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Do gender differences in academic attainment correspond with scholastic attitudes? An exploratory study in a UK secondary school

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Abstract

Research has examined how standardized tests give rise to gender differences in English and STEM attainment, but little research has explored gender differences in classroom-based attainment and the degree to which these correspond to differences in school-related attitudes. To explore the extent to which gender-achievement gaps in classroom-based performance parallel differences in self-perceptions and scholastic attitudes. An independent sample of first (n = 187, age 11–12, Study 1) and second-year students (n = 113, age 12–13, Study 2) from a UK comprehensive secondary school completed a questionnaire measuring academic mindset, self-efficacy, self-concept, competence beliefs, personal and social self-esteem, and endorsement of gender-subject and career stereotypes. Responses were then matched to their respective classroom grades in English, mathematics, science, and computing. Girls outperformed boys in English in their first year but reported lower global self-esteem and greater endorsement of science-career stereotypes. Conversely, girls outperformed boys in mathematics in their second year, but paradoxically reported lower self-concept and competence beliefs in mathematics and science, and higher competence beliefs in English. Across both studies, mindset, self-efficacy, competence beliefs, and social self-esteem were positively related to English attainment; academic self-efficacy was positively related to mathematics attainment; and mindset, self-efficacy, self-concept, and competence beliefs were positively related to science attainment. Gender-achievement gaps in classroom-based academic attainment are complex and highly nuanced; they appear to vary between school subjects across years and may not correspond with similar differences in self-perceptions and scholastic attitudes.

1 | INTRODUCTION

The observed gender-achievement gap between boys and girls in Western cultures is a key concern for researchers, policymakers, and practitioners seeking to understand when and why attainment differences emerge and how to mitigate them. However, the existence of gender differences in academic attainment represents a highly complex and nuanced phenomenon. National comparisons using standardized test scores as an indicator of achievement reveal that boys generally outperform girls in mathematics, science, and technology (STEM subjects), but underperform comparatively in English language and literacy (Breda, Jouini, & Napp, 2018; Kim, Al Otaiba, Wanzek, & Gatlin, 2015; Reilly, Neumann, & Andrews, 2015, 2017; Sax et al., 2016; Stoet & Geary, 2013). Conversely, research evaluating

teacher-assigned school grades indicates that girls outperform boys in most school subjects (Legewie & DiPrete, 2012; Mulholland, Hansen, & Kaminski, 2004; Pennington, Kaye, Qureshi, & Heim, 2017). Many attempts have been made to explain why assessment format moderates the gender-achievement gap (see Voyer & Voyer, 2014). Specifically, researchers have explored cognitive factors, such as the type of learning involved, and social factors, such as the role of anxiety, confidence, and the salience of gender stereotypes in test settings (Kenney-Benson, Pomerantz, Ryan, & Patrick, 2006; Segool, Carlson, Goforth, Von Der Embse, & Barterian, 2013; Wang & Degol, 2017). Nevertheless, most studies focus on attainment gaps in specific subjects (i.e., girls in mathematics), and few studies explore individual-level factors that may account for gender differences in classroom-based performance (Voyer & Voyer, 2014). Based on theories of achievement motivation (see Elliot & Dweck, 2005, 2007; Elliot, Dweck, & Yeager, 2017), the current study assessed whether gender differences in classroom-assigned English, mathematics, science, and computing grades correspond to similar differences in academic mindset, self-efficacy, self-concept, competence beliefs, global and social self-esteem, and gender stereotype endorsement.

Implicit theories of intelligence propose that *academic mindset* may be a key factor associated with educational achievement (Rattan, Savani, Chugh, & Dweck, 2015). Students with a "fixed mindset" perceive that their abilities are stable traits that cannot be developed, whereas students with a "growth mindset" perceive that abilities can be fostered through effort and persistence (Dweck, 2006, 2008). Research suggests that students who adopt a growth mindset may be more likely to pursue challenges and show resilience to setbacks, which in turn fosters their learning and achievement (Blackwell, Trzesniewski, & Dweck, 2007; Paunesku et al., 2015; Verniers & Martinot, 2015). Moreover, academic mindset seems to be influenced by knowledge of stereotypes which exacerbate perceptions that gender is a fundamental characteristic of ability (Dar-Nimrod & Heine, 2006; Dweck, 2006, 2008; Good, Aronson, & Harder, 2008; Pennington & Heim, 2016). Indeed, adopting a fixed mindset has been shown to have a detrimental impact on girls' interest, participation, and performance in mathematics and science (Burkley, Parker, Stermer, & Burkley, 2010; Huang, Zhang, & Hudson, 2018). This body of work has led to the implementation of interventions that aim to foster academic achievement by teaching students the advantages of espousing a growth mindset (Aronson, Fried, & Good, 2002; Good, Aronson, & Inzlicht, 2003; Good, Rattan, & Dweck, 2012; Paunesku et al., 2015; Yeager et al., 2019; however, see Sisk, Burgoyne, Sun, Butler, & Macnamara, 2018).

Academic mindset has also been shown to positively correlate with *self-efficacy* and *self-concept* (Diseth, Meland, & Breidablik, 2014) to influence educational persistence and attainment (Honicke & Broadbent, 2013; Skaalvik, Federici, & Klassen, 2015). Whereas academic self-efficacy refers to an individual's judgment of their ability to succeed ("Can I do it?" Bandura, 1997; Skaalvik, 1997), academic self-concept reflects an individual's self-perception of their general competence ("Am I good at it?"). Research indicates that girls often report higher academic self-efficacy relative to boys when learning English language and literacy (Kim, Wang, Ahn, & Bong, 2015; Pajares & Valiante, 2001), whereas boys tend to exhibit higher self-efficacy in mathematics, computing, and science (Dai, 2001; Huang, 2013; Preckel, Goetz, Pekrun, & Kleine, 2008; Skaalvik & Skaalvik, 2004). Moreover, stereotypical attitudes pertaining to *gender-subject competence* appear to translate into students' perceptions about their academic self-concept, with girls reporting lower self-concept in mathematics and science and higher self-concept in English (Aronson & Steele, 2007; Chatard, Guimond, & Selimbegovic, 2007; Else-Quest, Hyde, & Linn, 2010; Ireson, Hallam, & Plewis, 2001; Smetackova, 2015). Similarly, girls express higher competence beliefs in English, whereas boys report higher competency in mathematics and science (Andre, Whigham, Hendrickson, & Chambers, 1999; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Rodríguez, Regueiro, Piñeiro, Estévez, & Valle, 2019). As such, the endorsement of gender-subject stereotypes seems to interact with students' personal perceptions of their capabilities to impact adversely upon academic achievement.

Global self-esteem is defined as an individual's positive or negative evaluation of the self (Rosenberg, 1965), and is a more general construct related closely to self-efficacy and self-concept (Chen, Gully, & Dov Eden, 2004; Trautwein, Lüdtke, Köller, & Baumert, 2006). Booth and Gerard (2011) revealed a positive relationship between self-esteem and English, science, and mathematics achievement in both UK and U.S. samples. However, there are inconsistent findings with regards to the directional influence of self-esteem on academic performance (Baumeister, Campbell, Krueger, & Vohs, 2003), which may be a consequence of gender differences in this construct and the malleable nature of self-appraisals during early adolescence (Bleidorn et al., 2016; Wigfield & Eccles, 1994). For example, girls have been found to report lower self-esteem during adolescence compared to boys (Baldwin & Hoffmann, 2002; Bleidorn et al., 2016; Kling, Hyde, Showers, & Buswell, 1999), and whilst an association between self-esteem and academic achievement appears to emerge in the early years of secondary school, it has been found to dissipate in subsequent school years (Alves-Martins, Peixoto, Gouveia-Pereira, Amaral, & Pedro, 2002).

To our knowledge, however, no research has investigated whether *social self-esteem* is an important factor associated with academic achievement. Social self-esteem refers to the importance of social relationships and group membership in bolstering self-worth (Crocker & Quinn, 1998; Jetten et al., 2015) and, given the social nature of the school climate, it is plausible that this construct relates positively to academic achievement. Furthermore, it is conceivable that gender differences may emerge in social self-esteem during secondary school because, at this life stage, adolescent girls tend to be more self-conscious of evaluation (Rankin, Lane, Gibbons, & Gerard, 2004; Rosenberg & Simmons, 1975) and place higher value on social relationships and support (Brutsaert, 1990; Clancy & Dollinger, 1993). Indeed, a recent qualitative study found that social persuasion and comparison emerge as key themes when exploring students' confidence in mathematics and English skills, with girls describing the influence of social sources more often than boys (Butz & Usher, 2015).

A wealth of research also proposes that, through socialization processes, children learn to endorse *gender-stereotypes* pertaining

to different performance domains (i.e., "girls are bad at math"), which may impact upon their related academic performance, participation, and interest (Beyer, 2014; Breda et al., 2018; Makarova, Aeschlimann, & Herzog, 2019; Nosek et al., 2009). Both parents and teachers have been shown to endorse gender-subject stereotypes that translate into students' endorsement of boys' better ability in STEM subjects and girls' better ability in English language and literacy (Andre et al., 1999; Bleeker & Jacobs, 2004; Muenks, Grossnickle-Peterson, Green, Kolvoord, & Uttal, 2020; Muntoni & Retelsdorf, 2019). In turn, the theory of stereotype threat suggests that being judged in the light of a negative stereotype can undermine performance and aspirations in the associated domain (Good, Woodzicka, & Wingfield, 2010; Hartley & Sutton, 2013; Huguet & Régner, 2007; Pansu et al., 2016). The pervasive nature of gender stereotypes has, therefore, been suggested to contribute to women's underrepresentation in STEM-related subjects and fields (Cundiff, Vescio, Loken, & Lo, 2013; Garriott, Hultgren, & Frazier, 2017; Master, Sapna, & Meltzoff, 2016; Reuben, Sapienza, & Zingales, 2014).

2 | RESEARCH OVERVIEW

A wealth of research has uncovered various factors that might explain differences between girls' and boys' academic attainment. Most research, however, has focused on assessing gender-achievement gaps in standardized test settings, with little research assessing the factors that might bring about gender differences in classroom-based assignments. Moreover, research tends to focus on specific school subjects (e.g., girls in maths), and there is a relative dearth of literature that assesses boys' scholastic attitudes and associated attainment. The current study therefore aimed to examine whether gender differences emerged in secondary school students' classroom grades and assessed further whether any observed gender-achievement gaps parallel differences in self-perceptions and scholastic attitudes. Across two studies, an independent sample of first-year (Study 1) and second-year (Study 2) secondary school students completed a questionnaire measuring mindset, academic self-efficacy, self-concept, global and social self-esteem, and gender-subject and career stereotype endorsement. These responses were then matched to their academic attainment in English, mathematics, science, and computing; school subjects in which gender differences have been previously documented.

3 | STUDY 1

3.1 | Method

3.1.1 | Participants

First-year secondary school students (n = 204, Year 7; 11–12 years of age) were recruited from a comprehensive secondary school in the United Kingdom (equivalent to high school in the United States). Of this initial sample, 17 students were removed from the final data set due to not completing the questionnaire (n = 7) or missing attainment grades (n = 10). This resulted in a final sample of 187 students (92 girls; 98.9% White British), with 19.3% having a diagnosis of Special Educational Needs and 3.7% receiving free school meals; none of which differed significantly as a function of gender. The study was approved by the Faculty Research Ethics Committee and adheres to the ethical guidelines outlined in the Declaration of Helsinki. The raw anonymized data set and questionnaire is publicly available: https://osf.io/t7jq6/.

3.2 | Measures

3.2.1 | Mindset

Mindset was assessed using eight questions adapted from the mindset literature (Dweck, 2006, 2008; Dweck, Chiu, & Hong, 1995). Students responded to questions such as "I embrace challenges" on a 6-point Likert scale between 1 (Strongly Disagree) and 6 (Strongly Agree). One item ("I learn from criticism") was removed to increase internal reliability (Cronbach's $\alpha = 0.65$). A total score was then computed by summing the remaining seven questions with higher scores indicative of a growth-ability mindset.

3.2.2 | Academic self-efficacy

Academic self-efficacy was measured using an adapted version of the *Academic Self-efficacy Scale* (ASES; Schmitt, 2008). Students responded to 4-items such as "I believe I can achieve good grades at school" on a 5-point Likert scale between 1 (Strongly Disagree) and 5 (Strongly Agree). The scale resulted in acceptable internal reliability in the current study after one item ("I worry that I won't be successful in school") was removed (a = 0.78). A total score was computed by summing up the items with higher scores corresponding with higher self-efficacy.

3.2.3 | Academic self-concept

Academic self-concept was measured using questions adapted from Marsh (1990, 1993). Specifically, students' perceptions of their self-concept in English, mathematics, and science[1] subjects were assessed. A series of 11 statements such as "I learn things quickly in English class" and "Mathematics is not one of my best subjects" were rated on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). A total score was then derived for each of the subject subscales, which all resulted in high internal consistency (English; a =

[1]As a result of human error, questions relating to academic self-concept and personal competence beliefs in computing were inadvertently omitted from the questionnaire battery.

0.81, mathematics, $a = 0.85$, science, $a = 0.89$). Higher scores correspond to higher academic self-concept.

3.2.4 | Competence beliefs

Competence beliefs were assessed using an adapted scale from Andre et al. (1999). Students responded to single items for each focal school subject. Questions began with the statement "I am good at…" with the three subjects of English, mathematics, and science affixed to the end. Responses were recorded on a 5-point Likert scale anchored between 1 (Not good at all) and 5 (Really good) and single items were analyzed for each respective subject grade. Higher scores correspond to higher competence beliefs.

3.2.5 | Global self-esteem

The *Self-Esteem Scale* (Rosenberg, 1965) was used to assess global self-esteem. Students responded to 10-items such as "I have a number of good qualities" on a 4-point Likert scale anchored between 0 (Strongly Disagree) and 3 (Strongly Agree). This measure resulted in acceptable internal consistency in the current study ($a = 0.75$) and a total score was computed. Higher scores correspond to higher global self-esteem.

3.2.6 | Social self-esteem

Social self-esteem was assessed using the *Approval of Others* sub-scale of the Contingencies of self-worth scale (see Crocker, Luhtanen, Cooper, & Bouvrette, 2003; Crocker & Quinn, 1998). Students responded to 10-items such as "It is important to me to be well thought of by others" with responses recorded on a 5-point Likert scale between 1 (Strongly Disagree) and 5 (Strongly Agree). This measure resulted in acceptable internal consistency in the current sample ($a = 0.76$) and a total score was computed. Higher scores correspond with higher social self-esteem.

3.2.7 | Stereotype endorsement

Perceptions of gender-subject and gender-career stereotypes were assessed using an adapted scale from Andre et al. (1999):

Gender-subject stereotypes

Students responded to four questions relating to their endorsement of gender-subject stereotypes in English, mathematics, science, and computing (e.g., "Overall, do you think boys or girls are better at English?"). Responses were recorded on a 9-point Likert scale anchored between 1 (Girls better) and 9 (Boys better) with the mid-point labeled to denote a neutral response (5 = No difference between boys and girls). Individual items were analyzed separately for each respective subject. Here, scores above the mid-point correspond with the perception that boys perform better than girls within a certain subject.

Gender-career stereotypes

Students responded to four questions such as "Who works in jobs that use a lot of English?" with the same four subjects included at the end of each statement. Responses were recorded on a 9-point scale between 1 ("Mostly women") and 9 ("Mostly men"), with the midpoint labeled to denote a neutral response (5 = No difference/equal numbers of men and women). Individual items were analyzed separately for each respective subject. Scores above the mid-point correspond to the perception that men are mostly present within a certain career.

TABLE 1 Subject-specific attainment levels re-coded into ordinal classifications

	Classification/Grouping		
	Lower (−)	Middle	Upper (+)
Level 1	1	2	3
Level 2	4	5	6
Level 3	7	8	9
Level 4	10	11	12

3.2.8 | Academic attainment

Academic attainment was measured using a metric of Grade Point Average (GPA) in the school subjects of English, science, mathematics, and computing. Here, students were given a categorical grade provided by the teachers using National Curriculum guidelines and professional judgment. For the purpose of our statistical analyses, these categorical grades were transformed into ordinal grades from 1 (Level 1 Lower) to 12 (Level 4 Upper; See Table 1), with higher scores representing higher grades.

3.3 | Procedure

Upon obtaining parental and personal informed consent, students were invited to take part in a study exploring their school-related attitudes. They completed a questionnaire battery that measured mindset, academic self-efficacy, self-concept, competence beliefs, global self-esteem, social self-esteem, and endorsement of gender-subject and career stereotypes. Questionnaire wording was adapted so that they were age-appropriate and targeted the specific school subjects of interest. The questionnaire took approximately 30 min to complete during form time, and school tutors were on hand to answer any questions. Students' responses on the questionnaire were then matched with their respective attainment scores for the subjects of English, mathematics, science, and computing.

3.4 | Results

3.4.1 | Analytic strategy

In accordance with guidelines by Tabachnick and Fidell (2013), missing values for each questionnaire (<10%) were replaced with the mean for the corresponding question item.

The analysis strategy followed an exploratory data-driven approach: First, ordinal logistic regression (PLUM procedure) was conducted to explore gender differences in academic attainment. Second, a Multivariate Analysis of Variance (MANOVA) was conducted to explore gender differences in scholastic attitudes, with simple main effects elucidated using Bonferroni-corrected pairwise comparisons. Finally, given initial findings, bivariate correlational analyses were conducted with 1,000 bootstraps to examine general relationships between scholastic attitudes and academic attainment.

Gender differences in academic attainment

Findings indicated that gender significantly predicted English performance, with girls outperforming boys with an odds ratio of 2.73 (95% CI, 1.63 to 4.58), $\widehat{B} = 1.00$, Wald $\chi^2(1) = 14.43$, $p < .001$, $R^2 = 8\%$. Gender did not significantly predict grades in mathematics, science or computing, all $p > .05$. Table 2 presents the regression matrix.

TABLE 2 Regression matrix with gender as a predictor of academic attainment for first-year students (11–12 years)

			95% CI for Odds ratio		
Predictor: gender	$\widehat{B}$ **(SE)**	**Wald**	**Lower**	**OR**	**Upper**
English	1.00 (0.26)***	14.43	1.63	2.73	4.58
Mathematics	0.45 (0.26)	3.10	0.95	1.57	2.61
Science	0.20 (0.26)	0.58	0.74	1.22	2.01
Computing	0.41 (0.26)	2.45	0.90	1.51	2.52

Note: Gender was coded 1 = Female, 2 = Male.
***$p < .001$.

TABLE 3 Descriptive statistics of scholastic attitudes in the first year as a function of students' gender

		Boys	
	Girls	***M* (*SD*)**	**Total**
Mindset	31.21 (4.62)	31.47 (4.24)	31.34 (4.42)
Academic self-efficacy	10.94 (2.01)	11.38 (1.60)	11.17 (1.82)
Academic self-concept			
English	10.12 (2.63)	10.58 (2.56)	10.35 (2.60)
Maths	13.46 (3.40)	14.43 (3.39)	13.95 (3.42)
Science	12.67 (3.49)	13.21 (4.07)	12.95 (3.80)
Competence beliefs			
English	3.70 (0.90)	3.54 (0.95)	3.62 (0.93)
Maths	3.70 (0.83)	3.86 (0.93)	3.79 (0.88)
Science	3.24 (1.02)	3.30 (1.09)	3.27 (1.05)
Global self-esteem	18.33 (3.78)[a]	19.45 (3.51)[a]	18.89 (3.68)
Social self-esteem	28.48 (4.22)	27.42 (5.26)	27.94 (4.79)
Gender-subject stereotypes			
English	4.52 (1.02)	4.45 (1.21)	4.49 (1.12)
Maths	5.00 (0.83)	4.86 (1.04)	4.93 (0.94)
Science	5.30 (1.02)	5.20 (1.10)	5.25 (1.06)
Computing	5.54 (1.07)	5.86 (1.26)	5.71 (1.18)
Gender-career stereotypes			
English	4.48 (1.16)	4.40 (0.99)	4.44 (1.08)
Maths	5.52 (1.90)	5.45 (1.20)	5.49 (1.19)
Science	5.76 (1.13)[b]	5.36 (1.16)[b]	5.56 (1.16)
Computing	5.99 (1.25)	5.95 (1.30)	5.97 (1.27)

Note: Common sub-scripts denote statistically significant differences, $p < .05$.

Gender differences in scholastic attitudes

A MANOVA was conducted to explore gender differences in scholastic attitudes. Findings indicated that there was a significant main effect of gender on scholastic attitudes, $F(18, 166) = 1.72$, $p = .040$, Wilks $\Lambda = 0.84$, $\eta_p^2 = 0.16$. Pairwise comparisons indicated that girls reported lower global self-esteem ($M = 18.33$, $SD = 3.78$) compared to boys ($M = 19.45$, $SD = 3.51$), $F(1, 185) = 4.43$, $p = .037$, $d = 0.31$. Girls also endorsed greater gender-career stereotypes in science, perceiving that there were more men in these careers, compared to boys ($M = 5.36$, $SD = 1.16$), $F(1, 185) = 5.79$, $p = .017$, $d = 0.35$. All other measured attitudes did not significantly differ by gender (all $p > .05$). Table 3 presents the descriptive statistics for all measures.

Relationship between scholastic attitudes and academic attainment

The initial analyses revealed that although girls outperformed boys in English, there were no corresponding gender differences in academic mindset, self-efficacy, self-concept, competence beliefs or social self-esteem. Instead, girls reported *lower* global self-esteem and greater endorsement of gender-science stereotypes. Given this pattern of results, we therefore examined general relationships between scholastic attitudes and academic attainment and assessed further whether these relationships were moderated by gender. Findings indicated a weak positive relationship between mindset and academic attainment in English ($r = .22$, $p < .01$), mathematics ($r = .25$, $p < .001$), science ($r = .18$, $p < .05$), and computing ($r = .23$, $p < .01$). There was also a weak positive relationship between academic self-efficacy and attainment in English ($r = .15$, $p < .05$), mathematics ($r = .23$, $p < .01$), science ($r = .23$, $p < .01$), and computing ($r = .14$, $p < .05$). There was a moderate positive relationship between academic self-concept in English and corresponding attainment ($r = .41$, $p < .001$), and a strong relationship between academic self-concept and corresponding attainment in mathematics ($r = .50$, $p < .001$) and science ($r = .54$, $p < .001$). There was also a moderate positive relationship between competence beliefs and corresponding attainment in English ($r = .46$, $p < .001$), and mathematics ($r = .44$, $p < .001$) and a strong positive relationship between competence beliefs and corresponding attainment in science ($r = .54$, $p < .001$). There was a weak positive relationship between social self-esteem and English attainment ($r = .17$, $p < .05$). Importantly, gender was not found to moderate any of these relationships, all $p > .05$. Finally, we assessed the relationship between the endorsement of gender-subject and career stereotypes as a function of gender. Findings indicated a weak negative relationship between girls' subject stereotype endorsement in science and their respective attainment ($r = -.24$, $p < .05$). All other relationships were nonsignificant ($p > .05$). Table 4 presents the correlation matrix.

3.5 | Discussion

Findings from Study 1 revealed that gender predicted English attainment, with girls outperforming boys within their first year of secondary school. This is consistent with prior research documenting a female advantage in classroom assigned grades in English language and literacy (Legewie & DiPrete, 2012; Mulholland et al., 2004; Pennington et al., 2017). In contrast with previous research (Pennington et al., 2017), however, no significant gender differences were found in classroom-assigned grades for mathematics, science, and computing. Moreover, girls' relatively better performance in English did not appear to correspond with gender differences in scholastic attitudes. Instead, girls recounted *lower* global self-esteem compared to boys in their first year of secondary school, which supports past research demonstrating this gender difference in adolescence (Alves-Martins et al., 2002; Baldwin & Hoffmann, 2002; Bleidorn et al., 2016; Kling et al., 1999). Counter to prior research (Booth & Gerard, 2011), however, global self-esteem

TABLE 4 Relationships between scholastic attitudes and academic attainment in English, maths, science, and computing in first-year secondary school students

	Attainment			
	English	Maths	Science	Computing
Mindset	0.22**	0.25***	0.18*	0.23**
Academic self-efficacy	0.15*	0.23**	0.23**	0.14
Academic self-concept[1]	0.41***	0.50***	0.54***	–
Competence beliefs[1]	0.46***	0.44***	0.59***	–
Global self-esteem	0.06	0.12	0.07	0.01
Social self-esteem	0.17*	0.05	0.10	0.06
Subject stereotyping (girls)	0.07	0.07	−0.24*	−0.04
Subject stereotyping (boys)	−0.08	0.08	−0.002	0.01
Career stereotyping (girls)	0.005	0.05	−0.18	0.14
Career stereotyping (boys)	0.01	−0.05	0.15	0.07

[1]Of respective study subject. Subject and career stereotyping were analyzed as a function of gender because the endorsement of gender-related stereotypes (i.e., boys are better at mathematics) is likely to have different directional relationships on attainment.

***$p < .001$; **$p < .01$; *$p < .05$.

did not appear to be related to academic attainment in English for either girls or boys. This suggests that self-esteem may reflect a more general construct regarding positive and negative evaluations of the self that may not be associated with educational attainment (see Rosenberg, 1965; Trautwein et al., 2006). Furthermore, girls reported greater endorsement of gender-subject stereotypes in science (i.e., boys perform better than girls) compared to boys, which was found to be related negatively to their respective science attainment. This aligns with prior research (Good et al., 2010), suggesting that the endorsement of negative gender stereotypes might have an adverse impact on performance in science.

These unexpected findings are important because they highlight that gender differences in academic attainment may not be present across all school subjects. Moreover, girls' advantage in English relative to boys does not appear to be explained by corresponding gender differences in academic mindset, self-efficacy, self-concept, competence beliefs, social self-esteem or endorsement of gender-subject and career stereotypes. In order to corroborate these findings, Study 2 explored whether similar patterns of achievement and attitudes emerge in an independent sample of students in their second year of secondary school. This allowed us to explore whether gender differences in academic achievement and scholastic attitudes are stable across different school years, as well as assessing which of our measured factors reliably relate to academic attainment.

4 | STUDY 2

4.1 | Method

4.1.1 | Participants

Participants were 129 second-year students (Year 8; 12–13 years of age) recruited from the same comprehensive secondary school as Study 1. Of this initial sample, 16 students were removed from the final data set for not completing the questionnaire ($n = 14$) or due to missing attainment grades ($n = 2$). A final sample of 113 students (59 girls, 54 boys; 95.6% White British) was entered into the final analyses, with 17.7% having a diagnosis of Special Educational Needs and 5.3% receiving free school meals; both of which did not differ significantly by gender.

4.2 | Measures and procedure

The procedure was identical to that of Study 1 and internal reliabilities were acceptable for all measures (Cronbach's $a > 0.70$). Students' grades, however, were measured using a different metric in accordance with updated National Curriculum levels. Specifically, whilst first-year (Year 7) grades were marked by teachers on an ordinal scale between −1 and +4 (with higher numbers denoting higher grades and plus and minus numbers denoting lower and upper categories), students' grades in second-year (Year 8) were graded from Level 1 to 8 alongside new qualitative descriptors (The National Curriculum, 2010). According to these guidelines, Levels 4/5 represent expectations for most 12–13 year olds, wither higher levels corresponding to higher achievement. Each of these levels was also split into three ability categories (A, B, C) based on teachers' professional judgment. For the purpose of statistical analyses, these grades were re-coded from categorical scores to ordinal scores on a scale ranging from 1 (Level 3A; lowest grade) to the highest obtained level of 15 (Level 7A; see Table 5).

TABLE 5 Subject-specific attainment levels based on national curriculum guidelines, re-coded into ordinal classifications

	Classification/Grouping		
	Lower (C)	Middle (B)	Upper (A)
Level 3	1	2	3
Level 4	4	5	6
Level 5	7	8	9
Level 6	10	11	12
Level 7	13	14	15

4.3 | Results

4.3.1 | Gender differences in academic attainment

Ordinal logistic regression was conducted to explore whether gender predicted differences in academic attainment across the subjects of English, mathematics, science, and computing. Findings indicated that gender significantly predicted mathematics performance, with girls outperforming boys with an odds ratio of 2.78 (95% CI, 1.42–5.44), $\widehat{B} = 1.02$, Wald $\chi^2(1) = 8.86$, $p = .003$, $R^2 = 8\%$. However, gender did not significantly predict performance in English, science, or computing. Table 6 presents the regression matrix.

4.3.2 | Gender differences in scholastic attitudes

A MANOVA was then conducted to explore gender differences in scholastic attitudes. Findings indicated that there was a significant main effect of gender on scholastic attitudes, $F(18, 94) = 2.02$, $p = .017$, Wilks $\Lambda = 0.72$, $\eta_p^2 = 0.28$. Girls reported lower mathematics self-concept ($M = 13.39$, $SD = 3.68$) compared to boys ($M = 15.89$, $SD = 3.06$), $F(1,111) = 15.23$, $p < .001$, $d = 0.74$. Similarly, they reported lower competence beliefs in mathematics ($M = 3.75$, $SD = 0.90$) compared to boys ($M = 4.17$, $SD = 0.69$), $F(1, 111) = 7.63$, $p < .01$, $d = 0.52$. In addition, girls reported lower self-concept in science ($M = 12.93$, $SD = 3.43$) compared to boys ($M = 14.66$, $SD = 3.32$), $F(1, 111) = 7.46$, $p < .01$, as well as lower competence beliefs ($M_{girls} = 3.58$, $SD = 0.83$, $M_{boys} = 3.91$, $SD = 0.83$), $F(1,111) = 4.46$, $p = .037$, $d = 0.40$. Conversely, girls reported higher competence beliefs in English ($M = 4.00$, $SD = 0.79$) compared to boys ($M = 3.61$, $SD =$

TABLE 6 Ordinal regression matrix with gender as a predictor of academic attainment for Year 8 students (12–13 years)

			95% CI for Odds ratio		
Predictor: gender	$\widehat{B}$ **(SE)**	**Wald**	**Lower**	**OR**	**Upper**
English	−0.35 (0.33)	1.11	0.37	0.71	1.35
Maths	1.02 (0.34)**	8.86	1.41	2.78	5.44
Science	−09 (0.33)	0.08	0.48	0.91	1.74
Computing	0.17 (0.34)	0.26	0.61	1.19	2.31

Note: Gender was coded 1 = Female, 2 = Male.
**$p < .01$.

TABLE 7 Descriptive statistics of scholastic attitudes in the second year as a function of students' gender

		Boys	
	Girls	***M* (*SD*)**	**Total**
Mindset	31.89 (4.39)	32.22 (4.27)	32.04 (4.32)
Academic self-efficacy	14.88 (2.34)	15.39 (2.12)	15.12 (2.24)
Academic self-concept			
English	11.21 (2.13)	10.93 (2.30)	11.08 (2.21)
Maths	13.39 (3.68)[a]	15.89 (3.06)[a]	14.58 (3.61)
Science	12.93 (3.43)[b]	14.66 (3.32)[b]	13.76 (3.47)
Competence beliefs			
English	4.00 (0.79)[c]	3.61 (0.81)[c]	3.81 (0.82)
Maths	3.75 (0.90)[d]	4.17 (0.69)[d]	3.95 (0.83)
Science	3.58 (0.83)[e]	3.91 (0.83)[e]	3.73 (0.85)
Global self-esteem	18.42 (4.15)	19.69 (3.31)	19.03 (3.81)
Social self-esteem	31.83 (6.09)	30.87 (5.42)	31.37 (5.77)
Gender-subject stereotypes			
English	4.29 (1.10)	4.47 (0.88)	4.38 (1.00)
Maths	5.27 (1.10)	5.60 (1.22)	5.43 (1.16)
Science	5.49 (0.84)	5.49 (0.98)	5.49 (0.91)
Computing	5.69 (1.19)	5.64 (1.21)	5.67 (1.20)
Gender-career stereotypes			
English	4.33 (1.32)	4.36 (0.99)	4.34 (1.17)
Maths	5.90 (1.23)	5.87 (1.15)	5.88 (1.19)
Science	5.40 (1.24)	5.38 (0.83)	5.39 (1.06)
Computing	5.66 (1.20)	5.77 (1.11)	5.71 (1.15)

Note: Common sub-scripts denote statistically significant differences, $p < .05$.

0.81), $F(1, 111) = 6.68$, $p = .011$, $d = 0.49$. All other measures did not differ significantly by gender, all $p > .05$. Table 7 presents the descriptive statistics for all measures.

4.3.3 | Relationships between scholastic attitudes and academic attainment

The initial analyses revealed a gender-achievement gap in mathematics with girls outperforming boys, but this did not appear to correspond with gender differences in scholastic attitudes, with girls reporting significantly *lower* mathematics self-concept and competence beliefs relative to boys. Given these findings, we turned to examine general relationships between scholastic attitudes and academic attainment, as well as assessing whether these were moderated by gender.

Correlational analyses indicated that there was a weak positive relationship between mindset and English ($r = .21$, $p < .05$) and science attainment ($r = .21$, $p < .05$). There was a moderate positive relationship between academic self-efficacy and English attainment ($r = .30$, $p < .01$), and a weak positive relationship between academic self-efficacy and mathematics ($r = .19$, $p < .05$) and science attainment ($r = .27$, $p < .05$). There was a moderate positive relationship between academic self-concept in science and respective attainment ($r = .47$, $p < .001$), and a strong positive relationship between

competence beliefs in science and respective attainment ($r = .56$, $p < .001$). There was also a weak positive relationship between competence beliefs in English and respective attainment ($r = .23$, $p < .05$). There was a weak positive relationship between social self-esteem and attainment in English ($r = .29$, $p < .01$), mathematics ($r = .28$, $p < .01$), science ($r = .25$, $p < .01$) and computing ($r = .26$, $p < .01$). Gender was not found to moderate any of these relationships, all $p > .05$. Last, we assessed the relationship between the endorsement of gender-subject and career stereotypes as a function of gender. There was a moderate negative relationship between boys' subject stereotype endorsement in English (i.e., girls do better) and their respective performance ($r = -.31$, $p < .01$), and a weak positive relationship between their subject stereotype endorsement in mathematics (i.e., boys do better) and their performance ($r = .31$, $p < .01$). Unexpectedly, there was a moderate positive relationship between girls' gender career stereotype endorsement in mathematics, science, and computing (i.e., more men present in these careers) and their respective attainment mathematics ($r = .31$, $p < .05$), science ($r = .32$, $p < .05$) and computing ($r = .36$, $p < .05$). Table 8 presents the correlation matrix.

4.4 | Discussion

Findings from Study 2 revealed a significant gender-achievement gap in mathematics attainment, with girls outperforming boys in their second year of secondary school. Again, this is consistent with prior research using classroom assigned grades (Legewie & DiPrete, 2012; Mulholland et al., 2004; Pennington et al., 2017), which contrasts with findings from standardized tests (Voyer & Voyer, 2014). In contrast to Study 1, however, gender did not predict English attainment nor attainment in science or computing. This finding suggests that gender differences in attainment may fluctuate across different school subjects and between school years. Moreover, findings from Study 2 reveal that, despite achieving higher grades, girls reported *lower* academic self-concept and competence beliefs in mathematics compared to boys. Girls also reported lower academic self-concept and competence beliefs in science and higher competence beliefs in English compared to boys. Such findings are consistent with earlier research indicating that adolescent girls report lower academic self-concept and competence beliefs in mathematics and science (Dai, 2001; Huang, 2013) and higher competence beliefs in English (Andre et al., 1999). Surprisingly, however, academic self-concept and competence beliefs were not significantly related to mathematics attainment, and this relationship was not moderated by gender. This may suggest that other factors explain the gender-achievement gap between girls and boys in mathematics, such as engagement with learning, motivation, and interest, as well as teacher's own learning strategies and performance expectations (see Lee & Stankov, 2018; Meyer, Fleckenstein, Retelsdorf, & Köller, 2019; Spinath, Freudenthaler, & Neubauer, 2010).The general discussion now turns to a more detailed explanation of these findings, highlighting implications and avenues for future research.

5 | GENERAL DISCUSSION

The aim of the current study was to explore whether gender differences emerge in secondary school students' classroom assigned grades and whether these parallel self-perceptions and scholastic attitudes. Here we focused on girls' and boys' academic attainment in English, mathematics, science, and computing; school subjects in which gender-achievement gaps are typically documented (e.g., Kim, Al Otaiba, et al., 2015; Reilly, Neumann, & Andrews, 2015, 2017; Sax et al., 2016; Stoet & Geary, 2013). Guided by the achievement motivation literature (see Elliot & Dweck, 2007; Elliot et al., 2017), we focused on academic mindset, self-efficacy, self-concept, competence beliefs, self-esteem and gender-subject and career stereotype endorsement.

TABLE 8 Relationships between scholastic attitudes and academic attainment in English, maths, science, and computing in second-year secondary school students

	Attainment			
	English	Maths	Science	Computing
Mindset	0.21*	0.15	0.21*	0.10
Academic self-efficacy	0.30**	0.19*	0.27**	0.17
Academic self-concept[1]	0.10	0.05	0.47***	–
Competence beliefs[a]	0.23*	0.12	0.56***	–
Global self-esteem	0.05	0.04	0.15	0.10
Social self-esteem	0.29**	0.28**	0.25**	0.26**
Subject stereotyping (girls)	0.08	0.16	0.13	0.10
Subject stereotyping (boys)	−0.31*	0.31*	0.03	−0.04
Career stereotyping (girls)	0.11	0.31*	0.32*	0.36**
Career stereotyping (boys)	−0.19	0.20	0.20	0.03

[a] As a result of human error, questions relating to academic self-concept and personal competence beliefs in computing were inadvertently omitted from the questionnaire battery.

***$p < .001$; **$p < .01$; *$p < .05$.

Findings from Study 1 revealed that gender was a significant predictor of English attainment with girls outperforming boys within their first year of high school. This converges with previous research documenting a female advantage in English language (Kim, Al Otaiba, et al., 2015), particularly with regards to classroom assigned grades (Pennington et al., 2017; Voyer & Voyer, 2014). Nevertheless, this achievement gap did not correspond with gender differences in mindset, academic self-efficacy, self-concept, and competence beliefs. Whilst girls reported lower global self-esteem, this was not found to be related to academic attainment, suggesting that this construct may reflect general self-worth (Rosenberg, 1965; Trautwein et al., 2006). These findings therefore suggest that other (unmeasured) factors may explain the observed gender-achievement gap in English for first-year secondary students, which may include non-cognitive factors such as engagement with learning, homework and feedback, planned behavior, personality traits, and vocational interest (see Lee & Stankov, 2018; Meyer et al., 2019; Spinath et al., 2010; Stoet & Geary, 2018; Wang, Eccles, & Kenny, 2013). Future research would benefit from assessing these potential predictors in order to develop effective learning strategies that bolster boys' performance in this domain.

However, somewhat surprisingly, a different pattern of gender differences in academic achievement emerged in students' second year of secondary school. At this stage, gender significantly predicted attainment in mathematics with girls outperforming boys but a gender-achievement gap was not observed in English, science, and computing. This highlights the complex and nuanced nature of gender-achievement gaps, suggesting that these may not be observed consistently for school subjects across school years. Similarly, there were differences in scholastic attitudes between school years too; despite girls outperforming boys in mathematics, they reported *lower* academic self-concept and competence beliefs in both mathematics and science in their second year. At first glance this may seem like a paradoxical finding; however, past research has consistently shown that girls report lower mathematics self-concept and competence beliefs even when they perform similarly to boys (Else-Quest et al., 2010). One explanation for this is that girls' self-concept and competence beliefs in mathematics are influenced by gender-role socialization processes, such as parents and teachers' expectations of subject-specific performance and gender stereotyping (Bleeker & Jacobs, 2004; Fredricks & Eccles, 2002; Muenks et al., 2020; Muntoni & Retelsdorf, 2019; Tiedemann, 2000, 2002). Such assertion is underpinned by the gender intensification theory (Hill & Lynch, 1983), which posits that adolescents experience pressure to conform to gender stereotypes and this influences their confidence and interests in academic subjects. Consequently, girls tend to report less positive perceptions about male-stereotyped domains, such as STEM, and boys appear to report less positive views of female-stereotyped domains, such as English language (Nagy et al., 2010). A second explanation posits that boys may overstate their ability relative to girls in early education and adapt these perceptions overtime after receiving feedback (Fredricks & Eccles, 2002; Jacobs et al., 2002; Nagy et al., 2010). As such, it is plausible that gender differences in academic self-concept may emerge because girls might not overestimate their capabilities to the same extent as boys in their early school years.

It is important to question why we found minimal evidence of gender-achievement gaps given prior research in this area (e.g., Legewie & DiPrete, 2012; Mulholland et al., 2004; Pennington et al., 2017). First, this was a relatively small-scale study with findings derived from one UK comprehensive school. Different results may therefore emerge in other schools due to environmental, socioeconomic, and cultural differences. Furthermore, it is plausible that different schools implement diverse teaching strategies and interventions that may exacerbate or reduce gender-achievement gaps. Indeed, it is positive that we found few gender differences between girls' and boys' academic attainment and scholastic attitudes and this might reflect upon the school's own efforts to foster learning equality. However, work is needed to improve boys' academic performance over school years to afford educational equity. With this in mind, we turn next to reflect on the relationships found between scholastic attitudes and academic attainment, as educational strategies that foster these may improve academic performance.

Across school years, mindset correlated positively with English and science attainment, suggesting that a growth ability mindset is associated with better performance. This may suggest that leveraging a growth mindset particularly early on within school years can promote academic performance (see Rattan et al., 2015; Yeager et al., 2019). This could be implemented through interventions that aim to encourage effort, persistence, and resilience. Furthermore, academic self-efficacy positively correlated with English, mathematics, and science attainment, and competence beliefs correlated positively with English and science attainment. As such, fostering students' perceptions of success and judgments of their own capabilities may result in positive educational outcomes (Honicke & Broadbent, 2013; Skaalvik et al., 2015). Diverse relationships were also found between scholastic attitudes and academic attainment between the first and second year of secondary school. This might reflect the different influences of self-perceptions and school-related attitudes on performance across students' developmental trajectory. Specifically, whilst social self-esteem was only positively correlated with English attainment in the first year (11–12 years), it was positively related to attainment across *all* school subjects in the second year (12–13 years). Indeed, research indicates that children become more self-conscious during adolescence (Bowker & Rubin, 2009), and place increasing value on social support with other's perceptions becoming a source of self-worth. In turn, this social-comparative information seems to inform perceptions of their own capabilities with greater social self-esteem impacting positively on educational outcomes (see also Brutsaert, 1990; Butz & Usher, 2015; Clancy & Dollinger, 1993).

Furthermore, the endorsement of subject-gender and career stereotypes was associated with girls' and boys' attainment in

their second year. Here, boy's endorsement of subject-gender stereotypes in English negatively correlated with their English attainment, whilst endorsement of mathematics stereotypes positively correlated with their mathematics attainment. This is supported by prior experimental research demonstrating that boys' endorsement of gender stereotypes in English has a detrimental impact on their performance ("stereotype threat"; Hartley & Sutton, 2013; Huguet & Régner, 2007; Pansu et al., 2016). Future research should focus on ways to reduce negative gender stereotypes to lessen the potential impact these have on educational interests and performance. Unexpectedly, however, girls' endorsement of gender-career stereotypes (i.e., more men in STEM careers) was positively associated with their mathematics, science, and computing attainment. One potential reason for this is that girls may be motivated to disprove negative gender-maths stereotypes and consequently apply more effort to excel in this subject ("stereotype lift"; see Davies, Conner, Sedikides, & Hutter, 2016; Franceschini, Galli, Chiesi, & Primi, 2014).

6 | CONCLUSION

The current study explored the extent to which gender differences emerge in secondary school students' classroom assigned grades and whether these parallel self-perceptions and scholastic attitudes. Our findings reveal that girls outperformed boys in English in their first year of secondary school and outperformed boys in mathematics in their second year. Against expectations, however, these observed achievement gaps did not correspond with similar differences in mindset, academic self-efficacy, self-concept, competence beliefs, global or social self-esteem and gender stereotype endorsement. Instead, girls reported lower global self-esteem in their first year, whereas they reported lower self-concept and competence beliefs in science and maths and higher competence beliefs in English in their second year. These findings therefore suggest that both gender-achievement gaps in academic performance and scholastic attitudes vary between school subjects across school years, demonstrating their complex and nuanced nature. Teachers and educationalists should remain mindful of this when developing strategies to reduce gender-achievement gaps as "one intervention may not fit all." Further, research should focus on additional factors that may explain gender differences in academic achievement more reliably, such as subject interest and engagement with learning and feedback, as well as the influence of teacher engagement, learning strategies, and performance evaluations.

CONFLICT OF INTERESTS

There are no conflicts of interest to report with respect to this research. This research was undertaken in collaboration with a UK school and the authors of this paper did not receive payment or any beneficiary for their work.

DATA AVAILABILITY STATEMENT

The raw anonymized dataset is available via the Open Science Framework: https://osf.io/t7jq6/.

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