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“THAT’S NOT ME”: STEM STEREOTYPES, SELF-CONCEPTS, AND MOTIVATION

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Christine R. Starr

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This Dissertation of Christine R. Starr is approved:

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Professor Campbell Leaper, Chair

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Professor Margarita Azmitia

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Professor Douglas Bonett

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Lori Kletzer

Vice Provost and Dean of Graduate Studies

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That’s Not Me: STEM Stereotypes, Self-Concepts, and Motivation

Christy R. Starr

Professionals in physical sciences, technology, engineering, and math (pSTEM) are often stereotyped as male geniuses who are also socially awkward, unattractive, individualistic, and unsuccessful in romantic relationships. These stereotypes may demotivate some individuals from pursuing pSTEM. However, they may also enhance motivation among individuals who feel that they fit the stereotype. Using balanced identity theory and expectancy-value framework, my dissertation investigated the effect of trait-based stereotypes about people in pSTEM among 310 high school students. I examined six trait-based stereotypes about pSTEM (male, genius, individualistic, socially awkward, unattractive, and romantically unsuccessful) and their related self-concepts. Stereotype endorsement was related to pSTEM identity and motivation. However, the direction of the relationship was moderated by a student’s own self-concepts. When a student’s self-concepts (self-perceived competencies or goals) were congruent with a stereotype, the stereotype was positively related to identity and motivation (stereotype lift). However, when self-concepts were incongruent, holding the stereotype was negatively related to a student’s identity and motivation (stereotype threat). Additionally stereotype threat occurred more often for girls, while stereotype lift happened more often for boys. Thus, the concordance between students’ trait-based stereotypes about pSTEM and self-concepts may help explain current gender gaps in pSTEM. KEYWORDS: expectancy-value; science; math; identity; underrepresentation; belonging

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That's Not Me: STEM Stereotypes, Self-Concepts, and Motivation

Over the course of the last few decades, researchers and policymakers have sought to increase students' interest in the physical sciences, technology, engineering, and mathematics (pSTEM), given the importance of these fields in society (Zakaria, 2011). One set of obstacles to getting adolescents interested in pSTEM are cultural stereotypes about people in pSTEM occupations. For example, computer scientists and engineers are commonly viewed as nerdy men who are geniuses, socially awkward, and romantically unappealing (Cheryan, Plaut, Handron, & Hudson, 2013). Negative stereotypes may be especially consequential when they are incongruent with an individuals' idealized self-concepts (e.g., Ferguson, Hafen, & Laursen, 2010). For example, students who stereotype people in pSTEM as nerdy geniuses may steer away from pSTEM if they value appearing as socially competent themselves or do not see themselves as gifted in math.

In my dissertation, I explored adolescent students' stereotyped beliefs about pSTEM in six areas: natural intelligence, social competence, physical attractiveness, romantic success, individualism, and gender. I also evaluated students' own self-concepts and goals in each of these six domains. Using the expectancy-value framework (Eccles & Wigfield, 2002) and balanced identity theory (Greenwald et al., 2002), I explored self-concepts and goals as moderators of the relationship between pSTEM stereotypes and pSTEM identity. Furthermore, I investigated pSTEM identity as a mediator between pSTEM stereotypes and motivation. In a path model, I expected that self-concepts would moderate the relationship between pSTEM stereotypes and identity, and that identity in turn would be positively related to pSTEM motivation (see Figure 1). By doing so, I sought to better understand why many talented students are not motivated to enroll in advanced courses, pursue majors, or aspirate towards occupations in pSTEM. Understanding these processes may more broadly illuminate why women are underrepresented in many STEM fields (National Science Foundation [NSF], 2017).

Adolescence is an important time to investigate how stereotypes affect pSTEM motivation because it is a developmental period when people are exploring their own identities (Lauermann, Tsai, & Eccles, 2017; Wang, Ye, & Degol, 2017). Furthermore, adolescents tend to affiliate in social cliques or friendship groups, which further shape self-concepts and behaviors (Brechwald & Prinstein, 2011; Brown, 1990). Finally, by adolescence children have developed the cognitive skills needed to compare group stereotypes to the self which may not be the case for younger children (explained in greater depth later) (Abrams et al., 2004; Patterson & Bigler, 2017). Within adolescence, high schoolers are important to study because they are beginning to choose their own courses and think about future career paths. During this period, many girls stop taking advanced math and science courses (such as AP physics) in high school, and differences in math test scores begin emerging (Leaper, 2015a). Certain factors (such as exploring potential career paths and taking advanced courses) may be more salient among juniors and seniors compared to students in their first and second years of high school.

Expectancy-Value Theory

Expectancy-value theory can help researchers explore factors related to a student's motivation to pursue certain fields while avoiding others (e.g., Eccles & Wigfield, 1995). According to the model, internal factors that affect motivation in a domain can be broken down into two main components: *expectancy beliefs* (belief of success in a domain) and *value beliefs*, (importance placed on a domain). Expectancy beliefs can be further broken down into two constructs: ability beliefs (self confidence in a domain) and perceived task difficulty (perceived difficulty of a task and amount of effort required to pursue it). Additionally, value beliefs can be further separated into intrinsic interest (enjoyment), extrinsic utility (usefulness for other life goals), and importance/attainment value (importance to central aspects of the self). A student's expectancy and value beliefs about a subject are moderately correlated with achievement (Eccles & Wigfield, 2002; Schoon & Eccles, 2014). Children and adolescents are more likely to be highly motivated in a subject if both their expectancy and value beliefs are high (Eccles & Wigfield, 2002). According to Eccles' model, expectancy and value beliefs are shaped by individual and environmental factors. Individual factors include identity, previous experiences, goals, and expectations. Meanwhile, environmental factors include parents, peers, cultural stereotypes, and the media (Eccles & Wigfield, 2002; Leaper, 2015b). Identities, such as gender identity or STEM identity, may also interact with stereotypes to influence a person's expectancy and value beliefs (Leaper, 2015a).

I also investigated adolescents' pSTEM career aspirations (interest and confidence in pursuing a pSTEM career). Having a positive assessment of future careers is an important step in beginning to identify with a career and choosing to officially pursue it (Stake & Mares, 2001). Similar to expectancy and value beliefs, girls and women are less likely than boys and men to aspire towards pSTEM careers, despite similar performance (Watt, Hyde, Petersen, Morris, & Rozek, 2017). Below, I will discuss identity as well as cultural stereotypes about pSTEM more in-depth.

Balanced Identity Theory, Self Perceptions, Identity and pSTEM Motivation

Balanced identity theory posits that people seek congruence between their self-concepts/perceptions, stereotypes, and group membership (Greenwald et al., 2002). Balanced identity theory has been adapted to make predictions about gender stereotypes, identity, and self-concepts in what is called the gender self-socialization model (Tobin et al., 2010). Of particular relevance is their identity construction hypothesis, which posits that the more a person's self-perceived attributes match the stereotypes of a group, the more they identify with that group. Another theoretical model of why individuals may engage with or avoid domains is the self-to-prototype matching approach (e.g., McPherson, Park, & Ito, 2018; Niedenthal, Cantor, & Kihlstrom, 1985; Setterlund & Niedenthal, 1993). This approach posits that individuals compare their own self-concepts to the prototypical student or worker in that domain when deciding which discipline to pursue. The more similar an individual's self-concepts are to that prototype the more likely they are to pursue it (Ehrlinger et al., 2018; Hanover & Kessels, 2004; McPherson et al., 2018). Prototypes of a domain such as pSTEM are largely based on cultural stereotypes as well as interpersonal interactions (Hannover & Kessels, 2004).

If there is a mismatch between a student's self-concepts and their stereotypes about people in pSTEM, they may disidentify with the domain and choose not to pursue pSTEM. For example, suppose a student holds a self-concept that emphasizes being attractive but also stereotypes people who work in pSTEM as unattractive. As a result, they may disidentify with pSTEM. This is similar to *stereotype threat* (see Steele, 2010). However, stereotypes about people in pSTEM may motivate adolescents who identify with the stereotype. For example, this may occur when a student does not value appearing physically attractive and views people in pSTEM as having similar attitudes. Then, they may feel that they identify with the domain and, in turn, may increase their motivation. This is similar to the phenomenon of *stereotype lift* (see Steele, 2010). Hence, stereotypes may bolster pSTEM identification and motivation of some students while hindering the identification and motivation of others because people are motivated to enter situations that match their self-concepts (Diekman & Eagly, 2008; Greenwald et al., 2002; Hannover & Kessels, 2004; McPherson et al., 2008; Niedenthal et al., 1985). In further support of this proposal, implicitly associating math with men (rather than women) was positively correlated with math participation, math positivity, expectancy beliefs, and achievement among men. In contrast, these predictors were negatively correlated with the same outcomes for women (Nosek & Smyth, 2011). Additionally, McPherson and colleagues (2018) found that the greater the discrepancy between stereotypes of scientists and self-concepts in communal, agentic, and scientific dimensions, the lower student's interest in pSTEM careers (stereotype lift was not observed in this study).

No prior studies exploring pSTEM and gender stereotypes in relation to motivation have been conducted with children or adolescents. Furthermore, only a few studies testing the balanced identity model (or similar models) in non-pSTEM domains have been conducted with children. One study done with children (Patterson & Bigler, 2016) among seven-to twelve-year-olds did not find support for the theory. This may have been due to age-related cognitive limitations. Children who have not yet achieved formal operations may not have the transitive logical skills necessary for balanced identity theory to work (Patterson & Bigler, 2016). For example, they may believe that science is not for girls, and believe that they are a girl, but not be able to make the logical leap that therefore science is not for them. Furthermore, children may not have second-order mental state understanding, whereby they can understand that being typical of (or deviant from) a group may result in differential inclusion within a group (Abrams et al., 2014). However, by adolescence, children's cognitive abilities have considerably developed with the onset of formal operations. Additionally, high school students are actively thinking about their identities, including in the context of academic performance and future career goals (Lauermann et al., 2017; Wang et al., 2017). As a result, I expected that a model based on balanced identity theory would predict motivation and identity among adolescents. As discussed next, I plan to investigate how six stereotypes about people in pSTEM affect student's identity and in turn their motivation in pSTEM.

pSTEM Identity as a Mediator

pSTEM identity may mediate the relationship of stereotype and self-concept matching to pSTEM motivation (expectancy beliefs, value beliefs, and career aspirations). Group identity refers to the connections someone makes between themselves and a group, such as pSTEM. Identity can focus on a variety of facets. The proposed study focuses on felt typicality (i.e., how similar a person feels to members of a given group) (Egan & Perry, 2001; Spence, 1993; Tobin et al., 2010). This facet was chosen based on the identity construction hypothesis, which focuses on how typicality is affected by the interaction of self-concepts and stereotypes (Tobin et al., 2010). Those who feel their self-concepts do not match the stereotypes of a group may feel less typical of that group; in turn, this discordance may decrease their motivation to enter that group. In a balanced identity model pSTEM identity would serve as the group-self association (see Figure 2). Theorists have argued that stereotypes lead people with disconcordant self-concepts to feel that they do not identify with domains, resulting in decreased motivation (Inzlicht & Schmader, 2012; Steele, Spencer, & Aronson, 2002). Thus, pSTEM identity may be an important mediator between stereotype and self-concept matching and motivation: Stereotypes may signify to some individuals that they do not belong in pSTEM domains. As a consequence, they may disidentify with the domain and decrease their expectancy-value beliefs and motivation to pursue pSTEM.

Empirical research supports the above model. One study among primarily European and Asian American women enrolled in science courses found that science identity mediated the relationship between implicit stereotypes and career aspirations (Cundiff, Vescio, Loken, & Lo, 2013). Women who more strongly associated science with men reported lower science identity; in turn, lowered science identity was related to lowered science motivation. Another study among a sample of Asian, Latinx, and European American undergraduate women found that STEM identity mediated the relationship between three kinds of stereotypes -- including nerd-genius stereotypes (discussed more below) -- and STEM motivation (Starr, 2018).

Based on prior empirical findings (Cundiff et al., 2013; Starr, 2018) as well as the identity construction hypothesis (Tobin et al., 2010), I hypothesize that pSTEM identity will mediate the relationship of stereotype and self-concept matching to pSTEM motivation. (For a graphical representation of this model, see Figure 1.) If students stereotype pSTEM as being for a certain kind of person (male, nerdy, and a genius) discordant with their own self-concepts, then they may have lower identification with pSTEM as well as have lower expectancy-value beliefs and pSTEM career aspirations. Below, I discuss the specific stereotypes that I will be exploring more in depth.

Nerd-Genius Stereotypes about pSTEM People

In a balanced identity model pSTEM stereotypes would serve as the group-attribute association (see Figure 2). The congruence between endorsing stereotypes and self-concepts in the same domain are expected to predict pSTEM identities and motivation. Accordingly, I hypothesized that (a) each stereotype would be positively related to pSTEM identity and motivation when it is congruent with adolescents' self-concept in the domain, but (b) each stereotype would be negatively related to pSTEM identity and motivation when it is incongruent with adolescents' self-concept in the domain. To test this model, I considered six key stereotypes associated with people in STEM occupations based on prior work (e.g., Cheryan, Plaut, et al., 2013; Diekman, Weisgram, & Belanger, 2015; McPherson et al., 2018). I refer to them collective hereon as *nerd-genius stereotypes*. As reviewed below, these include the expectations that people who excel in pSTEM are geniuses, socially awkward, unattractive, romantically unsuccessful, individualistic, and male.

First, professionals in pSTEM fields are also often stereotyped as *geniuses* or naturally gifted in the discipline (Cheryan, Plaut, et al., 2013; Ehrlinger et al., 2018; Hannover & Kessels, 2004; McPherson et al., 2018; Sainz et al., 2019; Storage, Horne, Cimpian, & Leslie, 2016). For example, among German middle schoolers, students were significantly more likely to rate a student who favored science as intelligent when compared to a student who favored the humanities (Hannover & Kessels, 2004). Congruently, one prior study indicates that people are more likely to attribute success to genius or innate intelligence in STEM fields than many other fields (Storage et al., 2016). Along with the genius stereotype, a second stereotype frequently associated with STEM fields is that people working in them are *socially awkward* (Cheryan, Plaut, et al., 2013; Hannover & Kessels, 2004). For example, middle schoolers rated students who liked science as significantly less socially competent than those who favored the humanities (Hannover & Kessels, 2004).

Third and fourth, people may also stereotype those in STEM as *physically unattractive* or geeky looking in appearance as well as *unsuccessful at dating*. Endorsement of these two stereotypes has been found among U.S. undergraduate students (Cheryan, Plaut, et al., 2013) as well as German middle school students (Hannover & Kessels, 2004; Kessels, 2005). Two other studies among U.S. undergraduates found that the women perceived feminine-typed appearance-related traits, such as wearing makeup, to interfere with their math success (Pronin, Steele, & Ross, 2004) and dating to interfere with STEM goals (Park, Young, Troisi, & Pinkus, 2011). Similarly, studies have found that males do not see women or girls who excel in STEM as attractive romantic partners (Kessels, 2005; Yoder & Schleicher, 1996). Similarly, experimental studies have found that portrayals of computer scientists as stereotypically geeky can demotivate women's interest in computer science (e.g., Cheryan, Drury, & Vichayapai, 2013; Cheryan, Plaut, et al., 2013; Cheryan, Siy, Vichayapai, Drury, & Kim, 2011).

Fifth, pSTEM fields have also been viewed as low in communal affordances (Diekman, Brown, Johnston, & Clark, 2010; McPherson et al., 2018). In other words, they are stereotyped as for *individualistic* people and correspondingly seen as being incompatible with collaboration, altruism, and helping others (Diekman et al., 2015). The perception that pSTEM is not communal or helping-oriented starts at a young age. One study among U.S. sixth graders found that only 14% of girls associated science with helping others (in contrast to 44% associating science with power) (Jones, Howe, & Rua, 2000). Finally, many people still explicitly stereotype STEM as a male domain. Studies employing the Draw-a-Scientist task have found that, when asked to draw a scientist, children and adolescents of both genders tended to draw a man in a lab coat with glasses (e.g., Miller, Nolla, Eagly, & Uttal, 2018; Steinke et al., 2007). A large meta-analysis of 78 studies spanning five decades found that although children and adolescents (grades K-12) have started to draw more scientists as woman over time, they still are more likely to draw male scientists compared to female scientists (Miller et al., 2018). This is especially true among older children and adolescents. Studies among undergraduates have found similar results (Cheryan, Plaut, et al., 2013; Cheryan & Plaut, 2010). By explicitly associating STEM with an outgroup, women may be less motivated to pursue STEM fields (Dasgupta & Stout, 2014; Leaper, 2015a).

Self-Concepts: Self-Perceived Competencies and Goals

The present study investigated self-perceived competencies and goals as two facets of non-academic self-concepts in the following domains: intellectually gifted (genius) in pSTEM, social competence (vs. socially awkward), physically attractive (vs. physically unattractive), dating success (vs. romantically unattractive), communal (vs. individualistic), and gender (being male).

Based on Harter's theoretical model, both self-perceived competencies and goals underlie a person's self-concept in a given domain (e.g., Neemann & Harter, 2012). Self-perceived competencies – or *self-perceptions* – refer to a person's self-evaluations in a given domain (e.g., “I am smart,” “I am attractive”). It is similar to the construct of ability beliefs in the expectancy-value model (Eccles & Wigfield, 2002). *Personal goals* reflect to the degree that doing well in a domain is important for the individual (e.g., “I want to be considered smart,” “I want to be attractive”). These two facets of self-concept – self-perceptions and goals -- are related but distinct (Neeman & Harter, 2012). For example, one might see oneself as traditionally attractive (high self-perception) but not place high priority on it (low goal). Similarly, persons may see themselves as socially inept (low self-perception) but wish that they were popular with their peers (high goal).

To consider the congruence between stereotypes of pSTEM as male, the gender self-concept focused on being male. This self-concept was assessed somewhat differently than described above for the other stereotyped domains. Self-perceived competence in this domain was evaluated in terms of felt typicality to males (e.g., “I feel like I am just like most boys”). This approach is based on prior theoretical models emphasize felt typicality to same or different gender groups as a dimension of gender identity (Egan & Perry, 2001; Spence, 1993). Although felt typicality has been primarily used to evaluate felt typicality with one’s gender ingroup, the construct has also been used to evaluate felt similarity to gender outgroups (Martin, Andrews, England, Zosuls, & Ruble, 2017). In addition, the personal goal related to being male was evaluated in terms of individuals’ interest in group ties to males (“I like to feel connected to boys”).

One of the research questions in the present research was to examine the relative fit of self-perceived competences and goals as facets of self-concept when testing the balanced identity model. To the author's knowledge, no previous studies have looked at both self-perceptions and goals in relation to balanced identity theory. Although both facets of self-concept may moderate the impact of STEM stereotypes on motivation, one might work better in the model than the other. On the one hand, self-perceptions may be more strongly related to adolescents' motivation and identification with a domain because they more directly reflect the degree of concordance between the self-concept ("I am smart" or "I am not smart") and stereotype endorsement in a domain ("People in STEM are geniuses"). Alternatively, there is some evidence to suggest that goals could be more influential. For example, in one previous study, researchers observed that mastery goals were better than self-perceived competencies in predicting students' academic identity (Yeung, Craven, & Kaur, 2012).

Although self-perceived competencies and goals may differ in how well they fit in the balanced identity model, I did not expect they would differ in their *pattern* of effects. That is, they are each considered facets of individuals' self-concepts. Hence, the concordance or discordance of either a person's self-perceived competencies (e.g., "I am smart") or goals (e.g., "I want to be smart") to their stereotyped beliefs ("People in STEM are geniuses") should have the same effect on motivation and identity. Therefore, in much of the subsequent review, I will refer generally to self-concepts rather than specifically to either self-perceptions or goals.

Gender as a Moderator

For all six domains, girls and women may be more affected by nerd-genius stereotypes when compared to boys and men due to holding fewer matching self-concepts and goals. Self-concepts and goals about pSTEM related attributes represent the self-attribute association in a balanced identity model (see Figure 2). Weaker pSTEM stereotype related self-concepts among girls may occur because of different societal expectations and stereotypes about girls and women. For example, women are less likely to be viewed as geniuses when compared to men (Bian, Leslie, Murphy, & Cimpian, 2018; Storage et al., 2016). Moreover, girls are less likely to view themselves as really smart (Bian, Leslie, & Cimpian, 2017). Similarly, women are often expected to be family-oriented and sociable (Eccles & Wang, 2016; Pagano, Hirsch, Deutsch, & McAdams, 2002), and they often have more family and relationship goals than men and boys due to cultural norms (Diekman & Eagly, 2008; Park, Young, Eastwick, Troisi, & Streamer, 2016). Additionally, women and girls are often socialized to value communal goals, such as helping others (Dasgupta & Stout, 2015). Consequently, they often end up placing high value on their physical appearance due to cultural pressures (Moradi & Varnes, 2017). As a result, nerd-genius stereotypes may contribute to current gaps in STEM (e.g., NSF, 2017), even though they are not all explicitly stereotypes about gender. Thus, I will explore potential gender differences in self-concepts as well as gender as a moderator of hypothesized effects.

There is evidence that the stereotypes described above especially negatively affect the STEM identity and motivation of girls and women. A recent study found that endorsing nerd-genius stereotypes affected undergraduate women's STEM identity and motivation beyond both explicit and implicit gender-STEM stereotypes (Starr, 2018). Similarly, an intervention aimed at increasing girls' STEM motivation by exposing them to real world women scientists found that girls' motivation actually decreased after the intervention, which perhaps was due to nerd-genius related stereotypes (Bamberger, 2014). Finally, a recent study among undergraduates found that feeling dissimilar to prototypical computer scientists may help explain the gender gap in computer science interest (Ehrlinger et al., 2018). These studies provide evidence that nerd-genius stereotypes may be especially demotivating to girls and women.

Present Study

In my research, I investigated whether high school student's stereotype-related self-concepts moderated the relationship of nerd-genius stereotypes to pSTEM identity and motivation. I separately examined self-perceived competencies and goals as facets of self-concepts. Based on the identity construction hypothesis, I hypothesized that self-concepts would significantly moderate this relationship. Specifically, I expected that people who endorsed nerd-genius stereotypes but did not feel they fit the stereotype would have lower pSTEM identity, while those who endorsed pSTEM stereotypes but felt they fit the stereotype would have higher identity. Furthermore, I expected that pSTEM identity would be a mediator between nerd-genius stereotypes and motivation.

Thus, in a path model, I hypothesized the interaction term would significantly relate to pSTEM identity, and simple slopes would reveal that the effect of stereotypes was significant for both people low in self-concept (negatively related) and high in self-concept (positively related). See Figure 1 for a graphic display of the proposed model. This hypothesized model was tested separately for the following stereotypes: genius (Hypothesis 1), socially awkward (Hypothesis 2), unattractive (Hypothesis 3), and romantically unsuccessful (Hypothesis 4), individualistic (Hypothesis 5), and male (Hypothesis 6). Additionally, I tested gender as a potential moderator, expecting that girls would be less likely to hold stereotype-congruent self-concepts when compared to boys. Furthermore, I explored age differences, comparing 11th and 12th graders to 9th and 10th graders. I hypothesized that younger students may have weaker relationships between predictor and outcome variables (e.g., pSTEM identity and career aspirations) due to having less time to explore their identities and career interests.

Finally, when examining self-concept and stereotype congruence in the above models, I considered self-perceived competencies and goals as separate facets of self-concept. Although I did not expect the patterns would differ for these two constructs, I explored whether one facet worked better in the models in than another.

Method

Participants

Participants were 310 students enrolled in physical science classrooms in seven Northern California High Schools. The majority of the students in the study were either sophomores (n = 136, 43.9%) or juniors (n = 137, 44.2%). Additionally, 31 students (10%) were in their senior year and one student was in their first year. When exploring age as a potential moderator, first years and sophomores were collapsed together. The majority of the students were either 15 years old (n = 107, 34.5%) or 16 years old (n = 154, 49.7%) when the study took place. Another 41 students (13.2%) indicated they were 17, and eight students (2.6%) indicated that they were 18 years old. Half of the study participants identified themselves as a girl (n = 155, 50%) and half as a boy (n = 155, 50%). One person self-identified as both a girl and as non-gender binary (students could self-select multiple gender identities) and was included along with girls in gender analyses.

Regarding race and ethnicity, participants primarily self-identified as Asian (n = 159, 51.3%), White (n = 72, 23.2%) or Latinx (n = 25, 8.1%). Additionally, 36 (11.5%) students identified as multiethnic. Of these multiethnic students, fourteen (4.5%) identified as Asian and White, six (1.9%) as Latinx and White, three (1.0%) as Black and White, and 16 (5.2%) as either three or more ethnic categories or another biracial category. Finally, nine (2.9%) students identified as Middle Eastern, two participants identified as Black, and one as Native American. Participants were also asked to report their mother's education level; 26.5% (n = 82) reported that their mother had not completed 4-year college, while 39.7% (n = 123) indicated their mother had completed a 4-year college degree, and 27.0% (*n* = 83) reported their mother had completed graduate school. (In addition, 22 participants either were not sure what their mother's education level was or did not answer.) Although this study did not measure family income, 14.5% of students in the school district receive free or reduced lunch.

Procedure

Teachers gave out the online survey to students in their classroom during the school day. The survey took students and average of 35 minutes. Teachers were compensated with a $100 Amazon gift card. Students first assented to the study and then filled out demographic information. Next, they were presented with information defining pSTEM and given several examples of what courses and careers qualify as pSTEM (e.g., astronomy, engineering, geology). Additionally, they were presented with several disciplines not considered part of pSTEM (e.g., biology, psychology, environmental studies). Students were then asked to check off which pSTEM courses they had taken or were presently taking as well as which courses they were interested in taking (not used in the present analyses). Following this, students were presented with pSTEM related questions about expectancy-value beliefs and career aspirations. Students then answered questions about pSTEM identity, nerd-genius stereotypes, and self-concepts. Each of these scales was on a separate page, and the page order was randomized. In the next section, students were asked seven questions about their feelings of belonging in pSTEM as well as how accepting they felt pSTEM is of underrepresented groups (not used in the present analyses). Finally, students were asked questions about their expectancy-value beliefs and career aspirations in humanities (not used in the present analyses). Except for demographic questions, the questions on each page were presented in random order throughout the survey.

Measures

Participant background. Students were asked to report their gender, ethnic and racial background, maternal education level, age, grade level, and math grade. For gender and ethnic/racial background, participants were asked to write their preferred identity; in addition, they were given a list of gender and ethnic-racial categories and asked to check as many as applied to them.

Nerd-genius stereotypes about people in pSTEM. To assess participants' stereotypes about people who work in pSTEM, six subscales were developed that build upon the Nerd-Genius Stereotypes about People in STEM Scale (Starr, 2018). The wording of some prior questions was modified. Also, two questions were added to increase the total number of items per subscale from three to five. In addition, two new subscales were included (male and individualistic).

The revised Nerd-Genius Stereotypes About People in pSTEM included the following six subscales: (1) geniuses (e.g., "People who work in pSTEM are geniuses," α = .78), (2) socially awkward (e.g., "People who work in pSTEM lack interpersonal skills," α = .88), (3) unattractive (e.g., "People who work in pSTEM look "geeky""; α = .88), (4) difficulties finding romantic partners (e.g., "People who work in pSTEM have a hard time getting dates," α = .91), (5) individualistic (e.g., "People who work in pSTEM tend to work alone," α = .84), and (6) male (e.g., "People who work in pSTEM are often men," α = .89). Participants were asked to rate each item on a scale of 1 = *strongly disagree* to 6 = *strongly agree*. All of the items for each subscale are presented in the Appendix.

Self-concepts. Self-perceived competencies and goals are two separate facets of self-concepts that were measured in six domains: intelligence ("genius"), social competence, physical attractiveness, romantic success, individualism (non-communal), and gender (being male). For each domain, five items were created to assess self-perceived competencies and five items to assess personal goals. These items were based on prior scales. Participants were asked to rate each item on a scale of 1 = *strongly disagree* to 6 = *strongly agree*. Below each of the self-perceived competencies and goals for each domain are summarized. (See Appendix for all scale items.)

***Self-perceived competencies*.** Five questions each were used to assess individuals' self-perceived competencies in each domain. With the exception of the being male domain, the wording for these items was similar to those used in Harter's Self-Perception Profile (Harter, 2012; Neeman & Harter, 2012). These included scales for self-perceived competencies regarding the following: genius in pSTEM (e.g., "I am naturally gifted in pSTEM"; α = .89), social competence (e.g., "I am at ease in social situations"; α = .89), physical attractiveness (e.g. "I spend time working on my physical appearance, and it shows"; α = .85), romantic success (e.g., "If I'm interested in someone romantically, it's likely that they'll also be interested in me"; α

= .89), and individualistic/non-communal (e.g., “I often go out of my way to help others”; α = .83). Finally, scales previously used to assess self-perceived gender typicality (Egan & Perry, 2001; Wilson & Leaper, 2015) were adapted to evaluate self-perceptions regarding being like males (e.g., “I feel like I am just like most boys”; α = .89).

***Personal goals*.** Another set of five questions was created to assess personal goals in each of the same self-concept domains. Except for the being male domain, the creation of these items were guided by the importance scales in Harter’s Self-Perception Profile (Harter, 2012; Neeman & Harter, 2012). These included scales for personal goals regarding the following: genius in pSTEM (e.g., “Being gifted in pSTEM is important to me”; α = .84), social competence (e.g., “I value being socially competent over many other goals”; α = .75), physical attractiveness (e.g., “It’s important to me that I look my best”; α = .78), romantic success (e.g., “Having a romantic partner is important to me”; α = .83), and individualistic/non-communal (e.g., “People in my community are very important to me”; α = .77). Scales used to evaluate ingroup ties (Cameron, 2004; Wilson & Leaper, 2 015) were adapted to evaluate personal goals regarding being like males (e.g., “I like to feel connected to boys”; α = .80).

pSTEM identity. Questions asked about the typicality facet of identity. Typicality reflects how similar one feels to people in pSTEM. To measure a participant’s pSTEM typicality, six questions adapted from Leaper and colleagues (Leaper, Farkas, & Brown, 2012) were used. These items were initially developed to measure gender typicality (Egan & Perry, 2001). The questions were adapted to measure pSTEM identity by replacing gender identification (e.g., women) with pSTEM. Example items include "I feel like I'm just like people who are good at pSTEM" and "I feel that the things I like to do in my spare time are similar to what most pSTEM oriented people like to do in their spare time". Participants were asked to answer on a scale of 1 = *strongly disagree* to 6 = *strongly agree*. Reliability was low when the entire scale was used (α = .66). Reliability became α = .83 when the following two items were removed: "I don't feel I fit in with pSTEM oriented people" and "I don't feel that my personality is similar to most pSTEM oriented people's personalities".

pSTEM expectancy and value beliefs. Fourteen items adapted from Eccles's expectancy-value motivation model (Eccles & Wigfield, 1995; Wigfield & Eccles, 2000) were used to measure participants' expectancy and value beliefs in pSTEM. All items are rated on a 5-point scale.

The expectancy beliefs scale includes ten items, six ability beliefs items and four perceived task difficulty items (α = .91). Sample questions include: "How well do you expect to do in your pSTEM courses this year?" (ability beliefs; 1= *not at all well* to 5= *exceptionally well*); "How good are you at learning something new in pSTEM?" (ability beliefs; 1= *not at all good* to 5 = *extremely good*); and "Compared to most other school subjects, how hard are pSTEM courses for you?" (perceived task difficulty; 1= *my hardest course* to 5 = *my easiest course*).

The value beliefs scale included four questions (α = .82). Two are extrinsic utility items and two importance/attainment value items. Sample questions include: "In general, how interesting or fun do you find pSTEM courses?" (intrinsic interest; 1 = *very boring* to 5 = *very interesting*); "How useful is what you learn in pSTEM courses for your life after you finish high school?" (extrinsic utility value; 1 = *not at all useful* to 5 = *very useful*); and "How important is it to you to do well in pSTEM courses?" (attainment value; 1 = *not at all important* to 5 = *very important*).

pSTEM career aspirations. The Motivation for a Science Career Scale (Stake and Mares, 2001) was used to measure participants' motivation to go into a pSTEM career. The four items were adapted by replacing "science" with "pSTEM." Sample questions include "Having a pSTEM career would be interesting" and "I have good feelings about a career in pSTEM." Participants will answer on a scale of 1 = *strongly disagree* to 7 = *strongly agree* (α = .96).

Results

Preliminary Analysis

A factor analysis was conducted for the self-perception and the goal facets of self-concept to determine if the two facets should be combined and analyzed separately. As expected, the factor analysis suggested that there were two components, one that centered on self-perceived competencies and the other that centered on goals. Therefore, self-perceptions and goals were analyzed separately rather than combined.

Bivariate correlations were run across key variables (see Table 1). Additionally, independent samples *t*-tests were conducted to assess potential group differences between girls and boys. See Table 2 for all gender group comparisons.

Path Models: Plan of Analysis

To test the hypotheses testing the relationships between pSTEM stereotypes, self-concepts, identity, and motivation, the R structural equation modeling (SEM) package lavaan was employed. A two-step modeling process was followed (e.g., Tabachnick & Fidell, 2013). First, the initial theoretical model was tested (see Figure 1) for each stereotype. Then, modification indices were examined to identify whether any potentially significant paths should be added to the model. Given my hypothesis that paths might differ for girls and boys, significant differences in pathways in the above model were tested based on student gender. First, multi-group analysis tested for significant differences in pathways. After testing for significant differences in paths, all non-significant paths were set to be equal. Second, interaction terms were investigated to test for gender as a moderator. A similar procedure was used to test potential differences based on year in school, described more below.

Model fit was tested using multiple indicators. First, the Tucker-Lewis Index (TLI), the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA) were examined. According to Hu and Bentler (1999) when considering both the TLI and CFI, a value $\geq .95$ indicates a good model fit, and values $\geq .90$ indicate an acceptable fit. According to McDonald and Ho (2002), RMSEA values $\leq .06$ indicate a good model fit and values $\leq .08$ indicate acceptable fit.

To determine if pSTEM identity significantly mediated the relationship of pSTEM stereotypes and self-concepts (self-perceptions or goals) to pSTEM motivation, the PROCESS macro model 4 for SPSS was used (Hayes, 2012) along with lavaan. Direct, indirect, and total effects for pSTEM identity as a mediator were investigated. If direct effects were small and indirect effects and total effects were large, then pSTEM identity was considered to be a mediator. When considering whether pSTEM identity mediated the relationship between a significant interaction effect and an outcome variable, moderated mediation (also known as conditional effects) were examined, using PROCESS macro model 7. If the index of moderated mediation is significant (95% confidence intervals do not contain 0) then pSTEM identity was considered a significant mediator for the interaction term. In both cases of mediation, lavaan was used to obtain standardized estimates and p-values while the PROCESS macro was used for other statistics, such as the index of moderated mediation. If effects indicated that pSTEM identity was not a significant mediator, then pSTEM identity was instead used as an outcome measure (alongside pSTEM expectancy, value, and career aspirations).

Additionally, if self-concept (self-perceptions or goals) was a significant moderator in the model (Hypotheses 1-6) simple slopes were further examined to determine the direction of significance. Simple slopes were calculated for each model at high self-concept (+1 *SD*), moderate self-concept (at the mean), and low self-concept (−1 *SD*) while still controlling for math grade. This was done by generating simple slope syntax for SPSS using SiSSy (Schubert & Jacoby, 2004). Simple slopes were first examined by gender and reported by gender if the paths differed; if they did not differ, the sample was collapsed.

Path Models: Results

With each of the following domains, the results are separately summarized for the path models using self-perceived competencies to assess self-concept and those using personal goals as to assess self-concept.

Hypothesis 1: Genius Stereotype

***Model with self-perceived competencies*.** According to indicators, the fully mediated model first proposed was a poor fit, $\chi^2(10, N = 303) = 99.36$, $p = < .001$; TLI = .74, CFI = .88, RMSEA = .172, 95% CI [.142, .203]. Analysis of modification indices showed significant and positive direct effects from genius self-perceptions to pSTEM expectancy beliefs as well as pSTEM career aspirations. In addition, there were direct effects from stereotyping people in pSTEM as geniuses to pSTEM career aspirations and value beliefs. Additionally, the modification indices suggest a direct and negative path between the interaction term and pSTEM career aspirations. This indicates that both believing you are a genius at pSTEM and the genius stereotype as well as the interaction between the two directly affected certain aspects of motivation which were not fully mediated by pSTEM identity.

Because of these significant direct paths the model was adjusted slightly to include the direct paths from genius self-concept and the related stereotype to pSTEM career aspirations and expectancy or value beliefs, respectively (see Figure 3). The partially mediated model was a good fit to the observed data, as indicated with fit indices which met the standard for a good fit, $\chi^2(6, N = 303) = 7.77$, $p = .255$; TLI = .991, CFI = .998, RMSEA = .031, 95% CI[0.000, 0.085]. Multigroup analysis indicated that gender was not a significant moderator.

Finally, pSTEM identity was investigated as a potential mediator between stereotyping people in pSTEM as unattractive and pSTEM expectancy beliefs as well as the interaction and expectancy-value beliefs. pSTEM identity was found to be a significant mediator between the interaction term and pSTEM expectancy beliefs; Index of moderated mediation = .038, *95% CI* = [.006, .065], standardized effect at high genius self-perceptions = .03, $p = .040$, effect at low genius self-perceptions = -.03, $p = .043$. Additionally, pSTEM was a significant mediator for the relationship between the interaction and pSTEM value beliefs; Index of moderated mediation = .055, *95% CI* = [.011, .096]; standardized effect at high genius self-perception = .08, $p = .018$, effect at low genius self-perception = -.08, $p = .021$.

Probing the interaction term's relationship to pSTEM identity revealed that the hypothesis was correct. After controlling for math grade, the simple slope between genius stereotype and self-perceived competence was significant and positive for students who reported high genius self-concept, $\beta = .12$, $t(298) = 2.14$, $p = .033$. Additionally, the simple slope was significant and negative for students who reported low genius self-perception, $\beta = -.12$, $t(298) = -2.08$, $p = .038$. Thus, among students who saw themselves as naturally gifted in pSTEM, the genius stereotype was positively related to pSTEM identity. Conversely, among students who did not see themselves as naturally gifted in pSTEM, holding the stereotype was negatively related to pSTEM identity. See Figure 4 for a display of this interaction. I additionally probed the interaction regarding pSTEM motivation. Unexpectedly, after controlling for math grade and pSTEM typicality, the simple slope between genius stereotype and self-perception was significant and positive among students who reported low genius self-perception, $\beta = .27$, $t(297) = 4.65$, $p = > .001$. This may be a suppression effect, which may have occurred after controlling for pSTEM typicality, and the finding should be viewed with caution.

Model with personal goals. A similar model was investigated regarding genius goals. However, there was no significant relationship between the genius personal goal or the interaction term and pSTEM identity or any other outcome variable.

Hypothesis 2: Socially Awkward Stereotype

Model with self-perceived competencies. According to indicators, the fully mediated model first proposed was a good fit, $\chi^2(10, N = 300) = 20.20$, $p = .027$; TLI = .96, CFI = .98, RMSEA = .058, 95% CI [.019, .095]. Despite an initial good fit, there was room for improvement. Analysis of modification indices showed significant and negative direct effects from the interaction term to pSTEM value, as well as from social self-perception to expectancy beliefs. This indicates that both the interaction and social self-perception directly affected certain aspects of motivation which were not fully mediated by pSTEM identity.

Because of these significant direct paths, the model was adjusted slightly to include them (see Figure 5 for model including standardized parameter estimates). The partially mediated model was a good fit to the observed data, as indicated with fit indices which met the standard for a good fit, $\chi^2(6, N = 300) = 8.34$, $p = .211$; TLI = .984, CFI = .996, RMSEA = .036, 95% CI[0.000, 0.089]. Gender was explored as a potential moderator using multigroup analysis but was not found to be a significant moderator. pSTEM identity was explored as a mediator between the interaction term and pSTEM expectancy beliefs as well as career aspirations. In addition, pSTEM identity was explored as a mediator between social self- perception and value beliefs as well as career aspirations. pSTEM identity not found to mediate these relationships (95% CI's all contained 0).

The observed interaction effect partially supported the hypothesized model. After controlling for math grade, the simple slope between the socially awkward stereotype and pSTEM identity was marginally significant and negative for students who reported a high social self- perception, $\beta = -.12$, $t(295) = -1.74$, $p = .083$. The stereotype was unrelated to pSTEM typicality among those with low social self-perception ($p = .33$). Additionally, when considering pSTEM value, the simple slope between the socially awkward stereotype and pSTEM value was marginally significant and positive for students who reported a low social self-perception, $\beta = .11$, $t(295) = 1.69$, $p = .093$. (The stereotype was not significantly related to pSTEM value among those with high social self-perception, $p = .145$.) Believing that people in pSTEM are socially awkward was negatively related to pSTEM identity among students who had a high social self-perception, and positively related to pSTEM value among students who had a low social self-perception. The interactions are displayed in Figure 6.

Model with personal goals. A similar model was investigated regarding social goals. There was no significant relationship between the social goal or interaction term and pSTEM identity or any other outcome variable (e.g., pSTEM competence beliefs).

Hypothesis 3: Physically Unattractive Stereotype

Model with self-perceived competencies. According to indicators, the fully mediated model first proposed was a mixed fit, $\chi^2(10, N = 299) = 29.50, p = .001$; TLI = .92, CFI = .97, RMSEA = .081, 95% CI [.048, .115]. Analysis of modification indices showed significant and negative direct effects (1) from attractive self-perception to pSTEM career aspirations and value as well as (2) from stereotyping people in pSTEM as unattractive to value beliefs. Finally, there was a direct effect from the interaction term to value beliefs. This indicates that self-perceived attractiveness, the unattractive stereotype, and the interaction of the two directly affected certain aspects of motivation.

Because of these significant direct paths, the model was adjusted slightly to include them (see Figure 7 for model with standardized parameter estimates). The partially mediated model was a good fit to the observed data, as indicated with fit indices which met the standard for a good fit, $\chi^2(12, N = 299) = 11.41, p = .495$; TLI = 1.00, CFI = 1.00, RMSEA = .000, 95% CI[.000, .080]. pSTEM identity was explored as a mediator between the interaction term and pSTEM expectancy beliefs as well as career aspirations. Addition, pSTEM identity was explored as a mediator between stereotyping people in pSTEM as unattractive and expectancy beliefs as well as career aspirations. pSTEM identity not found to mediate any of these relationships (all 95% CI's contained 0).

Probing the interaction indicated that after controlling for math grade, the simple slope between the Stereotype × Self-Perception interaction and pSTEM identity was significant and negative for girls (but not boys) who reported a high self-perceived attractiveness, β = -.24, $t(145)$ = -2.52, p = .013 (see Figure 8). Additionally, the simple slope between the unattractive stereotype and pSTEM value was significant and negative for girls (but not boys) who reported a high self-perceived attractiveness, β = .20, $t(145)$ = -2.13, p = .035 (see Figure 9).

Multigroup analysis revealed that gender moderated some of the direct pathways in the model. There was a significant and positive relationship between unattractive stereotype and pSTEM value was found for boys (but not girls) who reported a low self-perceived attractiveness, β = .20, $t(144)$ = 2.61, p = .010. Thus, girls experienced stereotype threat for pSTEM identity and value when they endorsed the stereotype that people in pSTEM are unattractive and viewed themselves as attractive, while boys experienced stereotype lift when they endorsed the stereotype but viewed themselves as unattractive.

Additionally, multigroup analysis indicated that some paths differed for girls when compared to boys. For girls (but not boys) endorsing the stereotype that people in STEM are unattractive had a direct negative relationship with girls' pSTEM identity (β = -.16, z = -2.11, p = .035) and value beliefs (β = -.13, z = -2.31, p = .021). For both genders, self-perceived attractiveness was negatively related to pSTEM career aspirations (β = -.20, z = -3.06, p = .002).

Model with personal goals. According to indicators, the fully mediated model first proposed was a mixed fit, $\chi^2(9, N = 290) = 13.27$, p = .151; TLI = .98, CFI = .99, RMSEA = .040, 95% CI [.000, .083]. Analysis of modification indices showed significant and negative direct effects from attractive goal to pSTEM career aspirations and to expectancy beliefs, as well as from stereotyping people in pSTEM as unattractive to value beliefs. Additionally, multigroup analysis indicated that pathways significantly differed between girls and boys. Contrary to as hypothesized, the interaction between attractive goal and pSTEM typicality was not statistically significant.

Because of these significant (and non-significant) direct paths, the model was adjusted slightly to include them and to remove the interaction term (see Figure 10). The partially mediated model was a good fit to the observed data, as indicated with fit indices which met the standard for a good fit, $\chi^2(10, N = 290) = 5.78$, p = .833; TLI = 1.03, CFI = 1.00, RMSEA = .000, 95% CI[.000, .053]. pSTEM identity was explored as a mediator where appropriate but was not found to mediate any relationships in the model (95% CI's all contained 0).

Multigroup analysis indicated that some paths differed for girls when compared to boys; in other words, gender was a significant moderator. Notably, several pathways were significant for girls but not for boys. Stereotyping people in pSTEM as unattractive was negatively related to pSTEM identity (β = -.17, z = -2.27, p = .023) and value (β = -.15, z = -2.55, p = .011) among girls, but not boys. Additionally, endorsing attractiveness goals were negatively related to pSTEM career aspirations (β = -.11, z = -2.01, p = .044) and pSTEM expectancy beliefs (β = -.20, z = -3.02, p = .003) among girls but not boys. In other words, holding the stereotype that people in pSTEM are unattractive and having attractiveness goals are directly negatively related to all aspects of pSTEM motivation for girls, but not for boys.

Hypothesis 4: Romantically Unsuccessful Stereotype

Model with self-perceived competencies. The model was tested with self-perceived competencies. There was no significant relationship between dating self-perceived competencies or the interaction and pSTEM identity or any other outcome variable.

Model with personal goals. According to indicators, the fully mediated model first proposed was a mixed fit, $\chi^2(11, N = 290) = 29.67$, p = .002; TLI = .93, CFI = .69, RMSEA = .077, 95% CI [.044, .110]. Analysis of modification indices indicated that none of the proposed variables (dating goals, stereotyping people in pSTEM as romantically unsuccessful, and the interaction between the two) were significantly related to pSTEM identity. Instead, there were direct effects from these three variables (including the interaction term) to pSTEM career aspirations, expectancy beliefs, and value beliefs. This indicates that dating goals, the romantically unsuccessful stereotype, and the interaction between the two directly affected all aspects of motivation, rather than being mediated by STEM identity.

Because of these significant direct paths, the model was adjusted to include them and remove pSTEM identity as a dependent variable (see Figure 11). The partially mediated model was a good fit to the observed data, as indicated with fit indices which met the standard for a good fit, $\chi^2(16, N = 290) = 19.80$, $p = .138$; TLI = .968, CFI = .994, RMSEA = .051, 95% CI[.000, .112].

Follow-up simple slope analysis indicated that gender was a significant moderator: among girls with high dating goals, there was a significant and negative relationship between the stereotype that people in pSTEM are romantically unsuccessful and pSTEM value beliefs, $\beta = -.26$, $t(140) = -2.72$, $p = .007$. Similarly, for girls with high dating goals there was a significant and negative relationship between the stereotype and pSTEM expectancy beliefs, $\beta = -.18$, $t(140) = -2.25$, $p = .026$ (see Figure 12). Additionally, the stereotype had a significant and positive relationship with pSTEM career aspirations among boys with low dating goals, $\beta = .20$, $t(139) = 2.32$, $p = .022$ (see Figure 13).

Hypotheses 5 and 6: Individualistic (Non-Communal) and Male Stereotypes

None of the models using either self-perceived competencies or goals as measures of self-concept were significant regarding either the individualistic domain (i.e., STEM is low in communal affordances) or the male domain (STEM is male). That is, there were no statistically significant Stereotype x Self-Perception interactions or Stereotype x Goal interactions in relation to pSTEM identity beliefs or motivational outcomes (all *p*'s < .10).

Grade Level Comparisons

Using multigroup analysis, the path models were run again looking for group differences by grade level (first year and second year of high school compared to third and fourth year of high school). I expected to find stronger relationships between self-perceptions or goals and outcome variables among students in their last two years of high school when compared to the first two years. Contrary to expectations, paths largely did not significantly differ based on grade level. Two exceptions were in the genius goal model and the dating self-concepts model. In the genius goal model, pSTEM identity had a significantly stronger relationship to career aspirations among older students and having the goal of being a genius in pSTEM had a significantly stronger relationship to pSTEM identity among younger students. For the model with dating self-perceptions, believing yourself to be successful at dating had a significant and positive relationship to pSTEM identity among younger students; however, dating self-perceptions were unrelated to pSTEM identity among older students. (Note that in the full model, having a dating self-concept was not significantly related to pSTEM identity.)

Discussion

Using balanced-identity theory (Greenwald et al., 2002), this study explored whether self-concepts moderate the relationship between stereotypes about people in pSTEM and pSTEM identity and motivation among U.S. high school students.

pSTEM stereotypes may hinder some students' pSTEM identity and motivation when they are incongruent with their self-concepts (self-perceived competencies or goals) but may help bolster pSTEM identity and motivation when they are congruent with their self-concepts or goals. This study specifically considered the identity construction hypothesis, which posits that the more a person's self-concepts match the stereotypes of a group, the more they identify with that group.

For three out of six stereotypes investigated, holding stereotype congruent self-concepts was positively related to pSTEM identity and motivation among students. Additionally, in some cases gender was a moderator. For two of the stereotypes (unattractive and romantically unsuccessful) having congruent self-concepts was positively related to pSTEM motivation only for boys (stereotype lift). Conversely, having incongruent self-concepts was negatively related to pSTEM motivation only for girls (stereotype threat). Furthermore, there were certain main effects which only negatively affected girls.

In most instances, the interaction between stereotypes and self-concepts had a direct effect on pSTEM motivational variables rather than being mediated by pSTEM identity. This is consistent with other research using balanced identity theory which found implicit stereotypes about STEM to have a direct effect on math self-concepts based on students' gender self-concepts (Cvencek et al., 2015; Cvencek et al., 2011). However, it is inconsistent with prior work which found that pSTEM identity mediated the relationship between stereotypes about STEM and motivational variables (Cundiff et al., 2013; Starr, 2018).

Below, I discuss the results. First, I review the results regarding the genius and socially awkward stereotypes, which affected boys and girls in similar ways. Next, I talk about the unattractive and romantically unsuccessful stereotypes, which affected girls and boys differently. Then, I discuss the male and individualistic stereotypes, which did not have significant results. After discussing these main findings, I discuss the extent that participant gender was a moderator, the relative effects of self-perceptions and goals in the model, and developmental period as a potential moderator. Finally, I discuss limitations and future directions, followed by conclusions.

Impacts of Genius Stereotype and Socially Awkward Stereotype

Both the genius stereotype as well as socially awkward stereotype and related self-concepts affected students the same way regardless of gender. The stereotype that people in pSTEM are geniuses lifted the pSTEM identity of those who viewed themselves as similar. Concurrently, the stereotype threatened the identity of those who saw themselves as dissimilar. In turn, pSTEM identity mediated the relationship between the Stereotype × Self-Perception interaction and STEM competence beliefs. Additionally, pSTEM identity mediated the relationship between this interaction effect and pSTEM value beliefs.

The finding that the genius stereotype reduced pSTEM motivation among those who saw themselves as dissimilar falls in line with prior research among undergraduates. McPherson and colleagues (2018) found that undergraduate students had lower career interest when they saw a greater discrepancy between themselves and scientists regarding scientific traits (e.g., intelligence). Students with self-concepts that are either congruent or incongruent with being a genius may affect their pSTEM identity because professionals in pSTEM fields are often stereotyped as geniuses or naturally gifted in the discipline (e.g., Cheryan, Plaut, et al., 2013).

Similar to the genius stereotype, the socially awkward stereotype affected students the same regardless of gender. Also, girls were not significantly more likely than boys to hold positive social self-perceptions and goals. Regardless of gender, those who believed the stereotype that people in pSTEM are socially awkward and viewed themselves as socially awkward had higher pSTEM identity and value beliefs. Concurrently, those who believed the stereotype but saw themselves as socially skilled had lower pSTEM identity and value. The pSTEM motivation of students with both low and high social self-perceptions may be affected because people working in pSTEM fields are stereotyped as being socially awkward (Cheryan, Plaut, et al., 2013).

Unexpectedly, having a high self-perceived social competence had a direct positive relationship to both pSTEM identity and pSTEM expectancy beliefs. It is possible that those with high self-perceived social competence also had higher academic self-concepts more generally due to higher self-esteem; however, this interpretation is speculative. The finding that boys and girls were similar in the path model suggests that the genius and socially awkward stereotypes may not contribute as much to gender gaps (unlike the unattractive and unsuccessful at dating stereotypes discussed below). That is, they may demotivate (or motivate) students in general.

Impacts of Unattractive Stereotype and Romantically Unsuccessful Stereotype

The unattractive and romantically unsuccessful path models both showed similar patterns. These two stereotypes and related self-concepts negatively affected girls' pSTEM motivation, while in some cases simultaneously bolstering boys' motivation. This was captured in interaction effects. Believing that people in pSTEM are unattractive or unsuccessful at dating was negatively related to the pSTEM motivation girls with a non-matching self-concept; in contrast, endorsing the same stereotype was positively related to the pSTEM motivation of boys with matching self-concept. The results also indicated direct effects. Merely having the goals of dating or wanting to be attractive were each negatively related to pSTEM motivation for girls (but not boys). Additionally, stereotyping people in pSTEM as unattractive was negatively related to pSTEM motivation among girls (but not boys). For the unattractive stereotype, both kinds of self-concepts (self-perceptions and goals) had models with significant relationships. For the romantically unsuccessful stereotype, only the model using goals was significant (discussed later).

These stereotypes and incongruent self-concepts may especially affect girls over boys for two reasons. First, holding attractiveness and dating self-concepts may be seen as incongruent with being good at pSTEM because people in pSTEM are often stereotyped as being unattractive. For example, Banchefsky and colleagues (2016) found that the more unattractive a woman scientist was rated, the more likely people were to rate her as being a scientist. This stereotype may demotivate girls more than boys because girls are often socially expected to be attractive (e.g., Calegero et al., 2011). Second, these self-perceptions and goals may be seen as incongruent with pSTEM because sexually or romantically attractive women are often not viewed as intelligent. For example, Daniels and Zurbriggen (2016) found that sexually objectified women were rated by adolescent girls and undergraduate women as less intelligent than non-sexually objectified women, and similar results have been found in a variety of Western samples (Daniels & Zurbriggen, 2016b; Graff, Murnen, & Smolak, 2012; Holland & Haslam, 2016; Loughnan et al., 2010; Stone et al., 2015).

My dissertation study found that the interaction between the stereotype and self-concept was negatively related to girls' pSTEM identity and motivation. However, I also found that the stereotype and self-concepts had a direct effect on girls regardless of a girls' endorsement of the other variable. In other words, girls had lower pSTEM identity and motivation merely when they felt attractive, had dating goals, or endorsed the stereotype that people in pSTEM are unattractive or romantically unsuccessful. Girls did not need to endorse both the stereotype and self-concept for it to affect them. This was especially true when considering the model with unattractive stereotypes and appearance goals. In this model, the interaction did not affect identity or motivational beliefs but rather there were several direct effects. This indicates that it might not just be enough to reduce the stereotype that people in pSTEM are unattractive or have difficulties in dating. Instead, it may also be important to decrease stereotypes about sexually objectified women being unintelligent. Additionally, we might work to reduce pressure on girls to focus on their appearance and romantic lives (e.g., Dustan, Paxton, & McLean, 2017).

Another notable result was that boys experienced stereotype lift (but not threat) when concerning the unattractive and romantically unsuccessful stereotypes. Boys who endorsed the stereotypes and said that they did not view themselves as attractive or have dating goals experienced stereotype lift. In turn, they reported higher pSTEM identity and motivation. The same effect did not occur for girls, even when they did not view themselves as attractive or have dating goals. This indicates that these stereotypes may help boys who view themselves as similar. But unlike the effect for girls, the stereotype did not hinder boys who do not see themselves as similar. Meanwhile, the opposite may happen for girls. They appeared to experience threat when they saw themselves as dissimilar, yet they did not indicate stereotype lift when they viewed themselves as similar to the stereotypes. It is unclear why boys only showed evidence of lift while girls only indicated apparent threat. It is possible that girls were more easily demotivated when their self-concepts did not match their stereotypes of people in pSTEM because they already were aware that women are underrepresented in these fields. Having a core identity (gender) already incongruent with pSTEM may make additional incongruencies particularly salient. Meanwhile, for boys, men are well represented in pSTEM so they may not feel as threatened if other identity beliefs they hold about themselves do not match the stereotypes they hold about people working in pSTEM. Thus, the present research suggests how nerd-genius stereotypes may contribute to the gender gaps in pSTEM by advantaging males and disadvantaging females.

Impacts of Male Stereotype and Individualistic Stereotype

The hypothesized balanced identity model was not seen regarding either individualistic stereotypes or male stereotypes of pSTEM. Below, I discuss why the hypothesized model may not have worked as hypothesized for both stereotypes.

There are several possibilities for why the individualistic stereotype hypothesis was not supported. One possibility for why the interaction was not significant is the relative differences in the endorsements of the individualistic stereotype and the related self-concepts. Individualistic self-concepts were inferred through low endorsement of communal self-concepts. However, communal self-perceptions and goals were among the highest self-concept measures among the students. Meanwhile, the stereotype that STEM is individualistic was one of the least frequently endorsed STEM stereotypes (see Table 2). It is possible that there was simply not much variation in self-concept and stereotype endorsement, which resulted in non-significant results. The finding that communal/helping self-concepts and related stereotypes did not have a strong effect on student's pSTEM motivation is consistent with other researchers who recently posited that this stereotype affects women and girls' motivation in pSTEM less than previous researchers have suggested (e.g., Cheryan, Ziegler, Montoya, & Jiang, 2017). Similarly, McPherson and colleagues (2018) found that communal and agentic scientist-self discrepancies did not affect students' pSTEM career interest as much as other kinds of self-concept and stereotype discrepancies.

There also was not support for the male = pSTEM stereotype in the tested models. This is surprising given some prior studies using implicit math = male associations did find support for the balanced identity model (e.g., Cvencek et al., 2015). In the present study, one possibility why the pattern was not replicated is that male gender may be considered a more non-negotiable and binary trait than other stereotypes and traits measured (such as the socially awkward stereotype and social self-concept). As a result, it is possible that gender identification (i.e., simply identifying as a boy or girl) would override how typical of boys you feel or your ingroup ties. In other words, a girl who sees herself as similar to boys may nonetheless view pSTEM as a male-dominated field; and thereby she still may not identify or feel motivated in pSTEM. Another possibility is that students may be thinking of different kinds of males when considering males in pSTEM and typical males more generally. For example, students may think of pSTEM as being for *nerdy* males when they are answering questions based on the pSTEM stereotype but think of *athletic* males when answering gender typicality questions. This would lead to a mismatch between the self-concept/goal and stereotype and result in an ineffective interaction term.

Gender as a Moderator

For two of the six domains, girls were more affected by the stereotype when compared to boys. Gender moderated the observed models regarding the concordances between the romantically unsuccessful stereotype and romantic self-concept as well as the congruence between the unattractive stereotype and attractive self-concepts Girls were negatively affected by incongruences between these stereotypes and self-concepts. In contrast, boys were unaffected or positively affected. The unattractive and unsuccessful at dating stereotypes and related stereotypes may have uniquely affected girls for multiple reasons. First, people tend to stereotype sexually objectified women and girls as unintelligent (e.g., Daniels & Zurbriggen, 2016), which might extend to people believing they are unfit for pSTEM careers. This may explain why merely having the goal to date or be attractive was negatively related to outcome variables for girls but not for boys. Second, most prior studies have focused on girls and women when exploring the stereotype that dating and attractiveness as incongruent with success in pSTEM (e.g., Kessels, 2005; Pronin et al., 2004). It is possible that people do not see attractiveness and dating to be as much as a detriment to men and boys' pSTEM success when compared to girls and women. Concurrently, boys and men may receive a boost when they do fit the unattractive or unsuccessful at dating stereotypes.

Gender was not a moderator for the genius and socially awkward stereotypes and related self-concepts. This indicates that these two stereotypes and related self-concepts may work similarly for students regardless of gender. They help or hinder student's pSTEM motivation based on matching self-concepts alone. This was unexpected, as gender was hypothesized to be a significant moderator for all stereotypes. It is possible that seeing oneself as a genius or socially competent are less gender-stereotyped when compared to self-concepts related to being attractive or successful at dating. Unlike the other domains, there are not clear negative and gendered stereotypes related to being a socially competent girl or not viewing yourself as a "pSTEM genius."

Contrary to expectations, girls were not significantly less likely than boys to have stereotype congruent self-concepts. This is in line with the gender similarities hypothesis and related meta-analysis (Hyde, 2005). The meta-analysis found there to be small to no difference by gender across many variables, including many self-concepts and goals (Hyde, 2005). Rather than having significantly different self-perceived competencies or goals when compared to boys, girls faced a cost for endorsing certain self-concepts and stereotypes while boys did not. Thus, stereotypes about people in pSTEM being unattractive and unsuccessful at dating, dating goals, and attractiveness self-concepts and goals may contribute to gender gaps in pSTEM.

Developmental Considerations

The study was the first to look at balanced identity theory among adolescents. Prior studies have explored both implicit stereotypes (Cvencek et al., 2015) and explicit stereotypes (Patterson & Bigler, 2014) among children using balanced identity theory. Support for balanced identity theory was indicated in the study using implicit measures but not in the study using explicit measures. In the latter study, the authors proposed it was due to children lacking formal operations. This cognitive limitation makes transitive logic difficult and may result in children not internalizing stereotypes about themselves despite believing a stereotype more generally (Abrams et al., 2014; Patterson & Bigler, 2018). The present study found support for balanced-identity theory when considering explicit pSTEM stereotypes among adolescents in high school. Thus, by adolescence, individuals may have the cognitive skills necessary (i.e., formal operations) to consider concordances between their endorsements of stereotypes about pSTEM and their related self-concepts. They are then able to adjust their identification and motivation in pSTEM accordingly. However, given two known studies have tested the balanced identity model in children, more research is needed to confirm the premise that identity matching may be less likely among children than adolescents.

Self-Concepts: Self-Perceived Competencies verses Goals

In the present research, I separated tested two facets of self-concept in the balanced identity models. These included self-perceived competence in a domain (e.g., feeling attractive) as well as the personal goal to excel in a domain (e.g., desire to be attractive). To my knowledge, no prior studies have compared the relative fits of self-perceptions and goals when testing models based on balanced identity theory.

Overall, the interaction between stereotype endorsement and self-perceived competencies significantly related to more outcome variables than the interaction between stereotype endorsement and goals. Additionally, self-perceptions had more significant main effects than personal goals did. Self-perceived competencies, rather than goals, may be more readily related to outcome variables such as pSTEM identity. Perhaps self-perceptions were more strongly related to outcomes because they correspond to how a person views their current self rather than who they aspire to be.

The one exception when goals worked better than self-perceptions in the model was with the romantic self-concepts. Here, romantic goals proved better than romantic self-perceptions in the model predicting pSTEM outcomes. One possible explanation is that many of the youth in the sample may have had limited dating experience. Given that majority of our sample were sophomores or juniors in high school, there may have been many students who were clear in their future dating goals but more uncertain about their current dating competencies.

Future Directions and Limitations

This study was informative in examining the balanced-identity approach in relation to pSTEM motivation among high school students. Furthermore, it helped to identify potential reasons for gender gaps in pSTEM. However, there are several areas in which this study could be improved. First, this study was correlational and examined stereotypes and self-concepts at one time point. Future studies might examine the longitudinal effect of endorsing pSTEM stereotypes using the balanced-identity approach. This might especially be interesting when examining indicators of persistence, such as declaring a pSTEM major in college or taking AP math courses.

Additionally, a longitudinal design could help explore changes across different periods of identity development (e.g., adolescence into emerging adulthood). This study did not find any consistent group differences based on grade level. This may have been because most students were either in their sophomore or junior year with grade level. A longitudinal study or a cross-sectional study with greater variation in grade level or age might find more interesting results. Also, future studies might explore balanced identity theory using implicit associations. Based on prior research exploring science-gender implicit stereotypes (e.g., Cvencek et al., 2011), employing implicit associations might help find support for the impact of nerd-genius stereotypes on young children.

Finally, a majority of the sample identified as either Asian or White. A more diverse sample may have allowed for investigating the effect of pSTEM stereotypes depending on other characteristics such as race/ethnicity. It is possible that other marginalized groups such as Latinx students or potential first-generation students will also be more frequently demotivated by incongruent self-concepts and stereotypes. Finally, if stereotypes about people in STEM are undermining some students' motivation, researchers and teachers can seek ways to counteract them (see Leaper & Brown, 2014). For example, future research could explore interventions where teachers directly challenge STEM stereotypes in classrooms, such as the view that scientists are "brilliant geniuses" or lack an active social life. Similarly, experimental studies might explore the effect of nerd-genius stereotypes in the media, and qualitative studies might explore their prevalence.

Conclusions

My dissertation extends prior research exploring the relationship between stereotypes about pSTEM and students' pSTEM motivation. I found that stereotypes about people in pSTEM negatively relate to students' pSTEM identity and motivation—in particular, girls are harmed by the stereotypes while boys are sometimes helped. Although a few studies have noted how endorsing stereotypes about people in pSTEM may predict high school or college students' pSTEM interest (Cheryan, Plaut et al., 2013; Ehrlinger et al., 2018; Garriott et al., 2017; Master, Cheryan, & Meltzoff, 2016; McPherson et al., 2018; Starr, 2018), I considered the combined effects of nerd-genius pSTEM stereotypes and self-concepts in relation to high school students' pSTEM identity and motivation. To my knowledge, this was the first study (1) to examine the relative contribution of self-perceptions compared to goals when testing the balanced identity model and (2) to examine balanced identity theory among high school students.

Notably, I found evidence to support the balanced-identity model whereby the impact of stereotypes on motivation may depend on the extent they are congruent or incongruent with individuals' self-concepts and goals (e.g., Greenwald et al., 2002; Hannover & Kessels, 2004; Niedenthal et al., 1985). Trait-based stereotypes about STEM, such as that people in pSTEM are geniuses or socially awkward, may steer some individuals away from pSTEM if these views are incongruent with their self-concepts. At the same time, some trait-based stereotypes about pSTEM may bolster the interest of those who see themselves as similar to the stereotype.

Finally, my research suggests how some pSTEM stereotypes may differentially affect girls and boys. Girls may be more likely to experience stereotype threat when their self-concepts do not match, while boys may be more likely to experience stereotype lift. Moreover, when concerning attractiveness and dating self-concept and related stereotypes, girls may experience direct and negative effects from holding these self-concepts or goals and stereotypes while boys are unaffected. As a result, nerd-genius stereotypes may contribute to current gaps in STEM (e.g., NSF, 2017), even though they are not all explicitly stereotypes about gender.

Table 1

Bivariate Correlations (N = 310)

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1.Grade Level	-.148**	-.073	-.179**	-.103	-.085	-.008	.020	.040	.024	-.162**	-.132*	-.048	-.017	-.016	-.083	-.065	-.001
2. Math Grade		.342**	.490**	.249**	.300**	.103	.068	.040	.036	.302**	.158**	.058	.128*	-.011	-.002	.022	-.005
3. pSTEM Identity		--	.547**	.541**	.570**	-.002	.008	-.014	-.009	.639**	.594**	.159**	.214**	.141*	-.013	.217**	.095
4. pSTEM Expectancy Beliefs			--	.440**	.441**	.014	.044	.051	-.018	.607**	.317**	.193**	.133*	.114*	-.095	.123*	-.046
5. pSTEM Value Beliefs				--	.673**	.165**	.019	-.016	-.068	.375**	.584**	.081	.078	.009	-.040	.054	-.022
6. pSTEM Career Aspirations					--	.109	.070	-.011	.010	.517**	.582**	.022	.053	-.072	-.085	.010	-.018
7. Genius Stereotype						--	.412**	.412**	.353**	-.018	.098	.105	.077	-.002	.074	.115*	-.024
8. Awkward Stereotype							--	.844**	.836**	.123*	.074	-.010	.071	.122*	.143*	.204**	.139*
9. Unattractive Stereotype								--	.843**	.112	.003	-.003	.039	.136*	.123*	.216**	.148*
10. Romantically Unsuccessful Stereotype									--	.078	.021	-.012	.037	.080	.144*	.191**	.186**
11. Genius SP										--	.618**	.227**	.303**	.296**	.154**	.309**	.190**

12. Genius Goal	--	.004	.216**	.159**	.120*	.217**	.123*
13. Social SP		--	.503**	.541**	.285**	.463**	.190**
14. Social Goal			--	.430**	.535**	.343**	.395**
15. Attract. SP				--	.597**	.702**	.356**
16. Attractive Goal					--	.421**	.564**
17. Dating SP						--	.372**
18. Dating Goal							--

Note. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$. SP = Self-Perception

Table 2
Descriptive Statistics and Gender Group Comparisons for Major Variables (N = 310)

	Scale Alpha	Scale Range	All (n = 310) *M* (*SD*)	Girls (*n* = 155) *M* (*SD*)	Boys (*n* = 155) *M* (*SD*)	t*(df)*	*d*
Math Grade	n/a	4-15	12.07 (2.62)	12.11 (2.60)	12.03 (2.65)	.28 *(308)*	.03
pSTEM Identity	.83	1-6	3.10 (1.07)	3.00 (0.98)	3.21 (1.14)	-1.76^{+} *(300.83)*	.20
pSTEM Expectancy Beliefs	.91	1-5	2.96 (0.73)	2.89 (0.71)	3.03 (0.73)	-1.73^{+} *(308)*	.19
pSTEM Value Beliefs	.82	1-5	3.38 (0.78)	3.33 (0.75)	3.42 (0.82)	-.97 *(308)*	.12
pSTEM Career Aspirations	.96	1-7	4.41 (1.71)	4.36 (1.59)	4.45 (1.83)	-.46 *(308)*	.05
Genius Stereotype	.78	1-6	3.71 (0.94)	3.75 (0.89)	3.68 (1.00)	-.61 *(307)*	.07
Awkward Stereotype	.88	1-6	2.74 (1.00)	2.64 (0.93)	2.85 (1.07)	-1.85^{+} *(299.96)*	.21
Unattractive Stereotype	.88	1-6	2.75 (1.07)	2.52 (0.97)	2.97 (1.12)	-3.76^{***} *(304)*	.43

Rom. Unsuccessful Stereotype	.91	1-6	2.62 (1.06)	2.47 (0.97)	2.78 (1.13)	-2.54* *(298.62)*	.29
Individualistic Stereotype	.84	1-6	2.68 (.98)	2.60 (.93)	2.77 (1.03)	.933 *(304)*	.11
Male Stereotype	.89	1-6	2.92 (1.13)	2.98 (1.13)	2.86 (1.14)	-1.50 (307)	.17
Genius Self-Perception	.89	1-6	3.03 (1.16)	2.90 (1.11)	3.15 (1.19)	-1.88+ *(301)*	.22
Genius Goal	.84	1-6	3.46 (1.21)	3.42 (1.25)	3.50 (1.17)	-.53 *(302)*	.07
Social Self-Perception	.89	1-6	3.95 (1.06)	3.98 (1.06)	3.92 (1.06)	.51 *(300)*	.06
Social Goal	.75	1-6	3.86 (0.95)	3.97 (0.79)	3.76 (1.08)	1.98* *(303)*	.22
Attractive Self-Perception	.85	1-6	3.40 (0.98)	3.42 (0.95)	3.38 (1.02)	.38 *(301)*	.04
Attractive Goal	.78	1-6	3.49 (0.99)	3.50 (0.95)	3.48 (1.04)	.14 *(291)*	.02
Dating Self-Perception	.89	1-6	3.11 (1.05)	3.06 (0.96)	3.16 (1.13)	-.84 *(297)*	.10
Dating Goal	.83	1-6	3.22 (1.21)	3.03 (1.15)	3.42 (1.24)	-2.78**	.33

						(289)	
Communal Self-Perception	.83	1-6	4.28 (.92)	4.47 (.85)	4.09 (.95)	3.66^{***} (300)	.42
Communal Goal	.77	1-6	4.42 (.89)	4.55 (.82)	4.28 (.95)	2.71^{**} (301)	.31
Male Self-Perception	.89	1-6	3.47 (1.03)	3.06 (1.00)	3.86 (.92)	-3.93^{***} (300)	.45
Male Goal	.80	1-6	3.79 (.88)	3.63 (.95)	3.94 (.78)	-1.75^{+} (300)	.20

Note. $^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

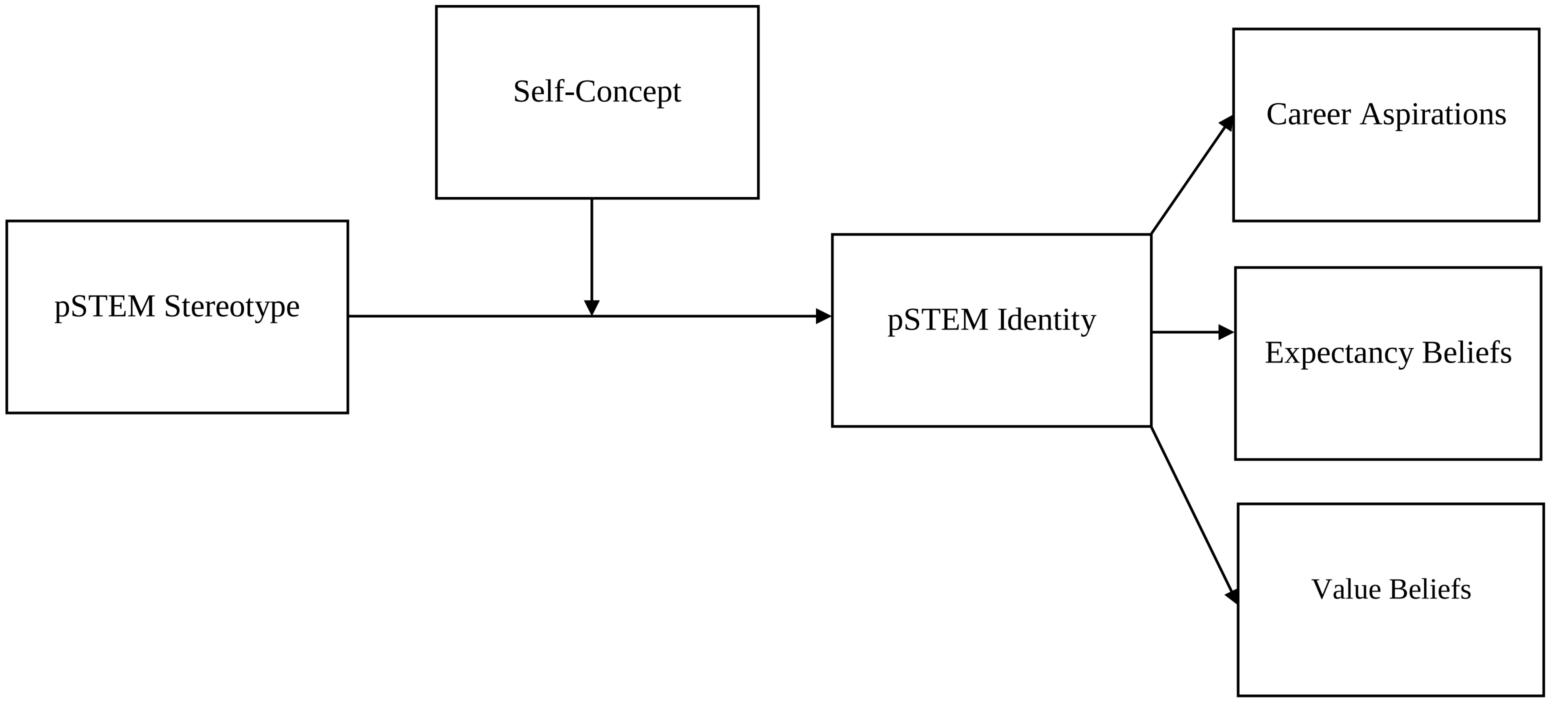

Figure 1. **Theoretical Path Model**.

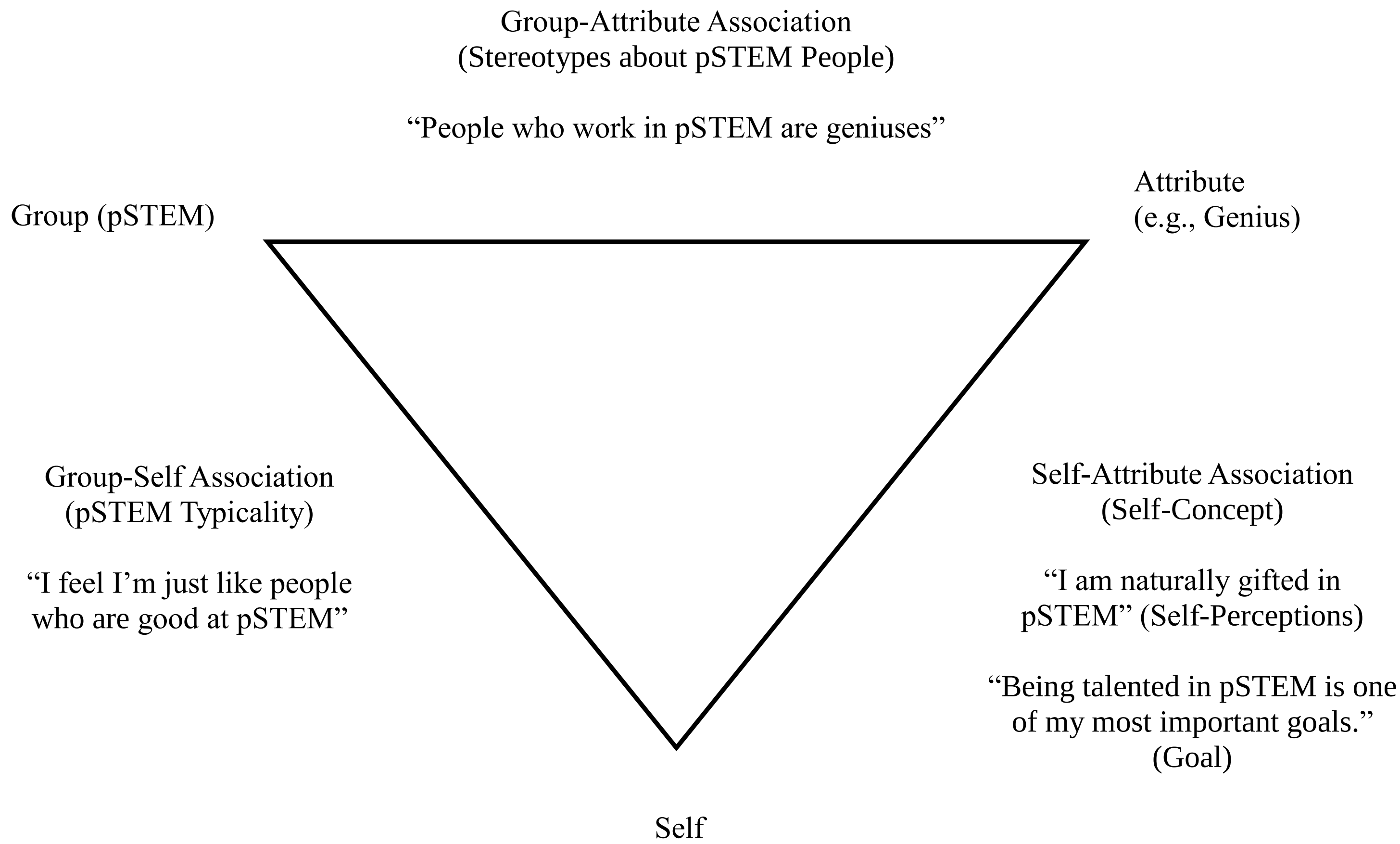

Figure 2. **Balanced Identity Theoretical Model**.

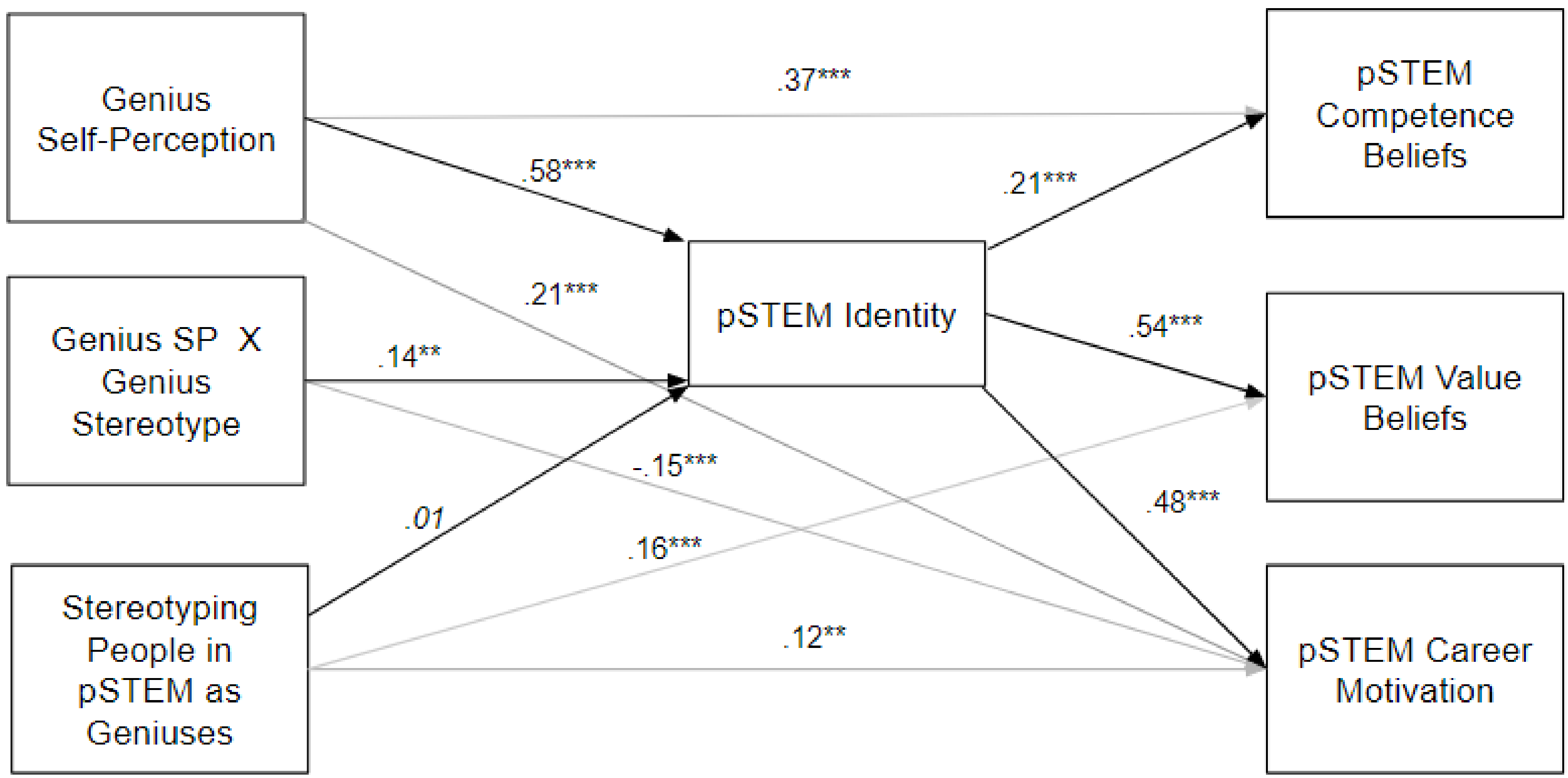

Figure 3. **Genius Stereotype and Genius Self-Perception**. Observed path model reflecting the associations among the tested variables (N = 303). Math grade was controlled for in analyses. *p < .05. **p < .01. ***p < .001.

Figure 4. **Genius Self- Perception × Genius Stereotype Endorsement**. Interaction significant at high genius self-concept (blue line) and low genius self- perception (green line). Self-Perception and stereotype endorsement are standardized.

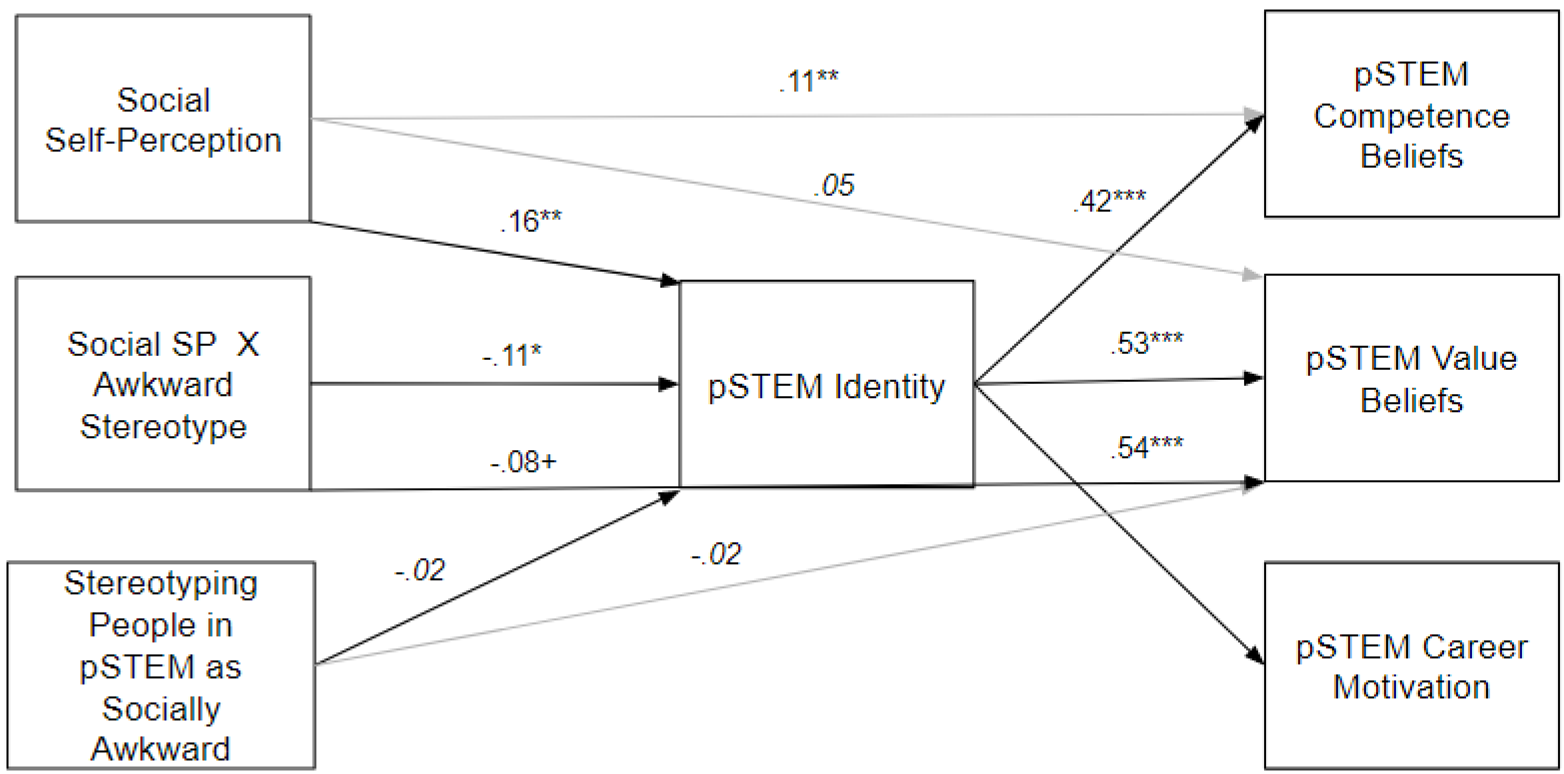

Figure 5. **Socially Awkward Stereotype and Social Competence Self-Perception**. Observed path model reflecting the associations among the tested variables (N = 303). Math grade was controlled for in analyses. *p < .05. **p < .01. ***p < .001.

Figure 6. **Social Self-Perception × Socially Awkward Stereotype Endorsement**. Interaction significant low social self-concept (green line). Self-Perception and stereotype endorsement are standardized.

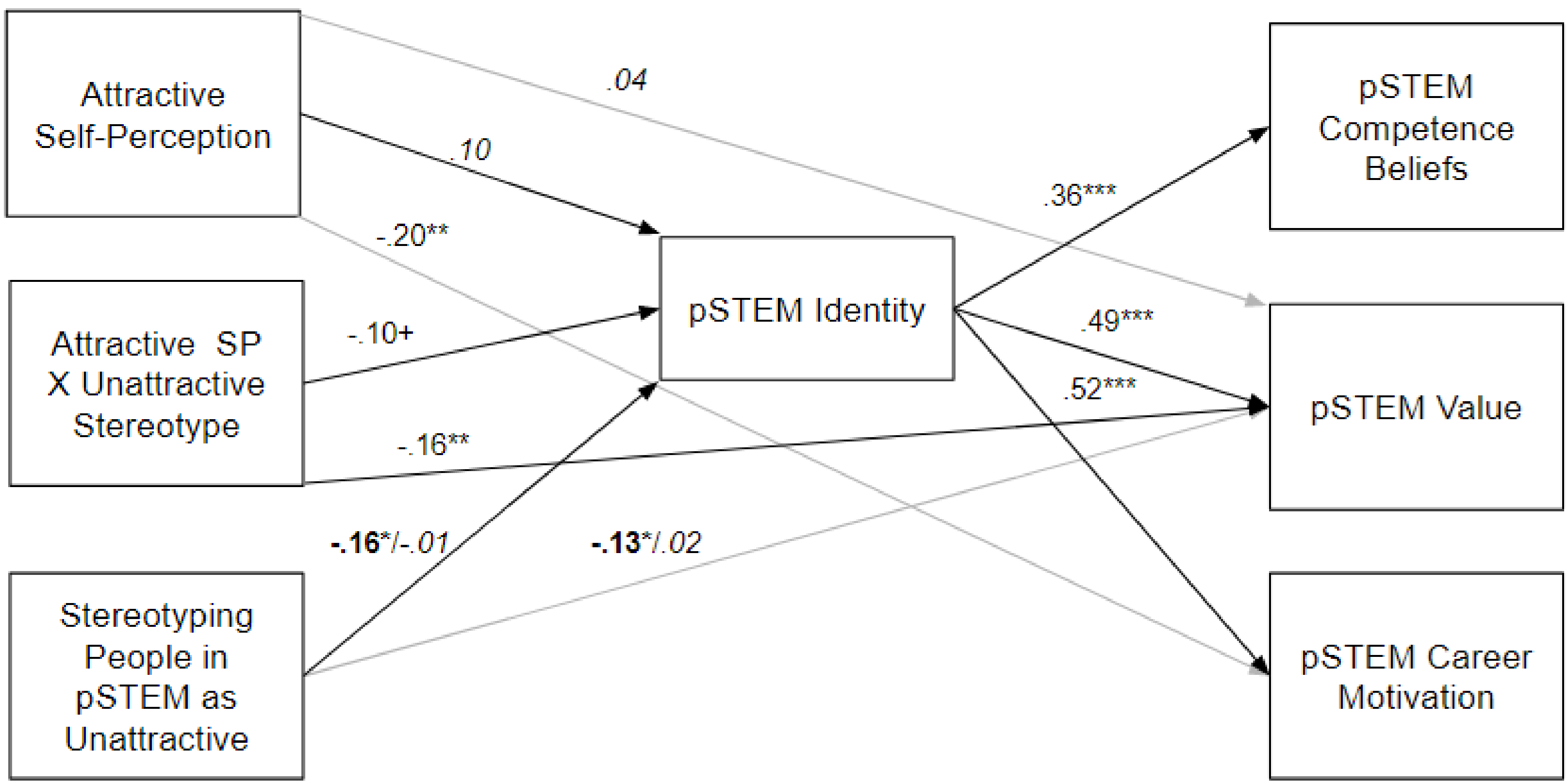

Figure 7. **Unattractive Stereotype and Attractive Self-Perception**. Observed path model reflecting the associations among the tested variables (N = 303). Math grade was controlled for in analyses. *p < .05. **p < .01. ***p < .001. When different beta weights are indicated for a particular pathway, the first (bolded) is for girls and the second is for boys.

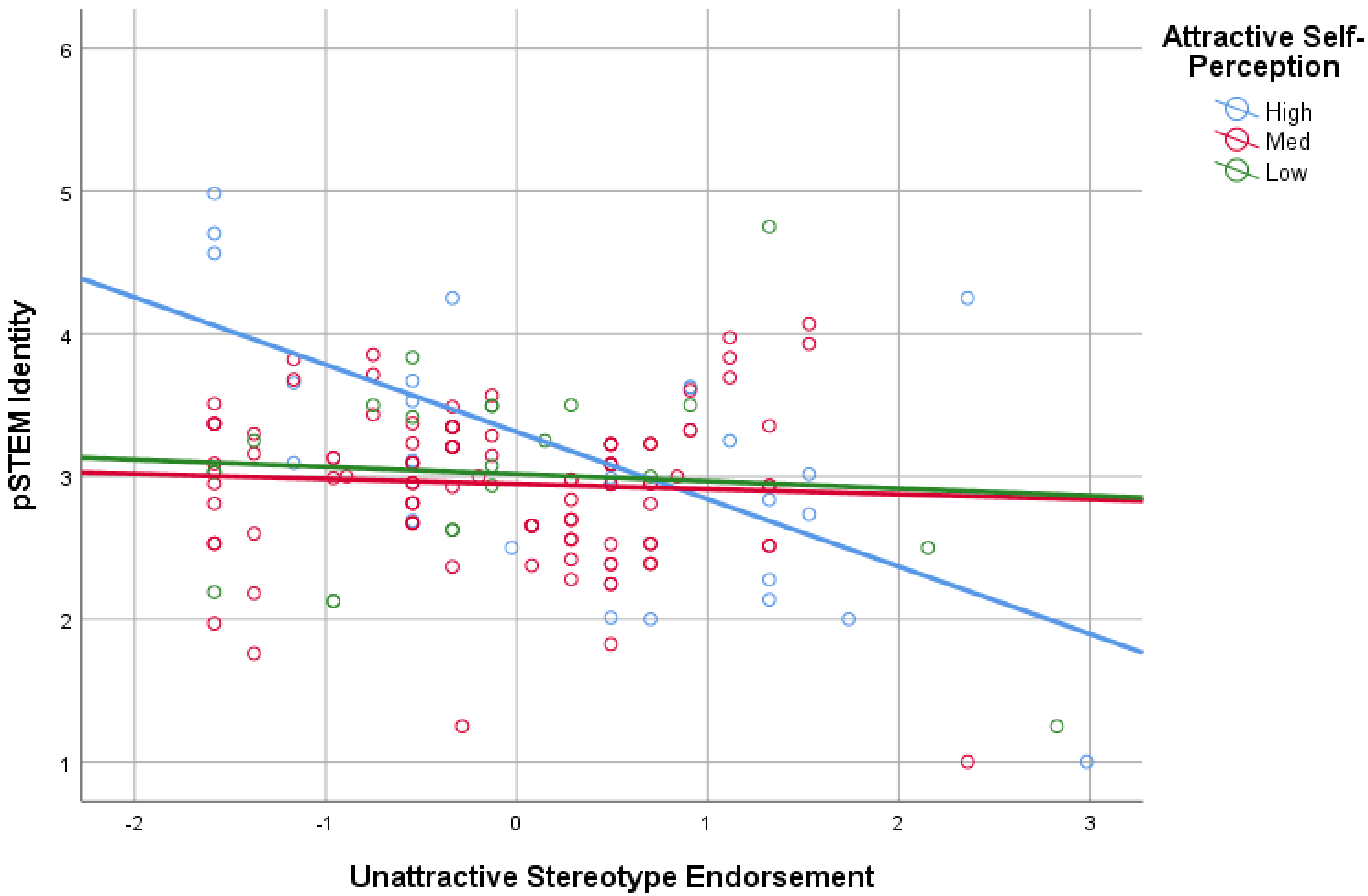

Figure 8. **Girls Attractive Self-Perception × Unattractive Stereotype Endorsement**. Interaction significant at high attractive self- perception (blue line). Self-perception and stereotype endorsement are standardized.

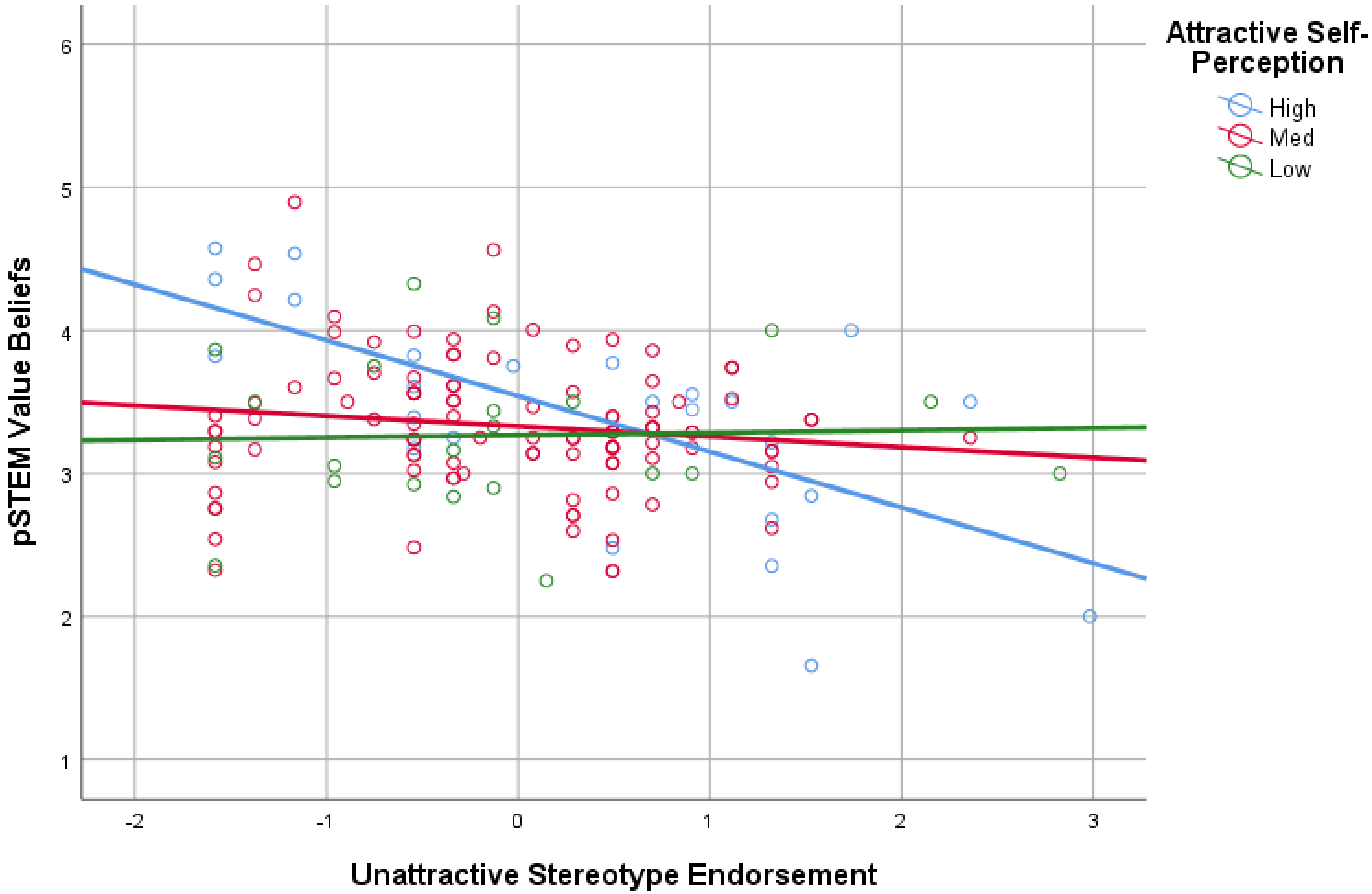

Figure 9. **Girls Attractive Self-Perception × Unattractive Stereotype Endorsement**. Interaction significant at high attractive self-perception (blue line). Self-perception and stereotype endorsement are standardized.

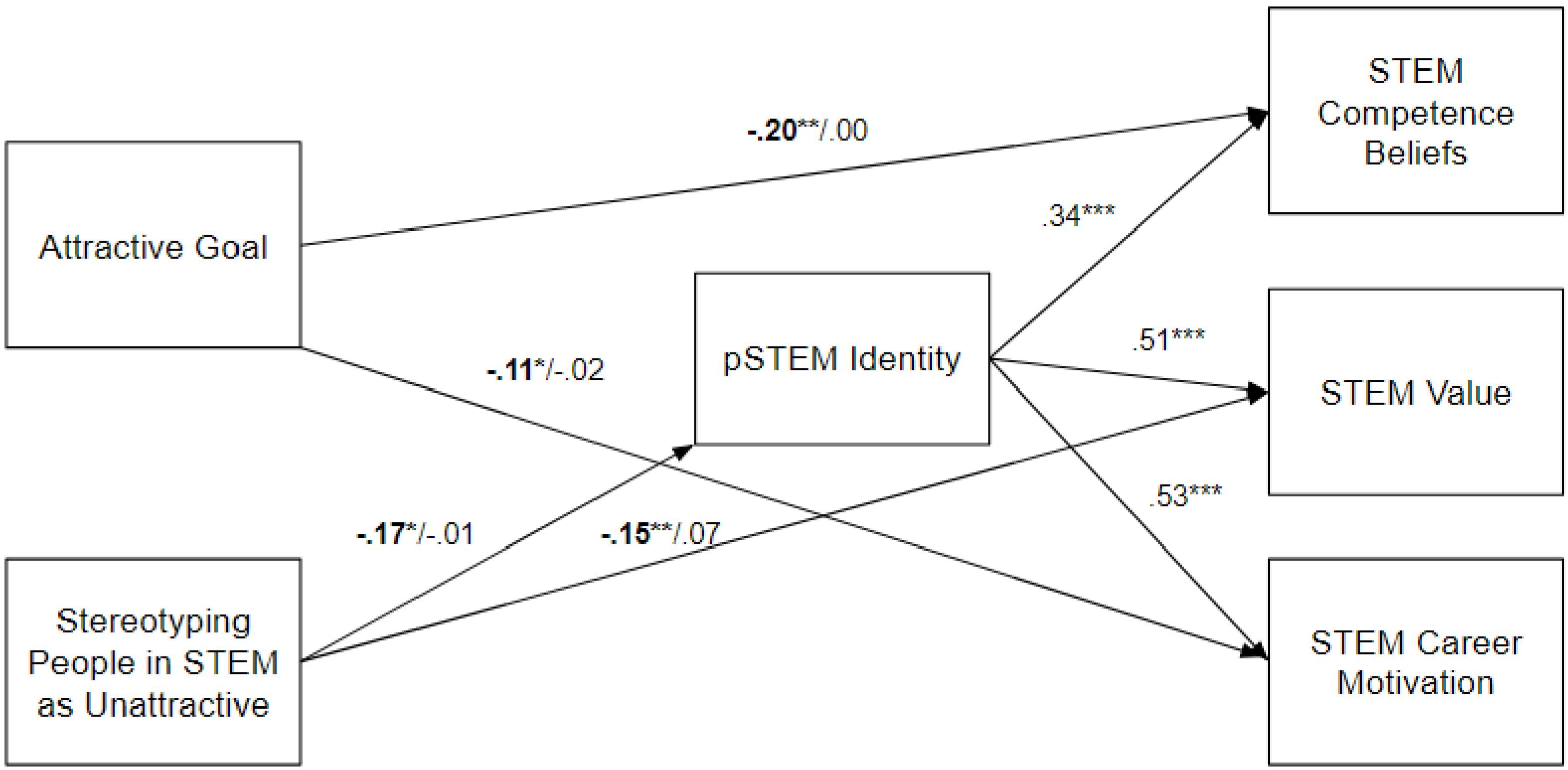

Figure 10. **Unattractive Stereotype and Attractive Goal**. Observed path model reflecting the associations among the tested variables (N = 303). Math grade was controlled for in analyses. *p < .05. **p < .01. ***p < .001. When different beta weights are indicated for a particular pathway, the first (bolded) is for girls and the second is for boys.

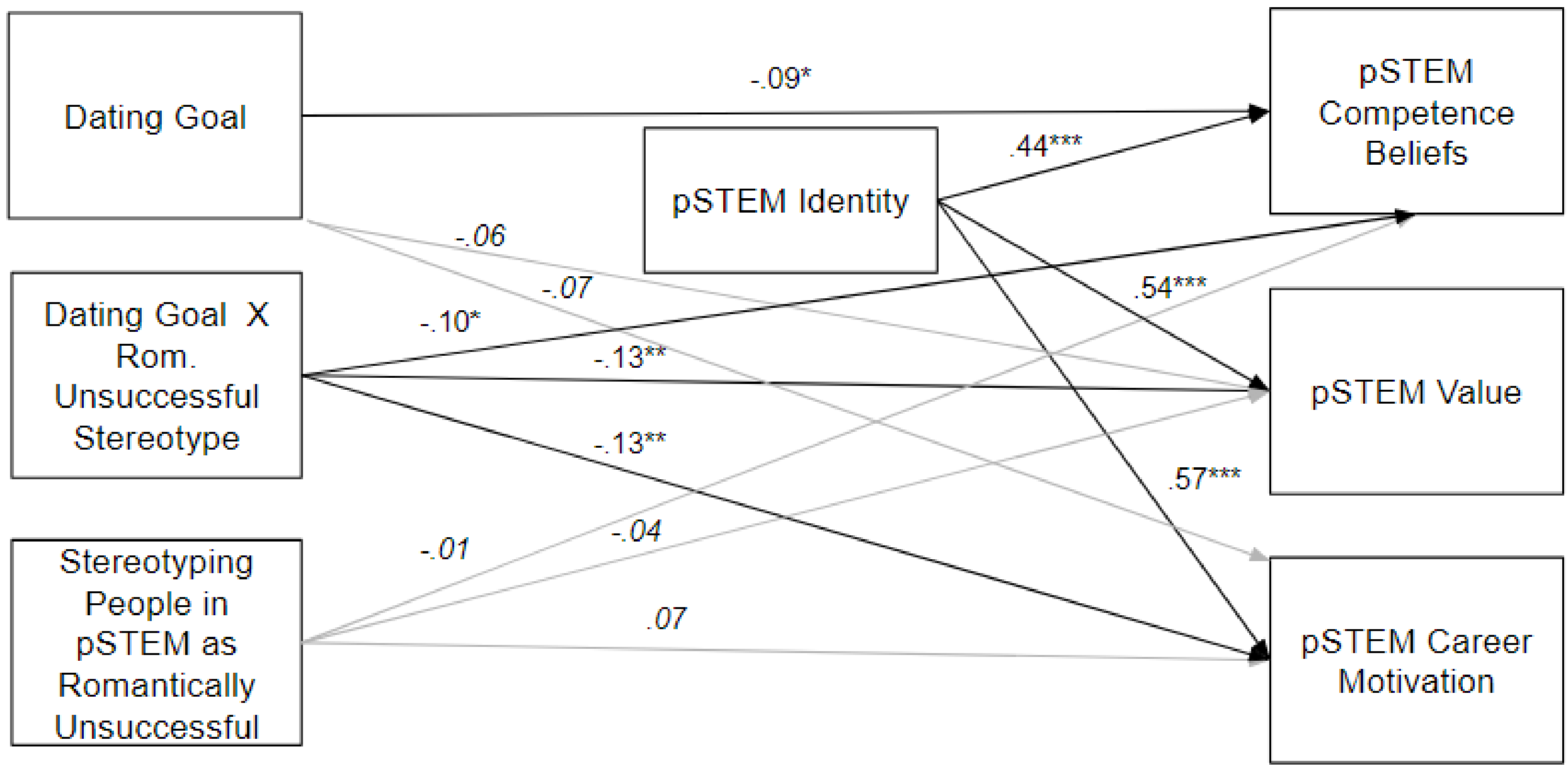

Figure 11. **Romantically Unsuccessful Stereotype and Dating Goal**. Observed path model reflecting the associations among the tested variables (N = 303). Math grade was controlled for in analyses. *p < .05. **p < .01. ***p < .001.

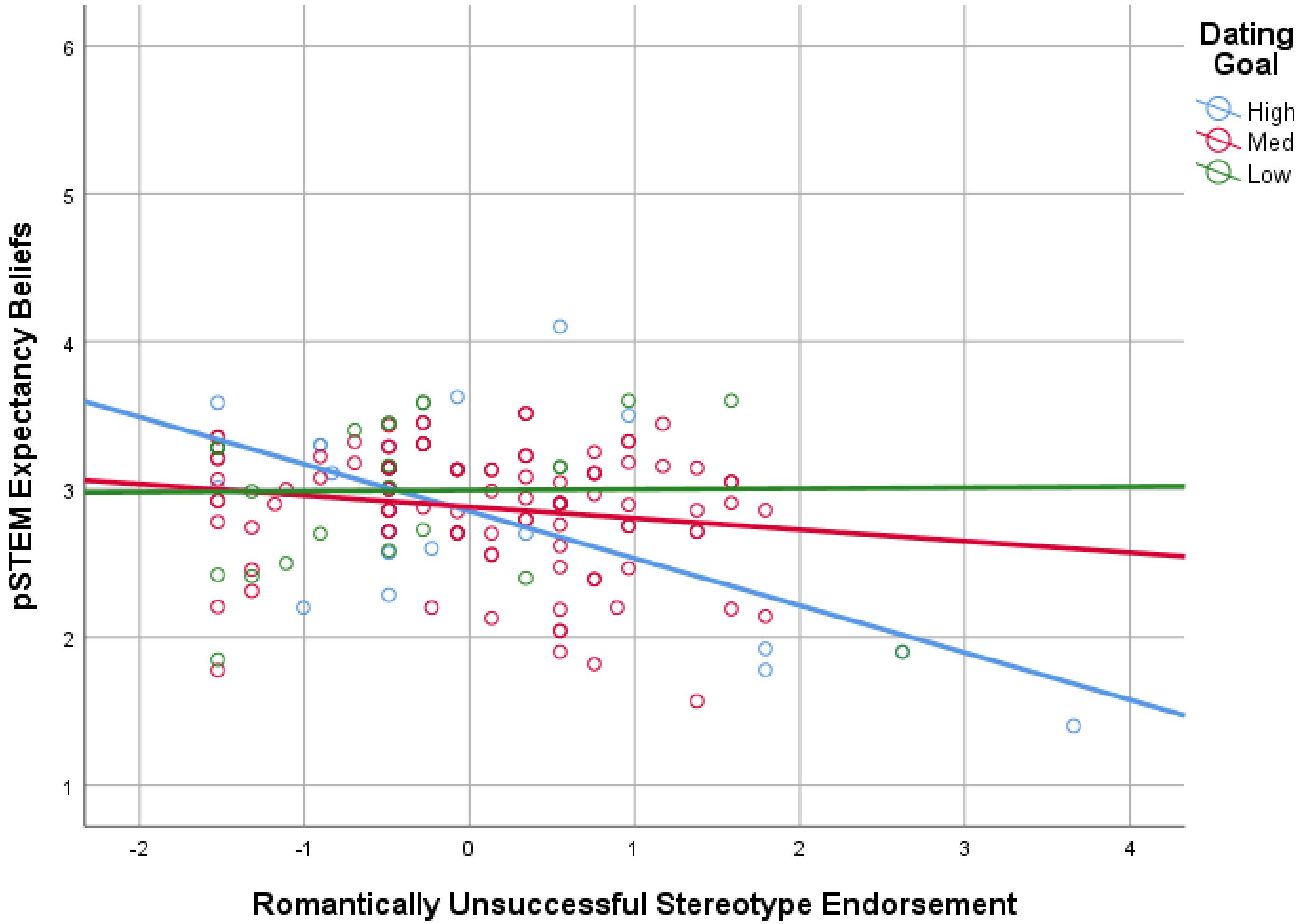

Figure 12. **Girls Dating Goal × Romantically Unsuccessful Stereotype Endorsement**. Interaction significant at high dating goal (blue line). Dating goal and stereotype endorsement are standardized.

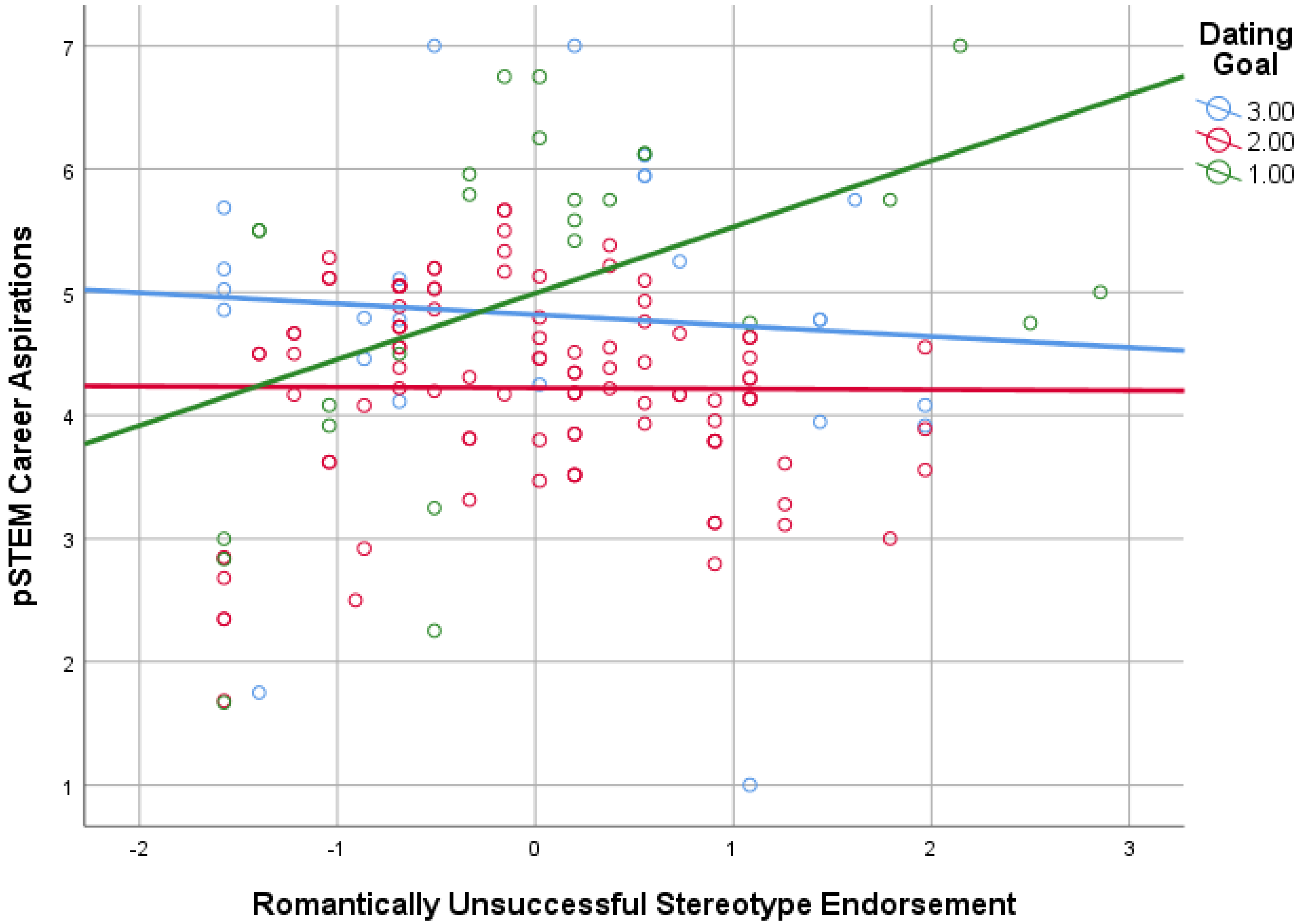

Figure 13. **Boys Dating Goal × Romantically Unsuccessful Stereotype Endorsement**. Interaction significant at low dating goal (green line). Dating goal and stereotype endorsement are standardized.

Appendix

Nerd-Genius Stereotypes Scale

Male
People who work in pSTEM are often men.
People who work in pSTEM are not usually women.
I associate pSTEM with men.
If I hear that someone works in pSTEM, I assume that they're a man.
In general, I do not expect women to be in pSTEM.

Genius
People who work in pSTEM are geniuses.
People who work in pSTEM are naturally very intelligent.
People who work in pSTEM are gifted in math.
People who work in pSTEM are brilliant.
People who work in pSTEM are frequently self-taught (e.g., coding).

Individualistic
People who work in pSTEM tend to work alone.
People who work in pSTEM often work on projects unrelated to people.
People who work in pSTEM don't often have the chance to help others.
People who work in pSTEM are more interested in things than people.
People who work in pSTEM don't often work with other people.

Socially Awkward
People who work in pSTEM are socially awkward.
People who work in pSTEM don't have many friends.
People who work in pSTEM are introverted.
People who work in pSTEM lack interpersonal skills.
People who work in pSTEM have a hard time making new friends.

Unattractive
People who work in pSTEM are unattractive.
People who work in pSTEM look "geeky".
People who work in pSTEM don't spend a lot of time on their physical appearance.
People who work in pSTEM don't really care what they look like.
People who work in pSTEM look "nerdy".

Romantically Unsuccessful
People who work in pSTEM find dating difficult.
People who work in pSTEM are more likely to be single than others.
People who work in pSTEM have a hard time getting dates.
People who work in pSTEM are *not* the most desirable people to date.
People who work in pSTEM have a lot of dating opportunities. (reverse)

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