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Who feels academically efficacious? Moving beyond the gender binary

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The goal was to explore global and domain-specific academic motivation using fine-grained assessments of *self-social gender identity*, specifically, early adolescent students' ratings of "gender similarity," that is, how similar they feel to the two major gender collectives. From these assessments, four profiles of gender identity were generated and were used to explore how variations in profiles related to both general and specific academic motivation. Participants included an ethnically/racially diverse community sample of binary-identified children ($n = 1,642$; 47% girls; $M_{\text{age}} = 9.05$, $SD = 0.91$) in Grades 3 to 5 from 77 classrooms in eight elementary schools. Analyses revealed that global motivation was significantly higher for students who reported feeling similar to one or both gender collectives, and lowest for those who reported low feelings of similarity to both gender collectives. Specific motivation in gender-specific domains showed a different pattern: students who feel similar to the gender expected to succeed in the academic domain did not show higher motivation in those gender-stereotyped academic domains. The findings suggest that the *self-social gender identity* is important for understanding global academic motivation but less so for understanding academic motivation in specific gender-stereotypic domains such as reading and math/science.

KEYWORDS

gender identity, gender similarity, academic motivation, academic gender stereotypes, gender

Introduction

In Western countries, where many classes are coeducational, noticing, studying, and understanding differences and similarities in academic success between students who are girls and boys have long been of interest to educators and have been monitored with national and international reports (U.S. Department of Education, 2023). There are two levels of concern. One is at a *global level* where concern is related to identifying which students are motivated to do well in school. Some of this focus has been on examining gender differences, although who is seen to be more motivated has shifted. For instance, early on, focus was on girls and why they were less successful than boys (Ghasemi and Burley, 2019; Lindberg et al., 2010; Voyer and Voyer, 2014); later, focus shifted to the "boy problem" in which boys are being outperformed by girls (Duckworth and Seligman, 2006; Epstein, 1998) and concerns about boys falling behind has garnered attention of the public and of researchers (U.S. Department of Education, 2023; Rogers et al., 2017). The other level of concern is about motivation in *specific academic domains*. Even with narrowing gender gaps (Leaper and Brown, 2014), interest remains in questions about

gender differences in math/science performance (e.g., [Fredricks and Eccles, 2002](#); [Herbert and Stipek, 2005](#)) and in reading performance (e.g., [Logan and Johnston, 2009](#)), and in particular, in the under-researched topic of academic motivation in those domains ([Vantieghe and Van Houtte, 2018](#)). A binary conception of gender underlies both of these concerns in those girls and boys are compared and similarities and differences are considered between the genders.

Conceptualizing gender as a binary has been useful for summarizing research but this approach is limited in that it provides only partial answers to the question of which students will be motivated and succeed in which academic domains. Given the large within-gender differences observed in many constructs (see [Zell et al., 2015](#) for a meta-synthesis), a reasonable next step is to consider within-gender variations. There are only a few cases in which researchers explored variations within each gender—such as whether students view themselves as being gender typical of their own gender (i.e., own-gender typicality) or not. In one of the most extensive studies of the relation of gender and own-gender gender typicality to academic motivation, researchers found that girls showed higher levels of motivation than did boys, and that gender-typical girls (who felt very similar to other girls) scored the highest on motivation. Gender-typical boys were lower in motivation but higher than gender atypical students (e.g., girls who felt little similarity to girls) ([Vantieghe and Van Houtte, 2018](#)). These initial findings on the role of own-gender typicality in motivation suggest that additional explorations of the role of own-gender typicality has potential to further understanding of academic motivation. And, to expand upon this research, we consider whether feeling similar or typical of a group, regardless of one's gender, may enhance academic motivation.

The goal of the present study was to use an expanded assessment of gender typicality, one that focuses on *self-social gender identity*. Specifically, we assessed students' *self-social gender identity* with a dual identity approach ([Martin et al., 2017a](#)) in which individuals indicate their similarity to peers in the two major gender groups (girls and boys) rather than similarity only to peers in their own gender group as has been done in previous research on gender typicality (e.g., [Egan and Perry, 2001](#); [Vantieghe and Van Houtte, 2018](#)). Based on these two similarity ratings we were able to use person-centered analyses to develop and then compare four types/profiles of students with differing self-social gender identities. Using these profiles, we address issues of global and specific academic motivation (as measured by task values and competence beliefs) in pre-adolescents. The focus was on students in 3rd to 5th grade as students in this age group begin to have hormonal changes related to puberty, have experience with peers, and may have developed gender stereotypes about coursework due to their experiences in their classes ([U.S. Department of Education, 2023](#); [Leaper, 2014](#); [Leaper et al., 2012](#); [Voyer and Voyer, 2014](#); [Xiao et al., 2023](#)). The goal was to use self-social gender identities to provides new insights into why some students succeed in school and others do not (see also [Vantieghe et al., 2014](#)), and to assess whether specific academic motivation varies depending on the gender stereotyping of particular academic domains.

The gendered classroom as an influence on students' academic motivation and beliefs

When gender has been a focus in research on academic motivation, attention has been focused on binary gender identities of individual students, such as focus on questions of whether girls or boys perform differently in certain academic domains as well as on beliefs that boys are better in certain math, science, and engineering domains (STEM). The conceptual framework underlying much of this research is an identity-based motivation model (IBM) in which behaviors or traits linked to social identity guide behavioral options ([Elmore and Oyserman, 2012](#)). In this framework, effort and motivation are interpreted through a lens of categorical gender identity (see also [Cook et al., 2022](#)). Students seek out information in the classroom from their same- and other-gender peers and use that information to guide their own behavior ([Martin and Ruble, 2004](#)). This information may be at a global level or focused on specific academic domains. At a global level, students may believe that girls are more interested in academic pursuits than are boys. At the level of specific coursework, students may notice other girls' success in reading and develop beliefs that reading is "for girls." As a result, this topic becomes more interesting and worth more effort for girls than for boys ([Elmore and Oyserman, 2012](#)). Expectations by teachers about students' interests and capabilities may further increase attention to, encouragement, and higher expectation of success in some topics than others, for instance, girls' interest in reading ([Elmore and Oyserman, 2012](#)). Similarly, math and science are seen to be "for boys" ([Stake and Nickens, 2005](#); [Tiedemann, 2000](#)): many studies have examined gender differences in math and science (for review see [Leaper, 2014, 2015](#)) and outlined concerns and potential causes about why girls have lower levels of motivation to succeed in these domains ([Alper, 1993](#); [Leaper and Brown, 2018](#); [Leaper et al., 2012](#); [Leaper and Starr, 2018](#)). A number of studies have supported the idea that identity-congruence plays an important role in academic success and has set the foundation for the development of successful interventions in schools ([Oyserman et al., 2006](#); [Oyserman and Destin, 2010](#); [Oyserman et al., 2007](#); [Oyserman et al., 2002](#)).

As important as are the questions of comparing boys and girls, it is likely that more fine-grained views of identity may provide additional insights into students' global and specific motivation. One reason for this assumption is that research has shown that there are often larger within-gender differences than between-gender differences in many constructs (see [Zell et al., 2015](#) for a meta-synthesis). Another reason is that identities are more complex than simple category labels: the identity-based motivation model is based on the assumption that self-concepts are multi-faceted and dynamic ([Elmore and Oyserman, 2012](#)). To better explore the role of identity in motivation, it is important to consider a wider array of gender identity variations than has been done in the past. We propose that can be done by exploring understanding of *self-social gender identity* or an expanded view of gender typicality—such as whether students view themselves as being gender typical of peers of their own gender and of peers of the other gender.

The dual identity approach—a deeper understanding of gender identity

Given the acknowledgment that gender identity is more complex than what has been represented by the binary view (Egan and Perry, 2001), it is reasonable to consider alternative approaches. Recent proposals suggest viable alternatives such as asking children to consider where they fall on a single dimension between girl and boy (Gülgöz et al., 2022) and identifying the importance of differing gender identity labels (e.g., fitting into a binary label even when one is transgender) (Wittlin et al., 2025). In the present research, we relied on a conceptualization in which gender is viewed as multidimensional and is represented by group membership (“I am a boy”), gender typicality, contentedness, and felt pressure as components (e.g., Egan and Perry, 2001). One dimension of gender identity—gender typicality—has been particularly effective in providing a way to think about variations within gender groups (Vantieghem et al., 2014).

In the past, to assess gender typicality, early adolescents were asked questions to assess the degree to which they feel typical of the gender group associated with their sex assigned at birth. Using this measure, variability has been found in the degree to which a person feels typical of their assigned gender: some girls feel more girl-typical than other girls; some boys feel more boy-typical than other boys. These variations in *own-gender typicality* relate to a variety of social and adjustment outcomes. Several studies illustrate that early adolescents who feel more typical of their gender group are more popular, more gender-typical in their interests, have higher self-esteem, and are better adjusted than adolescents who feel less typical (Carver et al., 2003; Egan and Perry, 2001; Yunger et al., 2004). Only a few studies examine links between own-gender typicality and academic outcomes and the findings are mixed. In college men, more gender-typical men had ability beliefs, interests, and preferences for gender-typical courses (Leaper and Van, 2008). Using a different measure related to gender, boys who held traditional ideologies about masculinity (e.g., emotional stoicism, aggression) were less academically motivated overall (Rogers et al., 2017). For girls, the patterns are less clear with some studies showing no relation (Leaper et al., 2012) and others showing that girls who were gender typical showed higher academic motivation than other girls (Vantieghem and Van Houtte, 2018). One reason for these discrepancies may be that gender typicality often is narrowly defined by typicality to own gender peers only; using more fine-grained approaches may provide clarity.

While research on own-gender typicality has laid the groundwork for understanding gender identity and its importance in adjustment outcomes, this measure does not take into account another important dimension of self-social identity, namely, how the person feels about the other gender collective. For instance, earlier measures would label as “low in own-gender typicality” two types of girls: a girl who strongly identifies with boys and not with girls and a girl who does not identify with girls or with boys. Given that gender-related norms and stereotypes center on the binary gender groups (e.g., Blakemore, 2003), one’s feelings about not just their own-gender group but the other-gender group are likely to be equally important. The dual identity approach (Martin et al., 2017a) provides this type of expanded assessment of gender typicality,

assessing how individuals view themselves in relation to boys and to girls (see also Andrews et al., 2016; Zosuls et al., 2016).

Using the dual identity approach, four profiles of gender identity can be identified from the two gender similarity scales as confirmed in prior research (e.g., Martin et al., 2017a) using youth samples: Own-Gender Similar (Own-GS) students feel very similar to peers who are the same gender as they are and do not feel similar to peers who are another gender; Other-Gender Similar (Other-GS) students feel more similar to other-gender peers than to own-gender peers; Both-Gender Similar (Both-GS) students feel similar to both gender groups which is akin to the idea of androgyny (Bem, 1974; Martin et al., 2017b); and students who are Low-Gender Similar (Low-GS) who feel little similarity to either gender group, which may align with the idea of “undifferentiated” individuals (Bem, 1975; Spence, 1985).

When felt similarity to both groups is assessed, low to moderate negative correlations are found between felt similarity to own- and to other-gender peers (Martin et al., 2017a). Not surprisingly, when typicality was expanded to include measures of both same- and other-typicality, and consistent with the gender similarity scale, low negative correlations are found with these two scales (Pauletti et al., 2017), thereby supporting the value and use of such dual identity measures. Furthermore, the significance of the dual identity approach is seen in its predictive value. Variations in gender similarity have been found to be predictive of social and adjustment outcomes (Andrews et al., 2019, 2016; Baiocco et al., 2021; Endendijk et al., 2019; Martin et al., 2017a; Pauletti et al., 2017; Zosuls et al., 2016) but, to date, have not been studied to explore how they relate to academic motivation.

In addition to moving beyond the gender binary, the dual identity approach moves beyond research on “own-gender typicality” and because of this, has several advantages over single dimension approaches. Specifically, this expanded approach allows for more conceptual clarity in the labels of “typical” vs. “atypical.” For instance, with the dual identity approach, gender typicality is more narrowly-defined than it has been before: now, highly “gender typical” individuals are those who report feeling highly similar to their own gender *and* also report feeling not at all similar to the other gender. Gender atypicality is distinguished into multiple types of atypicality. Instead of only one type of gender atypical individual (i.e., people low in own-gender typicality), the new approach identifies three additional profiles that can be viewed as being less gender typical: individuals who feel similar only to other-gender peers, those who do not feel similar to either group, and those who feel similar to both-gender groups (Martin et al., 2017a). Furthermore, in terms of measurement, the dual identity approach differs from continuous measures which identify a location on a single continuous dimension representing girl to boy (so a child might indicate an “in-between” location), the dual identity approach identifies locations on two dimensions, which when combined, produce multiple typologies representing both binary and non-binary similarity profiles. The dual identity approach does not address the importance or centrality of gender identity but rather how the self relates to the two major gender collectives.

As well as providing more nuanced measures of identity, these profiles also provide a look into students’ feelings of acceptance or belongingness with same- and other-gender peers. As Kilday and Ryan (2022) argued, peers play important roles as social

supports and as sources of socialization for students. Having a feeling of being socially connected/similar with others is important (Eccles and Wigfield, 2020; Schunk, 1987). When students feel socially supported, they feel enhanced belonging in a class (Ladd, 1990; Ladd et al., 1999; Ladd and Coleman, 1997). Students who feel accepted by peers perform better academically and like school better (Bouton et al., 2011; Caprara et al., 2000; Ladd et al., 1996; Master and Walton, 2013; Vollet et al., 2017). Students who feel strongly embedded within their classes show higher academic motivation (Reindl, 2021). Research using the dual identity approach has illustrated that students have peer relationships that align with their self-social identities (Martin et al., 2024): for instance, students who do not feel similar to either group have fewer interactions with and less positive interactions with other girls and boys, thus may be at risk for low peer acceptance in the classroom, which also negatively affects motivation. Some students feel similar to both gender groups and others feel similar to one gender group: each of these groups of students should have a strong sense of belonging in their class.

Thus, using the dual identity approach helps move focus away from binary gender categories to self-perceptions of gender similarity when predicting motivation and allows insights into peer acceptance. Given that the self-social identities encompass aspects of both identity and the social environment (e.g., peers), the measure may be useful in understanding the roles of both in academic motivation.

Current study

The major goal of the current study is to explore how typologies of gender similarity relate to early adolescent children's global academic motivation (beliefs and values) and also to academic motivation in specific gender-typed academic domains, specifically, reading/writing, math, and science. Students at this age have had experience with their peers in the classroom and very likely have developed gender-related stereotypes about academic domains; both of which might influence academic motivation in those domains (Voyer and Voyer, 2014; Xiao et al., 2023). The present research extends prior research (Vantieghem and Van Houtte, 2018) that assessed whether gender typical students have higher levels of academic motivation and competence beliefs compared to gender atypical students. First, consistent with past research using the dual identity approach, we expect to identify four profiles of gender similarity as described above, and these profiles should allow more nuanced insights into gender identity than in prior work. Second, with these profiles, we then explore how they relate to academic motivation and, in doing so, address questions about academic motivation that have yet to be answered. To address the global issue, for Goal 1, we assessed whether variations in gender similarity profiles relate to global academic motivation. Specifically, for Goal 1, given that peer acceptance by classmates relates to improved school success (Kindermann, 1993; Reindl, 2021; Solomon et al., 1996), and that the gender similarities profiles have been found to relate to peer relationships (Martin et al., 2024), we expect that students with felt gender similarity to one or more groups will exhibit higher motivation than

students with low felt similarity to both gender groups (Low-GS) (Hypothesis 1; H1).

To address the question of motivation in specific academic domains, the second goal (Goal 2) compares motivation in specific academic domains that are stereotyped as “masculine” (math and science) and “feminine” (reading/writing) for students varying in gender similarity patterns. Overall, we expect that alignment of gender similarity with stereotypes of academic domains will enhance motivation. That is, because of past stereotyping about reading being “for girls” and math and science being “for boys” (Cvencek et al., 2011; Ghasemi and Burley, 2019; Ma, 2008; Marks, 2008; Nosek et al., 2002) and the potential for students' motivation to be influenced by their identity (Oyserman and Destin, 2010; Oyserman et al., 2002), we expect that students who share a self-social identity that aligns with these domains will show higher motivation in those domains as compared to those less well-aligned. That is, we expect that students who feel similar to the gender expected to succeed in the academic domain would show higher motivation in that academic domain as compared to their motivation in counter-stereotypic domains. Specifically, students who feel similar to girls or to both girls and boys (i.e., Own-GS girls, Both-GS students, Other-GS boys) should report higher academic motivation in reading than do other students (H2a, H2b, H2c); students who feel similar to boys or to both boys and girls (Own-GS boys, Both-GS students, Other-GS girls) should report higher academic motivation in math/science than do other students (H2d, H2e, H2f).

Method

Participants

Data were collected from 1,642 students (47.30% girls; 52.40% boys, 0.30% missing; $M_{\text{age}} = 9.05$, $SD = 0.91$) in Grades 3 ($n = 518$), 4 ($n = 557$), and 5 ($n = 562$) from 77 classrooms in eight elementary schools in the southwestern United States. For race, the sample included 925 (56.3%) White, 191 (11.6%) Black or African American, 158 (9.6%) multiracial, 85 (5.2%) American Indian or Alaska Native, 76 (4.6%) Asian, 12 (0.7%) Native Hawaiian or other Pacific Islander, and 7 (0.4%) other. For ethnicity, the sample included 1,036 (63.1%) non-Hispanic/Latino and 508 (30.9%) Hispanic/Latino. Child gender was reported by parents on the consent form or by school records, with options male, female, other, and unknown. One child was identified as transgender and was grouped according to gender (not sex assigned at birth).

Procedures

The study procedures were approved by the university's Institutional Review Board and by participating school districts as well as schools. Parental consent was obtained for children's participation. Additionally, students were asked for their assent to participate before data collection. Data were collected across 3 years in cohorts, during the fall (Wave 1) and spring (Wave 2) semesters of each academic year. In the current study, we only used data

from Wave 1 across Cohorts 1, 2, and 3. Participants completed the survey using a paper-and-pencil method, either in individual classrooms or in large group settings, depending on the school's preference. The survey was read aloud to participants and trained research assistants were present to address any questions.

Measures

Gender identity

Gender identity was measured by the Perceived Similarity to Gender Groups Scale (Martin et al., 2017a), which included 10 items in total (e.g., “How similar do you feel to (other) girls/boys?”). The scale consisted of five unique items and each was repeated twice—once asking students to consider how similar they feel to peers who are girls and once how similar they feel to boys. Students in Cohort 1 rated the items using a graphical “circle” response scale (0 = *Farthest apart* to 4 = *Overlapping*) and students in Cohorts 2 and 3 rated the items using a traditional rating scale (0 = *Not at all* to 4 = *A lot*). Martin et al. (2024) found there were no significant differences using different rating scales. We recoded scores to reflect same- and other-gender similarity based on students' gender and averaged to create composites. The Cronbach's alphas of the measure in the current sample were 0.86 for same-gender peer's and 0.84 for other-gender peers.

Academic beliefs and values in math, science, and reading and writing

Academic beliefs and values across different subjects were assessed using a total of 24 items with eight unique items, each repeated three times for three different subjects (i.e., math, science, reading and writing; Eccles et al., 1993; Jacobs et al., 2002). Among eight unique items, four items assessed academic beliefs of their abilities in each domain (e.g., “How good are you in math/science/reading and writing?”) and four assessed academic values including interests, importance, and utility (e.g., “In general, how useful is what you learn in math/science/reading and writing?”). All items were rated on a 7-point scale and the options vary depending on the question (e.g., 0 = *not good at all* to 6 = *very good*). Additionally, all four items in academic beliefs were assessed in Cohort 1 but only three items were assessed in Cohorts 2 and 3. Specifically, one item (i.e., “Compared to most of your other school subjects, how good are you at math/science/reading and writing?”) was removed because students, particularly the younger ones, had a hard time understanding what we were asking (based on the questions they raised during data collection). Because it seemed confusing and we were likely not getting accurate responses, we decided to drop that question after Cohort 1 Wave 1. The global motivation composites were created by averaging the items in academic beliefs or academic values across all subjects (two composites; Goal 1), and to assess motivation specific to academic domains, composites were created within each academic subject (six composites; Goal 2). Cronbach's alphas in the current sample were 0.83 for academic beliefs and 0.83 for academic values across all subjects; 0.87 for math beliefs and 0.79 for math values; 0.89 for science beliefs and 0.81 for science values; 0.89 for reading and writing beliefs and 0.79 for reading and writing values.

Data analytic plans

To replicate the 4-profiles of gender similarity identified in prior research using the dual gender similarity measure (Martin et al., 2017a) and in a study involving two of three cohorts of these same students (Martin et al., 2024), we adopted a person-centered approach by conducting a series of Latent Profile Analyses (LPAs). Using two gender identity indicators (i.e., same- and other-gender similarity), LPAs with varying numbers of profiles (ranging from 2 to 5 profiles) were conducted in Mplus 8.4 with the Robust Maximum Likelihood estimator (MLR) following the steps of prior research (Collins and Lanza, 2010; Ferguson et al., 2020). In these models, the means of the indicators were freely estimated across profiles and the variances were constrained to be the same. Additionally, the indicators were uncorrelated within the profile because of the assumption of conditional independence after accounting for the latent class membership (Tein et al., 2013). To determine the optimal number of profiles, we considered: the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), sample-size adjusted BIC (SABIC), entropy, *p-value* of the adjusted Lo-Mendell-Rubin Likelihood Ratio Test (LMRT), and *p-value* of the Bootstrap Likelihood Ratio Test (BLRT) as well as parsimony and theoretical-related reasons. Lower values of the AIC, BIC, and SABIC indicate a better model fit. For entropy, a higher value indicates a more precise classification of individuals to profiles. The LMRT and BLRT compare the differences between the *k*-profile model and the *k*-1 profiles model, and a significant *p-value* indicates that the solution of *k*-profiles is statistically better than the *k*-1 profiles; therefore, the *k*-profile model should be retained. Nylund et al. (2007) found that BLRT outperforms the other tests (e.g., LMR) in terms of Type I error across all model settings. After identifying the model with optimal profiles, posterior probabilities were estimated for the likelihood of being in each profile, and participants were assigned to the identified profiles based on these probabilities.

Then, we used SPSS Version 29 to test hypotheses by conducting Multivariate Analysis of Covariance (MANCOVA) to examine whether children with different gender similarity profiles would differ in global academic motivation (beliefs and values) (Goal 1) and in motivation for specific domains (i.e., math, science, and reading and writing; Goal 2), after controlling for covariates (i.e., gender, classroom, ethnicity, cohort, grade). For Goal 1, in the Multivariate Analysis of Covariance (MANCOVA) model, two composites of ability beliefs and task values across all three domains were entered as dependent variables, and gender similarity profile variable was entered as the independent variable. Further, before controlling for students' gender, grade, ethnicity, cohort, and classroom as relevant demographic variables in the model (we note that Intraclass Correlation Coefficients were small, 0.007 for same-gender similarity and 0.019 for other-gender similarity), we also tested the assumption of homogeneity of regression slopes and found that all the interaction terms between covariates and profiles were not statistically significant (i.e., $p > 0.05$). These tests indicate that the assumption was met. When Box's test of equality of covariance matrices was significant, we first checked if there was a significant omnibus test of Pillai's Trace test before reporting individual *F*-tests. We reported Bonferroni pairwise comparisons when an individual *F*-test was significant. For Goal 2 regarding specific domains of academic motivation, we estimated

another MANCOVA model including two factors: gender similarity profile, categorical gender, as well as the interaction between them to predict motivation in specific academic domains (math, science, reading, and writing). Covariates included classroom, ethnicity, cohort, and grade. For this analysis, we focused on whether a significant gender by similarity profiles interaction was identified.

Results

Descriptive analyses

We examined descriptive statistics using SPSS Version 29. Table 1 presents means, standard deviations, and correlations among focal variables. All variables were relatively normally distributed with little missing data (4.7% to 6.6%). Within a subject, students' ability beliefs and task values were strongly and positively correlated. Across subjects, ability beliefs and task values were moderately and positively correlated.

Inferential analyses

Latent Profile Analysis showed that the 4-profile solution fit the data well while considering different indicators of fit and our conceptual expectations. Table 2 presents fit indices comparing different solutions, from 2-profile to 5-profile. Specifically, as Figure 1 shows, there are 133 (8.6%) Low-GS students, 85 (5.5%) Cross-GS students, 168 (10.9%) Both-GS students, and 1,160 (75%) Own-GS students.

For Goal 1, results showed an overall significant effect for gender similarity profile with a significant Pillai's Trace test, $F_{(6,2,900)} = 6.45$, $p < 0.001$, partial $\eta^2 = 0.013$. Further, gender similarity profile was a significant factor for both dependent variables ($ps < 0.001$); partial η^2 was 0.025 and 0.014 for academic beliefs and values, respectively.

Figure 2 shows significant pairwise comparisons across each of the gender similarity profiles for each dependent variable. H1 was supported. For academic beliefs, Low-GS students scored lower than Both-GS ($p < 0.001$), Own-GS ($p < 0.001$), and Cross-GS ($p = 0.014$) students, but the other three groups of students did not differ from each other. Similarly, for academic values, Low-GS students scored lower than Both-GS ($p < 0.001$), Own-GS ($p < 0.001$), and Cross-GS ($p = 0.032$) students, but the other three groups of students did not differ from each other. Additional analyses conducted for each academic domain showed similar patterns across domains.

For Goal 2, results showed an overall significant effect (Pillai's Trace test) for gender similarity profile, $F_{(18,4,287)} = 3.47$, $p < 0.001$, partial $\eta^2 = 0.01$, students' gender, $F_{(6,1,427)} = 2.11$, $p = 0.049$, partial $\eta^2 = 0.01$, but not for profile X gender interaction, $F_{(18,4,287)} = 1.45$, $p = 0.10$, partial $\eta^2 = 0.01$. As the omnibus test for profile X gender interaction was not statistically significant, the H2 hypotheses were not supported. Further, we note that out of six DVs, there was only one significant main effect of gender for reading beliefs, such that girls' scores were significantly higher than boys ($p = 0.014$). This suggests gender similarity as an assessment

of self-social identities provided additional insights into the role of the peer social contexts on students' global beliefs and values but did not lend support to the idea that more nuanced gender identities would better predict students' motivation in specific gender stereotyped academic domains.

Discussion

Gender is an important construct, one that has been frequently studied to explore its role in academic motivation. Much of this research has focused on comparing the binary gender groups of girls and boys (Duckworth and Seligman, 2006; Epstein, 1998; Ghasemi and Burley, 2019; Voyer and Voyer, 2014). Given that research suggests that feeling typical to own-gender peers may play an important role in academic motivation (Vantieghem and Van Houtte, 2018), it is important to examine how variations in gender identity matters, and especially important to use methods that provide more complex and nuanced assessments of gender identity. To do this, we used a dual identity approach which involves asking students to consider their feelings of similarity toward both major binary gender groups, which provides insights into *self-social gender identity*. The goal of the present study was to explore global and domain-specific academic motivation using this measurement approach. From these measures of gender similarity, we generated four profiles of gender identity and then were able to explore how variations in profiles of feeling similar to the two major gender collectives related to both general and specific academic motivation in early adolescent students. The findings suggest that the self-social gender identity is important for understanding students' global academic motivation but less so for understanding academic motivation in specific gender-stereotypic domains such as reading and math/science.

Self-social gender identity and global academic motivation

A clear pattern emerged in terms of global academic motivation. Students who fell into profiles indicating that they felt similar to their own gender group, to the other gender group, or to both groups were indistinguishable in their global academic motivation (task values and competence beliefs). Each of these three profiles, however, showed significantly higher motivation than the gender similarity profile characterized by not feeling similar to either group. Two aspects of these findings are particularly noteworthy. First, feeling similar to either one or both groups of peers related to high levels of motivation, consistent with past research on peer acceptance and on research illustrating that own-gender typicality is positively related to other areas of adjustment (Egan and Perry, 2001; Yunger et al., 2004). Being accepted and feeling connected to a group, regardless of the composition of the group (i.e., boys or girls or mixed groups), increases the likelihood that peers can provide both indirect support (e.g., encouragement) as well as direct support (e.g., help) that can enhance academic success (Caprara et al., 2000; Master and Walton, 2013). This advantage may be evident because the similarity measure involves asking individuals how the self relates

TABLE 1 Descriptive statistics and correlations among main study variables for the total sample (N = 1,642).

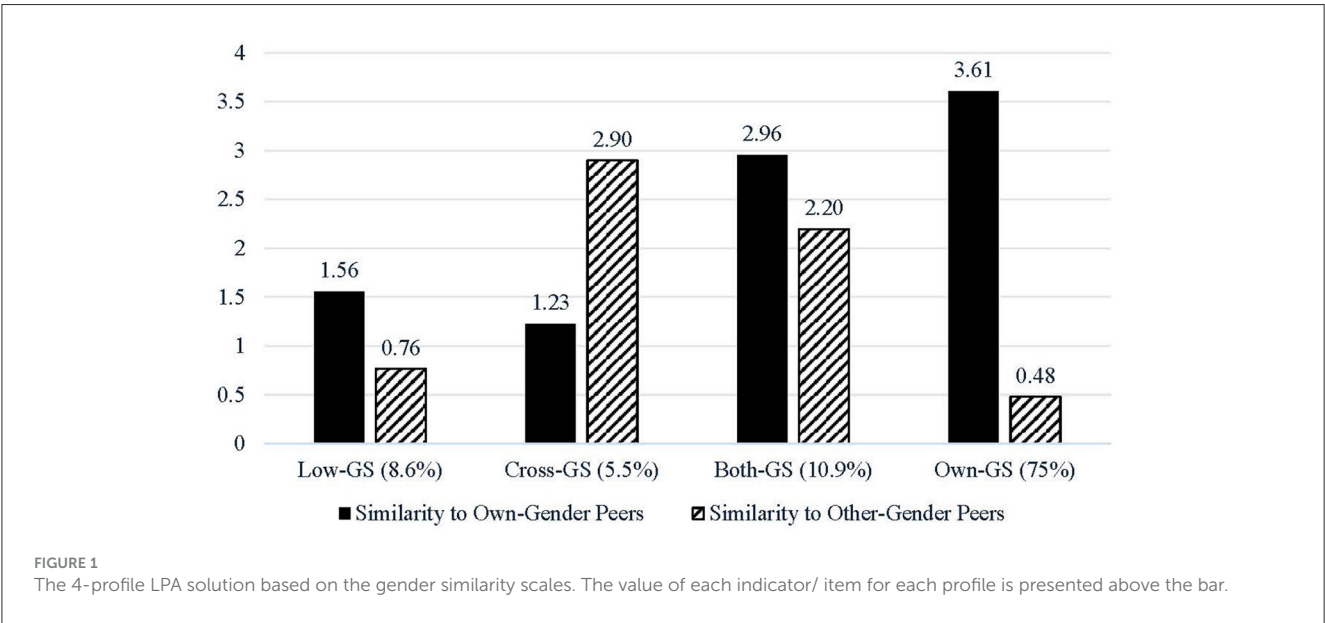
Variable	1	2	3	4	5	6	7	8	9	10
1. Math beliefs	—									
2. Science beliefs	0.25***	—								
3. Reading beliefs	0.26***	0.35***	—							
4. Math values	0.65***	0.15***	0.20***	—						
5. Science values	0.18***	0.64***	0.24***	0.32***	—					
6. Reading values	0.18***	0.21***	0.65***	0.41***	0.33***	—				
7. MSR beliefs	0.68***	0.75***	0.75***	0.44***	0.49***	0.49***	—			
8. MSR values	0.45***	0.44***	0.48***	0.77***	0.73***	0.77***	0.63***	—		
9. SG similarity	0.18***	0.11***	0.05*	0.09***	0.09***	0.003	0.16***	0.08**	—	
10. OG similarity	−0.02	0.09***	0.05	0.03	0.08**	0.09***	0.06*	0.09***	−0.45***	—
Mean	4.56	4.40	4.54	4.53	4.60	4.52	4.50	4.55	3.21	0.83
SD	1.35	1.46	1.45	1.44	1.40	1.40	1.03	1.07	0.95	0.89
Min	0	0	0	0	0	0	0	0	0	0
Max	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	4.00	4.00
N	1,555	1,551	1,547	1,563	1,564	1,565	1,549	1,559	1,537	1,533

MSR, Math, science, reading (composite score); SG, Same-gender; OG, Other-gender.
*p < 0.05, **p < 0.01, ***p < 0.001.

TABLE 2 LPA model fit summary.

Model	Log likelihood	AIC	BIC	SABIC	Entropy	Smallest class %	LMR p-value	LMR meaning	BLRT p-value	BLRT meaning
2	−3,672.217	7,358.434	7,395.838	7,373.600	0.916	14.5%	<0.001	2 > 1	<0.001	2 > 1
3	−3,545.001	7,110.001	7,163.436	7,131.668	0.908	6.2%	<0.001	3 > 2	0.001	3 > 2
4	−3,433.970	6,893.941	6,963.405	6,922.107	0.889	5.5%	0.33	4 = 3	0.001	4 > 3
5	−3,330.013	6,692.027	6,777.521	6,726.693	0.891	3.8%	0.002	5 > 4	0.001	5 > 4

The LMR test and the BLRT compare the current model to a model with k-1 profiles. LPA, latent profile analysis; AIC, Akaike's Information Criterion; BIC, Bayesian Information Criterion; SABIC, Sample-Adjusted BIC; LMR, Lo-Mendell Ruben; BLRT, bootstrap likelihood ratio test.



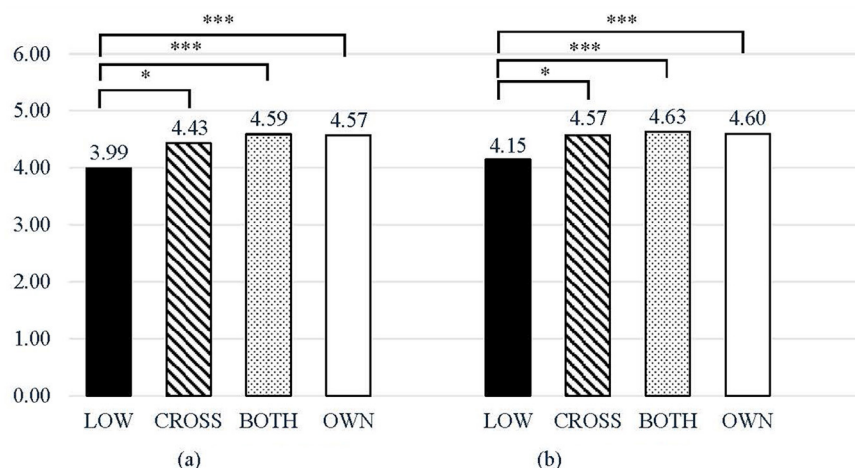


FIGURE 2

Comparisons of (A) Academic beliefs and (B) Academic values in all three academic subjects across four gender similarity profiles. * $p < 0.05$, *** $p < 0.001$.

to others, and as such, may be sensitive to feelings of peer inclusion as well as peer experiences. However, we also expected but did not find that feeling similar to both groups would provide an added advantage given prior research suggesting that peer acceptance by both same- and other-gender peers is beneficial for school liking and belongingness (Martin et al., 2022). Students who have more peers to interact with and to provide support would seem to be more likely to be academically motivated than those with fewer such peers (i.e., those feeling similar to only one group). It may be the case that affective aspects of school (such as school liking) are more sensitive to these kinds of variations in gender identity than is academic motivation. Age of the sample may be a factor: students who are older and more experienced, comfortable, and efficacious with peers may also be more likely to show benefits of feeling similar to the two major gender groups as compared to early adolescents who are less experienced. Further research is needed to explore these ideas.

The other noteworthy finding was that students who do not have a sense of similarity with peers in either major gender collective within their classroom showed the lowest motivation in both their academic competence beliefs and task values. In the present study, students who feel little connection with peers in either gender collective may be indicating that they feel gender atypical, and such a finding is consistent with research indicating that gender atypical individuals face risks for a variety of outcomes (see Yunger et al., 2004). Furthermore, these students may feel less acceptance by and connection with peers, which is consistent with research on peer experiences that shows that school success is often lower for students who have poor or difficult peer experiences (e.g., Poteat and Espelage, 2007). Based on prior research on peer experiences of children with varying gender similarity profiles (Martin et al., 2024), students who fall into the profile representing low similarity to both gender groups (low similarity to girls and low similarity to boys) also likely have fewer peer experiences and less positive interactions with peers than do student with other gender similarity profiles. Children low in gender similarity to both girls and boys may then feel a low level of acceptance in the

classroom, and these findings are consistent with prior research that has demonstrated that motivation relates to feeling a sense of peer acceptance (Kindermann, 1993; Reindl, 2021; Solomon et al., 1996). Whereas, these students may have a strong sense of acceptance elsewhere (e.g., with online or community groups), they may fail to have the direct and indirect support of classmates while engaged in academic work, thereby undermining their motivation. These students may also include students who are withdrawn or rejected, and for those students, other issues may also contribute to lower levels of motivation such as general anxiety or discrimination (Garcia-Coll et al., 1996). Whether these patterns change for older adolescents requires further research.

Self-social gender identity and specific academic motivation

Interestingly, the dual identity approach identifying four profiles of similarity did not prove useful for understanding *specific* academic motivation, for example, why some students are more motivated in reading and others in math and science. If it were the case that students who more strongly identified with girls show more motivation in reading, for instance, we would expect to find a gender of participant by gender profile interaction and that interaction was not found to be significant. There are several potential explanations for this null finding. One is that the similarity measure includes items addressing forms of gender identity such as appearance, behaviors, overall similarity but not any items relating directly to academic motivation or domains of academic interest. Another consideration is that stereotypes surrounding specific academic domains may have lost their power on students over the past few years, and instead, other factors likely explain individual differences in specific academic motivation. Much of the research on binary gender differences in academic domains was conducted more than 20 years ago, and although there is still evidence of math/science stereotypes beginning in childhood (Cvencek et al., 2011) and of beliefs that underlie

these stereotypes of boys being “really-really smart” being evident early in life (Bian et al., 2017), there is also some evidence suggesting a reduction in stereotyping over that time period (McGuire et al., 2020; Mulvey and Irvin, 2018). Furthermore, as children grow older, their tendencies to adhere to stereotypes appear to lessen, such that stereotypes might be less influential than in the early years (McGuire et al., 2020). Additionally, as students have more experience in the classroom (especially coed classrooms), they may come to learn information that counteracts or reduces their stereotypes, such as noticing no difference between the performance of girls and boys in STEM classes (Hyde, 2005; Lindberg et al., 2010). Future research is needed to continue to explore these possible explanations.

Strengths and limitations

Few studies have gone beyond the gender binary to understand how variations in gender identity relate to academic motivation (Leaper et al., 2012; Vantieghem et al., 2014). The present study does this while also extending these ideas to explore a specific form of identity—self-social identity—with the goal of examining its relation to both global and specific academic motivation for early adolescents. The findings suggest that measuring gender similarity is relevant for understanding motivation and, as such, more should be done to enhance students’ feelings of similarity within and across various gender groups. The results also suggest that these efforts might be particularly fruitful for students who may feel disconnected from both gender groups. Programs that target increasing feelings of belonging in older students (even in college) have been found to be effective (Oyserman and Destin, 2010; Oyserman et al., 2002): these ideas need to be extended to classrooms for younger children and early adolescents.

In terms of limitations, the present research focused on a narrow age range of early adolescent students using a cross-sectional design. Future research would benefit from including a wider age range and exploring whether these effects vary by age, race/ethnicity, or other factors (e.g., single sex schooling vs. coed schooling). The findings may have been biased by shared method variance because we asked for self-reports of gender similarity and of academic motivation, although both sets of measures require introspection and may be best completed by individuals rather than by others.

Conclusions

The goal was to explore global and domain-specific academic motivation using fine-grained assessments of *self-social gender identity* as this approach allows new profiles of gender identity to emerge and thus can expand beyond the common “gender differences” approach of comparing girls and boys on academic motivation. Specifically, the approach we used asked early adolescent students to provide ratings of how similar they felt to peers in the two major gender collectives. Global motivation was significantly higher for students who reported feeling similar to one or both gender collectives, and lowest for those who reported low feelings of similarity to both gender collectives.

Motivation in gender-specific domains (reading, math, science) showed a different pattern: students who feel similar to the gender expected to succeed in the gendered academic domain did not show higher motivation in those domains. The findings suggest that the *self-social gender identity* is important for understanding global academic motivation but less so for understanding academic motivation in specific gender-stereotypic domains such as reading and math/science. The results further highlight the important role of felt-gender similarity on academic motivation and suggest that educators should focus attention on ensuring that every student feels a sense of similarity/acceptance with peers in the classroom.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: <https://doi.org/10.48349/ASU/GXB8E0>.

Ethics statement

The studies involving humans were approved by Arizona State University Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants’ legal guardians/next of kin.

Author contributions

CM: Conceptualization, Funding acquisition, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing. SX: Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. AP: Formal analysis, Visualization, Writing – original draft, Writing – review & editing. LH: Funding acquisition, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission.

This had no impact on the peer review process and the final decision.

Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

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