the more care to provide supportive environments to girls in mathematics.

More gender differences were evident within mathematics favoring boys consistent with gender stereotypes, except the intriguing finding that boys experienced more maladaptive performance-avoidance goals in mathematics than girls in performance-oriented classrooms. This resonates with recent research demonstrating boys were overrepresented among a latent type of "struggling ambitious" students, who scored high on both positive and negative motivation dimensions in mathematics and science (Watt et al., 2019).

4.5 Study limitations

Four main limitations should be discussed in regard to the current study, concerning self-report assessments, some problematic construct reliabilities, the exploratory approach and use of cross-sectional data. First, all measurements were based on student self-report. These are constrained to measure only conscious perceptions, are prone to social desirability, and may not represent reality (Fulmer & Frijters, 2009). In this case we cannot be certain about the teachers' actual beliefs (in this study measured by a single item) or observable practices in class, only their students' subjective interpretations, which, however, should be important in influencing their motivational outcomes. Future studies could fruitfully combine multiple methods to assess classroom goal structure such as teacher reports (Wolters et al., 2010), or direct observations (Spearman & Watt, 2013). Aligning with previous findings (e.g., Martin & Marsh, 2005) most of the variance for motivational constructs occurred at the student level (ranging from 81.0 to 98.8%; compared with 1.2–19.0% at the classroom level), emphasizing the importance of interventions focused on individual student perceptions. Second, the measurement properties for classroom performance goal structures were marginal (αs = .59 in mathematics, .69 in English) which could produce a downward bias in identifying their effects.

Third, our exploratory approach including ten different predicting variables and their interactions on five different outcomes, poses the risk for Type 1 error. Unstandardized and standardized effects were reported for all statistically significant effects, and our conclusions and recommendations focus only on those which are strongest. It would be of benefit if further studies could test whether these and the other potentially meaningful effects can be replicated in future samples and settings. Finally, because this is a cross-sectional study, conclusions are limited with regard to developmental effects or reciprocal effects over time, which would need to be addressed by future research incorporating multiple assessments in a longitudinal design. Our correlational findings showed that the ways in which students perceived their teachers' beliefs together with classroom goal structures, explained a considerable portion of students' motivational outcomes in the two core subjects of mathematics and English.

4.6 Conclusions and recommendations

Perceived teacher beliefs proved to be a substantial and prominent predictor of several motivational dimensions in mathematics and English, emphasized in the dominant achievement-goal and expectancy-value theories. This held true even including classroom mastery and performance goal structures as competing predictors, and controlling for covariates among which students' perceived talent and prior achievement were most important. Perceived teacher beliefs also moderated the effects of classroom goal structures; the most substantial effect was for girls in English, whose intrinsic value and mastery goals were more positively affected than boys', by their perceived teacher beliefs. The examined outcomes extend our understanding of factors beyond achievement which can be affected (called for by Bergold & Steinmayr, 2023) as well as how perceived teacher beliefs can be implicated in other influential classroom processes.

The motivational outcomes which were most strongly predicted by perceived teacher beliefs in both domains were intrinsic (interest) value, and senior high school enrollment choices. Domain differences imply the need for further comparative designs to compare what may be particular to certain fields of study and why. Yet our findings clearly demonstrate the need for educators to promote positive beliefs in their students' talent potentials. This should be implemented with caution and serious consideration. Teachers and educators should refrain from sending the message that talent is a fixed trait which may debilitate students' motivation (Dweck, 2006), in contrast to mathematics teaching which transfuses growth mindset ideas to enhance students' engagement and learning (Boaler et al., 2021).

Appendix

Items to measure latent constructs in mathematics/English.

Construct	Items	Response options
Student-perceived teacher beliefs (Tpertal)	How talented does your teacher think you are at maths/English?	1: not at all–7: very
Perceived talent	Compared with other students in your class, how talented do you consider yourself to be at maths/English?	1: not at all–7: very
	Compared with other students in your Year at school, how talented do you consider yourself to be at maths/English?	
	Compared with your friends, how talented do you consider yourself to be at maths/English?	
	Compared with your family, how talented do you consider yourself to be at maths/English?	
	How talented do you think you are at maths/English?	
	Compared with students your age of the same sex, how talented are you at maths/English?	
	Compared with students your age of the opposite sex, how talented are you at maths/English?	
Intrinsic value	How enjoyable do you find maths/English, compared with your other school subjects?	1: not at all–7: very
	How much do you like maths/English, compared with your other subjects at school?	
	How interesting do you find maths/English?	
Mastery goal	An important reason why I do my maths/English work in school is because I want to get better at it.	1: not at all true–5: very true
	I like maths/English work that I'll learn from even if I make a lot of mistakes.	
	An important reason why I do my maths/English work is because I like to learn new things.	
	I like maths/English work best when it really makes me think.	
	I do my maths/English work because I'm interested in it.	1: not at all true–5: very true
Performance-approach goal	Doing better than other students in this class is important to me.	
	I want to do better than other students in my class.	
	I would feel successful if I did better than most of the other students in my class.	
	I'd like to show my teacher that I'm smarter than the other kids in my maths/English class.	
	I would feel really good if I were the only one who could answer the teacher's questions in class.	

Construct	Items	Response options
Performance-avoidance goal	One of my main goals is to avoid looking like I can't do my maths/English work.	1: not at all true–5: very true
	An important reason I do my maths/English work is so that I don't embarrass myself.	
	It's very important to me that I don't look stupid in class.	
	The reason I do my maths/English work is so my teachers don't think I know less than others.	
	The reason I do my maths/English work is so others won't think I'm dumb.	
	One reason I would not participate in maths/English class is to avoid looking stupid.	
Mastery goal structure	Our maths/English teacher really wants us to enjoy learning new things.	1: not at all true–5: very true
	Our maths/English teacher thinks mistakes are okay as long as we're learning.	
	Our maths/English teacher wants us to understand our work, not just memorise it.	
	Our maths/English teacher recognises us for trying hard.	
	Our maths/English teacher gives us time to really explore and understand new ideas.	
Performance goal structure	Our maths/English teacher lets us know which students get the highest scores on tests.	1: not at all true–5: very true
	Our maths/English teacher tells us how we compare to other students.	
	Our maths/English teacher makes it obvious when students are not doing well on their work.	
	Only a few students in our maths/English class do really well.	
	Our maths/English teacher points out those students who get good grades as an example to all of us.	
	Our maths/English teacher calls on smart students more than other students.	

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Author contributions HMGW: Conceptualization; Data curation; Investigation; Formal Analysis; Writing–Original Draft; Writing–Review and Editing; Funding Acquisition; Resources; Supervision. NM: Conceptualization; Methodology; Formal Analysis; Writing–Original Draft. LD: Writing–Review and Editing.

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Declarations

Competing interests Watt is an Associate Editor of the journal; Editorial status has no bearing on independently overseen editorial consideration. The authors declare no other competing interests directly or indirectly related to the work submitted for publication.

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Helen M. G. Watt Ph.D., is Professor of Educational Psychology at The University of Sydney and Director of Research Development (Social Sciences). She previously served at Monash, Michigan, Western Sydney, Sydney, and Macquarie Universities. Her longitudinal programs have implications for supporting career development of beginning teachers (https://www.fitchoice.org/), redressing gender imbalances in STEM (https://www.stepsstudy.org) and she founded Network Gender and STEM (https://www.genderandSTEM.com). She is Fellow of the Academy of Social Sciences in Australia, and the American Educational Research Association.

Nir Madjar Ph.D., is an Associate Professor in the School of Education at Bar-Ilan University, Israel, where he is Head of the Education Counseling program. His research focuses on personal and environmental aspects that promote adaptive academic and social motivation, based in achievement goal and self-determination theories.

Liam Dacosta is a Research Assistant in the School of Education and Social Work at The University of Sydney. He is also a Ph.D. candidate in the School of Psychology, focusing on how disease threat influenced social behaviors during the COVID-19 pandemic.