Examining Adolescent Daughters' and their Parents' Implicit Math-Gender Stereotypes

Christina Lapytskaia

A THESIS SUBMITTED TO THE FACULTY OF GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF ARTS

Graduate Program in Psychology

York University

Toronto, Ontario

June, 2018

Abstract

Women continue to be underrepresented in STEM fields, and research suggests that math-gender stereotypes may be a contributing factor. In the present research I examined daughters' and parents' implicit math-gender stereotypes during an important developmental period for career-related decisions: late adolescence. Participants (*N*=415) included adolescent girls (*N*=185, M_{age}=17) and at least one parent (*N*=230, M_{age} =49). Implicit math-gender stereotyping was measured using an IAT (Greenwald et al., 1998), and explicit stereotyping, math attitudes and math ability were measured using self-reports. Daughters and parents demonstrated significant implicit and explicit stereotyping, but no relationship emerged between daughters' and either parents' math-gender stereotypes. Moreover, parents' math stereotyping did not predict their daughters' math attitudes or ability. However, daughters' math attitudes and ability were predicted by their own implicit and explicit stereotyping. These findings highlight the importance of challenging math-gender stereotypes across development.

Dedication

With genuine appreciation and heartfelt thanks, I dedicate this thesis to the entire IPSC family.

Acknowledgments

I would like to express my sincere gratitude and appreciation to my supervisory committee member, Ward Struthers, for all of his help, support, and guidance, as well as my examining committee members, Julie Condor and Suzanne MacDonald, for their willingness to be part of this committee. I would also like to thank every single person involved in the creation and realization of this project. Although there were many long days and nights, each presented itself with an invaluable new learning opportunity (and lots of chocolate!).

An additional thank you goes out to my family for supporting me throughout the duration of this project, and for continuing to support me through my educational endeavors.

My deepest appreciation and acknowledgment goes to my supervisor, Jennifer Steele, for her never-ending kind words, support and encouragement. I would like to thank you for all of your hard work and guidance throughout this project, and for helping this thesis become a success.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Examining Adolescent Daughters' and their Parents' Implicit Math-Gender Stereotypes

Women typically make up close to 60% of all university graduates (Statistics Canada, 2015). However, the proportion of women graduating from specific programs can vary drastically. Although the gap has decreased across the years, a greater proportion of men continue to graduate from Science, Technology, Engineering, and Mathematics (STEM) programs. According to Statistics Canada (2015), only 39% of the graduates from STEM programs are women. Not only are women underrepresented within STEM programs, their representation within the different STEM fields varies, with women being least likely to pursue mathematics or engineering (Statistics Canada, 2015). For example, according to the 2011 National Household Survey (NHS), of all graduates aged 25 – 34 in a STEM program, 51,675 women received a STEM degree in engineering, mathematics or computer science, compared to 148,752 men who received a degree in the same fields (Statistics Canada, 2015). When considering the proportion of male to female graduates, it is evident that women are successfully completing STEM programs, but at much lower rates than men, ultimately leading to their underrepresentation within STEM careers. Considering the prestige (Jacobs, 2014; Smith, 2014), high pay (Jacobs, 2014), and demand for qualified personnel in STEM careers (Schwartz, 2015), this underrepresentation has the potential to place women at a life-long disadvantage.

For those women who do successfully pursue a STEM degree, data suggest that they may face disadvantages within STEM careers that their male colleagues do not encounter. A recent report found that women held only 23% of all full-time STEM positions, instead holding 41% of all part-time jobs, which tended to have lower pay (TD Economics, 2017). In addition, there is a consistent wage discrepancy, whereby women within the same roles typically earn 7.5% less than their male counterparts, even after controlling for education, experience and other factors, placing women at a consistent financial disadvantage (Shendruk, 2015; TD Economics, 2017). Moreover, only 4.7% of male STEM graduates reported being unemployed, compared to 7% of female graduates (Statistics Canada, 2015). This gender discrepancy seems to have persisted within our society for over three decades; in 1987 only 20% of the STEM workforce consisted of women, and by 2015 this number remained comparable at roughly 23% (Shendruk, 2015; TD Economics, 2017). In addition, only 18% of the members of the Canadian Engineering and Science Hall of Fame are women, only 22 of 186 prizes worth more than $200,000 were given to women during the decade between 2004 – 2014 by the Natural Science and Engineering Research Council (NSERC), and not a single woman has won NSERC's top prize ($1 million) since the Hertzberg medal's creation in 1991 (Schwartz, 2015).

There are many factors which can contribute to women's underrepresentation in STEM fields. Importantly, research suggests that innate gender differences in ability are not likely one of them (Spelke, 2005; Barres, 2005; Barres, 2006). Instead, research points to a host of social and environmental factors, including stereotyping and discrimination, which contributes to women leaving STEM fields (Schwartz, 2015). For example, research suggests that there is an expectation for women within science fields to take on administrative or social work in addition to their core duties; in one study, a third of the women felt an obligation to take on more traditionally feminine roles (e.g., going on coffee runs, scheduling meetings) and over half of women reported receiving backlash when displaying more traditionally masculine traits (e.g., being assertive in a meeting; Schwartz, 2015). This persistent stereotyping and discrimination has the potential to influence not only how girls and women are treated and differentially encouraged in STEM fields, but also their own self-perceptions, attitudes, and even performance (Lewis & Sekaquaptewa, 2016; Spencer, Logel, & Davies, 2016; Steele, Spencer, & Aronson, 2002; Steele, Reisz, Williams, & Kawakami, 2007; Walton, Logel, Peach, Spencer, & Zanna, 2015).

The goal of the present research was to extend our understanding of one specific factor that has the potential to contribute to women's self-perceptions and ultimately their representation in STEM fields: implicit math-gender stereotyping. Specifically, in the current research I examined the implicit and explicit math-gender stereotypes held by daughters, and their parents, at a time of great transition and decision-making in children's development: late adolescence. As adolescents transition to university, decisions that are made can shape young women's academic courses, their major, and ultimately their career path. Courses in math and science serve as gatekeepers to STEM majors and subsequent careers that can offer social and economic benefits above and beyond other fields. In the current research, I aimed to determine (a) whether implicit math-gender stereotypes differ across generations, (b) whether implicit math-gender stereotypes predict young women's math attitudes and self-reported math ability, and (c) whether parents' math-gender stereotypes predict daughters' implicit and explicit math-gender stereotypes, as well as their math attitudes and ability, at this important stage in development.

The development of implicit math-gender stereotypes

The vast majority of research examining math-gender stereotypes, in particular the transmission of math-gender stereotypes and attitudes between parents and their children, has focused on explicit, or self-reported, beliefs. In recent years, researchers have become increasingly interested in *implicit* stereotypes. Implicit stereotypes have been defined as cognitive associations between a social group and an attribute that are outside of our conscious awareness and are not accessible through introspection (Cvencek, Meltzoff, & Baron, 2012;

Kiefer & Sekaquaptewa, 2007; Lai, Hoffman, & Nosek, 2013). Implicit math-gender stereotypes are most commonly measured using an Implicit Association Test (IAT; Greenwald et. al., 1998; Greenwald et. al., 2003), which is a computer-based task that measures the speed with which people associate men with math and women with liberal arts (or language, humanities, etc.), as compared to the reverse pairing (women with math and men with arts; for examples see Passolunghi, Rueda Ferreira, & Tomasetto, 2014; Steffens et. al., 2010). Research using this and other related implicit measures has demonstrated that both children and adults implicitly math-gender stereotype, with participants being faster to pair math with male and arts with female, relative to the reverse pairing (Cvencek, Kapur, & Meltzoff, 2015; Kiefer & Sekaquaptewa, 2007; Lane, Goh, & Driver-Linn, 2012; Nosek, Banaji, & Greenwald, 2002; Nosek & Smyth, 2011; Passolunghi et. al., 2014; Steffens & Jelenec, 2011; Steffens et. al., 2010). However, the age at which children develop an implicit math-gender stereotype has been somewhat inconsistent across studies, suggesting possible cultural influences on the transmission of this stereotype (Nosek et. al., 2009).

For example, Cvencek, Meltzoff, and Greenwald (2011), examined American children in early elementary school who were between six and ten years of age (grades 1 – 5). Using a child-friendly Implicit Association Test, they found that both boys and girls implicitly math-gender stereotyped, and this was true among children in each grade level (i.e., 1, 3 and 5). Moreover, boys implicitly identified with math more strongly than girls did. Similarly, at an explicit level, both boys and girls endorsed a math-gender stereotype, and boys also explicitly identified with math more strongly than girls. These results suggest not only that the math-gender stereotype develops at a very young age, at both an implicit and explicit level, but that this stereotype influences children’s identification with math from early childhood.

Similarly, Cvencek and colleagues (2015) examined children in Singapore who were between six and ten years of age (in grades 1, 3 and 5), and found that, even though girls and boys did not differ in their math achievement scores, girls (but not boys) were quicker to pair male with math and female with language (relative to the reverse pairing) on a child-friendly IAT, and reported weaker identification with math than boys did. At an explicit level, boys were more likely to report a male character liking math as compared to a female character, suggesting the presence of an explicit math-gender stereotype for boys (but not girls). This is consistent with the possibility that young children's implicit perceptions of themselves, and mathematics, begins to reflect math-gender stereotypes from early elementary school.

Other research suggests a different pattern, where boys develop an implicit math-gender stereotype at a later age. For example, Passolunghi and colleagues (2014) examined Italian children between seven and thirteen years of age (in grades 3, 5 and 8), and found that girls implicitly stereotyped math across all three grades, while boys only implicitly gender stereotyped math in the eighth grade. In their study, the explicit math-gender stereotype increased from age seven to age ten (from the third to fifth grade) for both boys and girls, and remained stable by age thirteen (in the eighth grade). Most notably, although thirteen-year-old boys explicitly reported that girls are better at math than boys, they demonstrated the strongest implicit math-gender stereotyping. In sum, it appears that children begin to develop the math-gender stereotype at both an implicit and explicit level during elementary school, with girls potentially developing this stereotype earlier than boys.

By the time children have reached early adolescence, research suggests that the math-gender stereotype is more likely to be ingrained both implicit and explicitly. For example, Steffens and Jelenec (2011) examined the math-gender stereotypes of German students who were either in early adolescence (around 14 years, in the ninth grade) or in early adulthood (around 22 years, in university). They found that university students reported stronger explicit math-gender stereotypes than the younger adolescent students, and reported being overall more aware of this stereotype. However, at an implicit level, men held stronger math-gender stereotypes than women across both age groups. Most importantly, although women (across both age groups) had better math grades than men, men with stronger implicit stereotypes reported higher math ability, whereas women with stronger implicit stereotypes reported lower math ability. Although correlational, these results are consistent with the possibility that women's perceptions of their own math ability may be less influenced by their actual math performance and more by their level of implicit math-gender stereotyping.

Additional research with university students suggests that these implicit math-gender stereotypes continue into adulthood, possibly with consequence. For example, research with undergraduate women has found that women who endorse greater implicit math-gender stereotypes perform worse on math exams and express less interest in pursuing a math-related career, particularly when they strongly identify with their gender (Kiefer & Sekaquaptewa, 2007; Lane, Goh, & Driver-Linn, 2012; Ramsey & Sekaquaptewa, 2011). Moreover, adults' math-gender stereotypes also predict more negative math attitudes, decreased math identity and lower math performance (Kiefer & Sekaquaptewa, 2007; Nosek, Banaji, & Greenwald, 2002).

Negative associations with math may not only contribute to women's underrepresentation within STEM fields, but may exacerbate the stereotypes already present within these fields. For example, Smyth and Nosek (2015) examined adults' science-gender stereotypes using the IAT. Adults reported both implicit and explicit science-gender stereotypes, however, men showed greater implicit stereotyping than women, and men in STEM fields showed greater implicit stereotyping than men within non-STEM fields. Interestingly, women within STEM fields also demonstrated the implicit science-gender stereotype, although to a *lower* extent than non-STEM women. Moreover, individuals within science majors or careers (i.e., biological/physical sciences and engineering – the fields with the greatest female underrepresentation) had the largest difference between men and women's implicit stereotyping, with men showing greater stereotyping and women showing less implicit stereotyping.

Although the majority of this research has been correlational and cross-sectional, taken together the findings are consistent with the possibility that the stereotypes children develop towards math throughout their childhood and into adulthood can shape their experiences, expectations, and choices in later life. It is important, therefore, to understand the many social factors that may influence children's math-gender stereotype development and ultimately their attitudes towards math. A growing body of literature has examined in greater depth some of the main social factors contributing to this gender gap. One major source of socialization being examined is the role of parents.

The Transmission of Math-Gender Stereotypes

A great deal of research has examined how parents influence their children's academic attitudes and achievement. Although none of this research has specifically focused on the relationship between parents' and children's implicit math-gender stereotyping, a number of studies have suggested that parents' attitudes and behaviors can directly, and indirectly, support and socialize math-gender stereotypes among their children (Bhanot & Jovanovic, 2005; Eccles, 1983; Simpkins, David-Kean, & Eccles, 2005). Math is an activity that can be complex and require parental support, assistance and encouragement in order to develop children's persistence with challenging math problems (Simpkins, David-Kean, & Eccles, 2005). As such, the types (and frequency) of mathematical activities parents engage in with their children predicts their children's math ability later on (Hart, Ganley, & Purpura, 2016).

One way that parents transmit their attitudes and stereotypes to their children is through parent-child coactivity, which is when both parties engage in an activity together (Simpkins, David-Kean, & Eccles, 2005). Coactivity provides parents with the opportunity to teach their children new skills and encourage their development. Past research suggests that coactivity increases children's participation in math activities. For example, when both parents report engaging in frequent math behaviors (e.g., paying bills, planning a budget etc.), children's participation in math also increases (Simpkins, David-Kean, & Eccles, 2005). However, of greatest relevance to the current research, previous findings suggest that mothers encourage boys to engage in math activities more often than girls, and parents purchase math materials for boys more frequently than for girls (Simpkins, David-Kean, & Eccles, 2005). Thus, despite parents explicitly engaging in positive math activities with their children, parents nevertheless may indirectly and unwittingly socialize a math-gender stereotype to their children by treating sons differently from daughters.

Homework is another common means through which parents can indirectly express their academic attitudes to their children. One way is through intrusive support, which occurs when parents interrupt their child to provide unwanted homework help (Bhanot & Jovanovic, 2005). Research suggests that parents' self-reported gender stereotypes are significant predictors of intrusive support during homework, such that parents with stronger self-reported math-gender stereotypes are more likely to provide intrusive support during math homework (Bhanot & Jovanovic, 2005). Parents with stronger math-gender stereotypes also report lower perceptions of their children's math ability, which results in their children reporting lower perceptions of math ability (Bhanot & Jovanovic, 2005). Interestingly, despite boys receiving more intrusive support from parents, girls were more sensitive to such intrusions during math homework; hence, the message parents send with their intrusions may reinforce math-gender stereotypes by suggesting that girls are inadequate at completing their math homework on their own (Bhanot & Jovanovic, 2005). Some research suggests that parents may also indirectly transmit their attitudes and stereotypes through their level of math anxiety. Past research has found that mothers report higher explicit levels of math anxiety than fathers do, and consequently, children in mother dyads have significantly lower math attitudes than children in father dyads (Casad, Hale, & Wachs, 2015). Specifically, when both mothers and daughters reported high math anxiety, daughters experienced the largest decreases in math attitudes, grades and self-reported ability (Casad, Hale, & Wachs, 2015). As a result, particular attention should be paid to the transmission of math-gender stereotypes from mothers to daughters.

Moreover, there also appear to be differences in how mothers and fathers perceive sons' and daughters' abilities, although research examining fathers' perceptions has provided inconsistent results. In one study, fathers held higher expectations of success from their sons, while expecting greater effort from their daughters to achieve success in math, despite young boys and girls receiving similar math test scores (Yee & Eccles, 1988). In a more recent study, fathers reported higher perceptions of their child's math ability, for both sons and daughters, than mothers did (Bhanot & Jovanovic, 2005). By contrast, research with mothers suggests a more consistent trend: mothers report higher levels of math-gender stereotyping. For example, despite boys and girls demonstrating similar levels of math ability, mothers view boys as being better at math (Bhanot & Jovanovic, 2005). Mothers with greater math-gender stereotyping also view their daughters as having lower math ability than sons; as a result, sons reported higher self-reported math ability than daughters (Jacobs & Eccles, 1992). Additionally, mothers of sons rated their child as being more talented in math, whereas mothers of daughters rated effort as the primary reason for their child's success (Eccles, 1983; Yee & Eccles, 1988). Hence, it appears that daughters are particularly susceptible to parental attitudes, especially when it is from their mother; research suggests that mothers frequently report more negative associations between daughters and math.

In sum, parents' beliefs about math can shape their subsequent behaviors, depending on their child's gender. Research suggests that parents generally support the view that boys are better than girls at math, have higher expectations of success from sons, and purchase more math-related activities for their sons (Eccles, 1983; Simpkins, David-Kean, & Eccles, 2005; Yee & Eccles, 1988), whereas parents, in particular mothers, tend to report that their daughters require more assistance and need to put in more effort to achieve a good grade in math (Bhanot & Jovanovic, 2005; Eccles, 1983; Yee & Eccles, 1988). However, past research has not examined the direct relationship between parents' and their children's math-gender stereotypes. In addition, no research to date has examined implicit math-gender stereotyping among parent-child dyads.

Current Research

In the current research I aimed to extend previous findings by examining the intergenerational transmission of math-gender stereotypes between parents and their adolescent daughters, with a specific focus on implicit math-gender stereotypes. The first goal of this study was to determine whether math-gender stereotyping differs across two generations – adolescent daughters and their parents – by comparing parents' implicit and explicit math-gender stereotypes with their daughters'. If math-gender stereotypes are changing, one might expect daughters' implicit stereotypes to reflect this and that they would therefore demonstrate significantly less stereotyping than their parents. However, given that the representation of women in STEM fields has not changed dramatically in the last 20 years, I did not anticipate that adolescent daughters would show significantly less implicit math-gender stereotyping than their mothers or their fathers.

The second goal was to examine whether young women's implicit math-gender stereotypes would predict their math attitudes and self-reported math ability during a critical period of transition and career-related decision-making: late adolescence. Given previous findings with children (Cvencek, Meltzoff, & Greenwald, 2011; Simpkins, David-Kean, & Eccles, 2005) and adults (Steffens & Jelenec, 2011), I anticipated that among these emerging adults, implicit math-gender stereotyping would predict unique variance in math attitudes and ability, above and beyond any variance accounted for by explicit stereotypes.

Finally, given the lack of literature examining parents' and children's implicit math-gender stereotyping, I examined whether parents' math-gender stereotypes (both implicit and explicit) as well as parents' math attitudes would predict their daughters' math-gender stereotypes, as well as their math attitudes and math ability. Based on previous research (Bhanot & Jovanovic, 2005; Bleeker & Jacobs, 2004; Casad et. al., 2015; Maloney et. al., 2015), I anticipated a significant relationship to emerge between mothers' stereotypes and daughters' attitudes towards and self-reported ability in math, with mothers' implicit math-gender stereotyping predicting decreased math attitudes and ability in their daughters (Bhanot & Jovanovic, 2005; Jacobs & Eccles, 1992). By contrast, as fathers' perceive their children as having greater math ability (Bhanot & Jovanovic, 2005), I did not anticipate a relationship between fathers' and daughters' math attitudes or math-gender stereotypes.

Method

Participants

A total of 658 people participated during York University's Fall and Spring Campus Open House Days.[1] As part of the psychology department and Faculty of Health or Glendon College recruiting events, prospective students and their parents were offered the opportunity to participate in a research study. Parents and children were specifically recruited and encouraged to participate, however, anyone who expressed an interest in taking part was given the opportunity to do so.

For the present study, only daughters aged 15 to 19 years of age who participated along with at least one parent (mother, father, or both) were included.[2] The final sample consisted of 415 participants including 185 daughters (M_{age}= 17 years, *SD*=.64), as well as 147 mothers (M_{age}= 48 years, *SD*=5.05) and 83 fathers (M_{age}= 50 years, *SD*=5.08).[3] Of the daughters, 102 (55%) participated with only their mother, 39 (21%) participated with only their father, and 44 (24%) participated with both a mother and a father, leading to 147 daughter-mother dyads and 83 daughter-father dyads. A post-hoc sensitivity power analysis was conducted, in order to calculate the minimum effect size that could be detected based on power of α = .80. For paired samples t-tests, Cohen's *d* effect size estimates ranged from *d*= .24 to *d* = .46. For regression models, effect size estimates ranged from *d*= .06 to *d* = .24. These results suggest that, despite a larger sample size, some of the results may be underpowered, a point I return to in the General Discussion.

---

[1] Data were collected during Fall 2011 (Keele and Glendon Campuses), Spring 2012 (Keele Campus), Fall 2012 (Keele Campus), Spring 2013 (Glendon Campus), and Fall 2017 (Keele and Glendon Campuses)

[2] In order to avoid duplicate family data, six additional adolescents who met this criterion were excluded as they were the second daughter to participate within the same family.

[3] Among the adolescents who participated, (*N* = 329, M_{age}= 17.23, *SD* = 2.2), 80% were female (*N*= 262) and 77% (*N* = 272) had at least one parent participate with them.

Among the mothers, 61% identified as Caucasian (*N* = 90), 10% identified as East/ South-East Asian (*N* =14), 8% identified as Black/ African American (*N* = 11), 5% identified as Middle Eastern (*N* = 7), 5% identified as South Asian (*N* = 7), 4% identified as Hispanic (*N*= 6), 3% identified as Native (*N* = 5), 4% identified as "Other" (*N*= 6) and one individual did not specify their race. Among the fathers, 54% identified as Caucasian (*N* = 45), 11% identified as South Asian (*N* = 9), 11% identified as Black/ African American (*N* = 9), 7% identified as East/ South-East Asian (*N* = 6), 4% identified as Hispanic (*N*= 3), 2% identified as Middle Eastern (*N* = 2), 2% identified as Native (*N* = 2), and 9% identified as "Other" (*N*= 7).

Moreover, the majority of mothers (31%; *N*= 45) reported obtaining an undergraduate degree and 23% (*N*= 34) reported completing college (the lowest education level reported was "some high school" and the highest was "completed doctoral degree"). Similarly, the majority of fathers (26%; *N*= 22) reported obtaining an undergraduate degree and 22% (*N*= 18) reported completing a graduate degree (the lowest reported education level was "some high school" and the highest was "completed doctoral degree"). The average household income reported by mothers was between $50,000 - $74,999 and the average household income reported by fathers was between $75,000 - $99,999.

Eighty-eight percent of daughters were in grade 12 (*N* = 164) and had an overall average of 84.08% (*SD* = 6.18). The majority (70%) did not believe they would pursue a degree in STEM and 44% (*N* = 83) stated that they were very unlikely to pursue a degree in STEM (compared to 6% who stated they were very likely to pursue a degree in STEM). Additionally, 68% (*N* = 126) indicated they are planning to obtain a Bachelor of Arts, while only 19% (*N* = 36) indicated they are planning to obtain a Bachelor of Science; 38% (*N*= 70) explicitly reported that they were interested in pursuing a degree in psychology.

Materials

Implicit math-gender stereotyping. Implicit math-gender stereotyping was measured using an Implicit Association Test (IAT; Greenwald et al., 1998; Greenwald et. al., 2003). The IAT was designed to measure cognitive associations between concepts using reaction times. Participants were asked to categorize a series of words using one of two computer keys. Headers remained on the screen to serve as a reminder of the correct categorization concepts. A small red X appeared on the bottom of the screen when an incorrect response was given and remained on the screen until the correct response was provided. Participants were instructed to categorize the words as quickly and accurately as possible.

Participants first completed a block containing 20 practice trials. For each trial participants were required to press one computer key if the word was related to the category "male" (i.e., male, him, he, man, men) and another key if the word was related to the category "female" (i.e., female, her, she, woman, women). In a second block, participants similarly sorted math (i.e., calculate, compute, math, multiply, sum) and liberal arts (i.e., arts, history, English, humanities, literature) words using these same two keys.

Next, participants completed one of two critical blocks. In each critical block participants were presented with 60 trials containing all four concepts (male, female, math, and liberal arts) that were grouped in "practice" (20) and "real" (40) critical trials as outlined by Greenwald and colleagues (2003). In one critical block, participants pressed one key to categorize male and math words together, and pressed the other key if the word was a female or liberal arts word. After one additional practice block, in which only male and female words were sorted and the computer keys used to sort these words were reversed, participants completed a second critical block. In the second critical block, participants were again presented with 60 trials (20 "practice" and 40 "real") containing all four concepts, however they now pressed one computer key if the word was a female or math word and another key if the word was a male or liberal arts word. The order in which the two critical blocks appeared was counter-balanced between participants.

The IAT data were scored using the recommended guidelines by Greenwald, Nosek, & Banaji (2003). Only the "practice" and "real" critical trials from each of the two critical blocks were used for the analysis. Each participant's data were converted into an IAT D-Score (α= .83), such that positive values represented a "male+math" and "female+arts" association (i.e., the math-gender stereotype) whereas negative values represented a "female+math" and "male+arts" association.

Eighteen daughters, 11 mothers and 12 fathers did not complete the IAT. In addition, as is standard practice (Smyth & Nosek, 2015) any participant whose reaction times had over 10% of responses with less than 300 milliseconds were excluded from the data (N= 4; 3 daughters, 1 mother), as well as any participant who was a three standard deviation outlier on this measure (N=2; 1 daughter and 1 mother). Data from an additional three daughters were removed as they had more than a 30% error rate (Smyth & Nosek, 2015). Finally, the data from two fathers were removed as they were assigned the same participant number. The remaining sample with implicit data included 158 daughters, 134 mothers and 69 fathers (N= 361).

Explicit math-gender stereotyping. To assess explicit math-gender stereotypes, two 1-item measures that mirrored the implicit measure were used. Participants were asked to indicate on a 7-point semantic differential type scale (Nosek, Banaji, & Greenwald, 2002; Smyth & Nosek, 2015) the extent to which they believed math was more "male" (7) or "female" (1). The same question was used to assess participants' explicit liberal arts stereotypes, and a relative score (math-arts) was created with higher scores indicating greater relative math-gender stereotyping. Although all scores met the assumption of normality, data from two mothers was removed as each was a numerical outlier.

Explicit academic attitudes. Self-reported explicit academic attitudes were measured using two four-item semantic differential scales[4] (e.g., 1=Bad and 7=Good; 1=Avoid and 7=Approach). Participants were first asked to use the adjectives provided to rate their feelings towards math and were then asked to use the same four adjectives to assess their attitudes towards liberal arts (Nosek, Banaji, & Greenwald, 2002). The math items were averaged to create an explicit math attitudes composite score, with higher scores indicating more positive attitudes towards math (α= .89 for daughters, α= .84 for mothers, α= .78 for fathers). A comparable composite score was created for attitudes towards liberal arts (α= .92 for daughters, α= .84 for mothers, α= .81 for fathers). A difference score was also created, with higher scores indicating more positive attitudes towards math (versus arts). This difference score is used in all analyses unless otherwise noted. One father's data and one daughter's data were removed from the relative attitudes score, as each was an outlier (by three standard deviations). In addition, the difference score for daughters was non-normal, thus the data was transformed using a location shift of +6 (i.e., to avoid negative values) followed by a power transformation of .66 (Tukey, 1977). As the data were not symmetrically distributed, Tukey's ladder of power transformation was applied (Velleman & Hoaglin, 2004). The value of the power was chosen such that the skewness of the transformed data is zero. This transformation normalized the data for the relative scores by transforming the original distribution into a symmetrical distribution. For ease of interpretation, raw means and standard deviations are reported unless otherwise indicated.

[4] Participants also completed an additional scale consisting of two feeling thermometer (Nelson, 2008) questions, asking participants to indicate their attitudes from 0 (really cold) to 100 (really warm) towards math and arts. However, this scale was not the focus of the current research and was not used in any subsequent analyses.

Explicit academic ability. The explicit academic ability scale consisted of six questions (three math-related; three arts-related). Participants used a 7-point Likert scale (1=strongly disagree and 7=strongly agree) to rate their ability in math and arts (e.g., "I am good at math compared to other people" and "Liberal arts has always come pretty easy to me"; Plante, de la Sablonniere, Aronson, & Theoret, 2013). For each participant, each of the three items were first averaged to create two separate composite scores: math ability (α= .88 for daughters, α= .93 for mothers, α= .89 for fathers) and arts ability (α= .86 for daughters, α= .87 for mothers, α= .92 for fathers). A difference score was also created (math-arts), with higher scores indicating greater self-reported ability in math (versus arts). This difference score is used in all analyses unless otherwise noted. One daughter's data was removed from the difference score, as it was an outlier (by three standard deviations). Similar to the math attitudes difference score, the math ability difference scores for daughters were non-normal, thus the same transformation was applied.

Demographics. All participants were asked to confirm their relationship to anyone completing the study with them, their gender, and age. Daughters were asked to indicate the type of degree (i.e., BA, BSc, or other) they planned to pursue, their current grade (e.g., 11, 12) and grade point average. Parents were asked to indicate their current occupation, the number of years they have been in their present occupation, the percentage of men in their current occupation, as well as some demographics, such as their race, annual household income and highest level of education[5].

[5] Daughters also completed a questionnaire assessing their identification with their parents and were asked to report additional information about their academic interests, including their overall grades in various math, science and English classes, the post-secondary program they wanted to study and the occupation they ultimately want to hold. Both parents and daughters answered some additional questions about their math and arts beliefs, and were asked to indicate the gender they most identify with; all participants were also asked about their English ability (in reading, writing and understanding). None of these variables were the focus of the current research, and are not discussed further.

Procedure

Participants were either recruited by research assistants during the Experience York event, or approached the welcome table voluntarily. Each participant provided informed consent prior to commencing the study, and for any adolescents under the age of 18, their parent or guardian also provided consent for their child's participation. Participants were asked to complete the IAT first, followed by the explicit questionnaire, with the exception of when all the laptops were occupied. In such cases, once participants had completed the questionnaire, they were asked to complete the IAT. To help ensure that participants worked independently, research assistants led each family member to seats as far away from each other as possible and further asked that they not disclose their answers or discuss the questions until the study was over.

All participants completed identical explicit measures, with the exception of the measures noted above. Once all participating family members had completed the study, they were debriefed, thanked for their time and encouraged to fill out a ballot for a chance to win a gift card.

Results

Cross-generational math-gender stereotyping. To examine whether there were any cross-generational differences in implicit math-gender stereotyping, I first conducted a series of paired samples t-tests. Mothers (M=.38, SD=.36) and daughters (M=.39, SD=.34) showed no significant differences in implicit stereotyping, $t(120)$=.38, p=.70, d=.04, see Figure 1. Fathers (M=.38, SD=.39) and daughters (M=.37, SD=.33) also showed no significant differences in implicit stereotyping, $t(62)$= -.25, p=.80, d= -.03. As an additional analysis, I also compared fathers' and mothers' implicit stereotyping for those daughters who arrived with both parents. Mothers' (M=.36, SD=.40) and fathers' (M=.41, SD=.39) similarly showed no significant differences in implicit math-gender stereotyping, $t(37)= -.56$, $p=.58$, $d= -.09$. One-sample t-test comparing mothers', fathers' and daughters' implicit stereotypes against zero (i.e., no stereotyping) were each significantly different from 0, *p*s < .001; each group showed an implicit math-gender stereotype, see Table 1.

Next, I conducted a series of paired samples t-tests using the relative explicit math-gender stereotype scores. Mothers and daughters showed a significant difference in explicit math-gender stereotyping, $t(137)= 2.01$, $p= .046$, $d= .20$, with daughters ($M= 1.02$, $SD=1.78$) endorsing significantly *higher* math-gender stereotypes than their mothers ($M= .64$, $SD= 1.50$), see Figure 2. By contrast, fathers ($M= .90$, $SD= 1.77$) and daughters ($M= .77$, $SD= 1.70$) did not significantly differ in their explicit math-gender stereotyping, $t(77)= -.55$, $p=.58$, $d= -.06$. Similarly, mothers ($M= .38$, $SD= 1.66$) and fathers ($M= .74$, $SD= 1.66$) did not significantly differ in their explicit math-gender stereotyping, $t(39)= -.98$, $p= .33$, $d= -.16$. In order to test whether participants explicitly endorsed stereotypes, a one-sample t-test was run comparing mothers', fathers' and daughters' explicit stereotypes against zero. Each group showed a significant explicit math-gender stereotype on this explicit measure, *p*'s < .001, see Table 1.

Relationships between daughters' and parents' implicit math-gender stereotyping. Next, I examined whether a relationship existed between daughters' and their parents' stereotypes. As can be seen in Table 2, daughters' implicit stereotypes were not significantly correlated with their mothers' implicit, $r(121) = .03$, $p = .71$, or explicit, $r(119) = -.09$, $p = .35$, math-gender stereotypes, nor with their fathers' implicit, $r(63) = .02$, $p = .86$, or explicit, $r(65) = -.07$, $p = .58$, math-gender stereotypes. Similarly, daughters' explicit math-gender stereotypes were not significantly correlated with their mothers' implicit, $r(134) = .08$, $p = .37$, or explicit, $r(136) = .06$, $p = .49$, math-gender stereotypes, nor with their fathers' implicit, $r(68) = -.06$, $p =$

.66, stereotypes. However, there was a significant correlation with fathers' explicit, $r(78) = .22$, $p = .049$, math-gender stereotypes.

As can be seen in Table 2, no significant relationship emerged between implicit and explicit math-gender stereotyping for either daughters, $r(156) = .02$, $p = .78$, mothers, $r(127) = .04$, $p = .67$, or fathers, $r(66) = .13$, $p = .30$. In addition, although there was a much smaller sample of daughters' who had both their mother and father participate, these parents did not show a significant positive relationship between their implicit stereotypes, $r(38) = .28$, $p = .09$, nor their explicit stereotypes, $r(40) = -.21$, $p = .19$.

Consistent with these correlations, when daughters' implicit stereotype scores (i.e., the IAT D-score) were regressed on daughters' own explicit math-gender stereotype scores, mothers' implicit stereotypes, and mothers' explicit math-gender stereotypes, the model was not significant, $R^2 = .01$, $F(3, 110)= .28$, $p= .84$, suggesting that neither daughters' own explicit stereotypes, nor their mothers' implicit or explicit stereotypes, predict daughters' implicit stereotypes. The same model was computed using fathers' scores. The overall model was also not significant, $R^2 = .04$, $F(3, 55)= .74$, $p= .54$. Again, this suggests that neither daughters own, nor their fathers' stereotypes, predict daughters' implicit stereotypes.

A similar model was computed with daughters' explicit math-gender stereotyping as the outcome variable, with daughters' implicit math-gender stereotype scores, mothers' implicit stereotypes and mothers' explicit stereotypes as the predictors. The overall model was not significant, $R^2 = .01$, $F(3, 110)= .52$, $p= .67$. When mothers' scores were replaced by fathers' scores, the model was similarly not significant, $R^2 = .09$, $F(3, 55)= 1.91$, $p= .14$.

Predicting daughters' math attitudes. To first evaluate the strength of the reported attitudes, I conducted a series of one sample t-tests comparing mothers', fathers' and daughters' explicit math attitudes. All family members' math attitudes were significantly different from 0 (see Table 1). Notably, whereas fathers reported more positive math (versus arts) attitudes, mothers and daughters reported more positive arts (versus math) attitudes. Next, to examine whether daughters' self-reported attitudes were predicted by their own and their parents' stereotyping, as well as their parents' attitudes, respectively, a series of multiple regression models were computed. Prior to running the models, all variables were centered.

Using regression analyses, I first made use of the entire sample of daughters (those who participated with a mother, a father, or both) to examine whether daughters' math attitudes were predicted by their own implicit and explicit math-gender stereotypes. The overall model was significant, $R^2 = .09$, $F(2, 148)= 7.51$, $p= .001$. As can be seen in Table 3, both implicit stereotypes, $B= -1.42$, $t(149)= -3.13$, $p=.002$ and explicit stereotypes, $B= -.20$, $t(149)= -2.21$, $p=.03$, were significant predictors of daughters' math attitudes, with greater gender stereotyping predicting less positive math attitudes[6]. As math attitudes was a relative measure (math versus liberal arts), I re-ran this analysis using only math attitudes, followed by only liberal arts attitudes, as the outcome variables. When math attitudes alone were considered, the model was again significant, $R^2 = .11$, $F(2, 151)= 9.64$, $p<.001$, with both implicit, $B= -1.27$, $t(153)= -3.67$, $p<.001$, and explicit, $B= -.16$, $t(153)= -2.34$, $p=.02$, stereotyping being significant predictors of math attitudes. By contrast, the overall model for arts attitudes was not significant, $R^2 = .01$, $F(2, 151)= .75$, $p= .48$.

[6] As an exploratory analysis, follow-up regression models were computed including the interaction of daughters' implicit and explicit stereotype scores. Daughters' math attitudes were regressed on daughters' own implicit stereotype, explicit stereotype and the interaction of implicit and explicit stereotype scores. The overall model was significant, $F(3, 147)= 5.05$, $p=.002$. Both implicit, $t(149)= -3.13$, $p=.002$, and explicit, $t(149)= -2.12$, $p=.03$, stereotypes were significant predictors, but the interaction term was not, $t(149)= .45$, $p=.66$. The model was re-run with daughters' math ability as the outcome. Again, the overall model was significant, $F(3, 150)= 2.99$, $p=.03$. However, only implicit stereotypes were a significant predictor of math ability, $t(152)= -2.70$, $p=.008$, and both explicit stereotypes, $t(152)= -1.12$, $p=.27$, and the interaction term, $t(152)= .54$, $p=.59$, were not significant predictors.

Next, daughters' math attitude scores were again regressed on daughters' own implicit and explicit math-gender stereotypes, as well as on mothers' implicit and explicit math-gender stereotype scores, and mothers' math attitudes. This analysis only included daughters' who had come to the recruitment day with their mother (or with their mother and father). The overall model was significant, $R^2 = .11$, $F(5, 104)= 2.62$, $p= .03$. As can be seen in Table 4, only daughters' implicit stereotype score was a significant predictor of daughters' math attitudes, $B= -1.54$, $t(108)= -2.84$, $p=.005$; the more daughters implicitly stereotyped math, the less positive their attitudes were towards math. When the outcome variable was math attitudes alone, the overall model was again significant, $R^2 = .15$, $F(5, 106)= 3.85$, $p= .003$, with daughters' implicit math-gender stereotype scores being the only significant predictor of daughters' math attitudes, $B= -1.51$, $t(110)= -3.80$, $p<.001$. When the outcome variable was liberal arts attitudes alone, the overall model was not significant, $R^2 = .01$, $F(5, 105)= .27$, $p= .93$.

The same regression models were then computed using fathers' data. Daughters' math attitude scores were regressed on daughters' own implicit and explicit math-gender stereotype scores, as well as on fathers' implicit and explicit math-gender stereotype scores, and math attitudes. This analysis only included daughters who had come to the recruitment day with their father (or with their mother and father). The overall model was significant, $R^2 = .23$, $F(5, 49)= 2.93$, $p= .02$. Again, daughters' implicit stereotype scores were a significant predictor of daughters' math attitudes, $B= -1.68$, $t(53)= -2.10$, $p=.04$. In this model, daughters' explicit math-gender stereotype scores were also a significant, negative predictor of daughters' math attitudes, $B= -.52$, $t(53)= -2.73$, $p=.01$, however, as can been seen in Table 5, none of the father variables were significant predictors of daughters' math attitudes. When the model was re-run using daughters' math attitudes (i.e., the composite score), the overall model was no longer significant,

R^2 = .15, *F*(5, 50)= 1.82, *p*= .13[7]. Similarly, the overall model examining daughters' liberal arts attitudes was not significant, R^2 = .08, *F*(5, 52)= .93, *p*= .47.

Predicting daughters' self-reported ability. In order to first evaluate the strength of each family members' self-reported ability, I conducted a series of one sample t-tests comparing mothers', fathers' and daughters' self-reported math ability. Both daughters' and fathers' self-reported math ability was significantly different from 0, *p*'s < .001; fathers reported significantly stronger self-reported math (versus arts) ability, while daughters reported significantly strong self-reported arts (versus math) ability. Mothers' self-reported math (versus arts) ability was not significantly different from 0, *p*= .94, see Table 1.

Next, to examine whether daughters' self-reported math ability was predicted by their, or their parents', stereotypes, a regression model was first run using all daughters' data. Specifically, daughters' self-reported ability in math was regressed on daughters' own implicit and explicit stereotypes. The overall model was significant, R^2 = .05, *F*(2, 151)= 4.36, *p*= .02. As can be seen in Table 6, daughters' implicit stereotype scores were the only significant predictor, *B*= -1.49, *t*(152)= -2.71, *p*=.008, with greater stereotyping predicting lower self-reported math ability. The model was rerun with daughters' math ability (i.e., the non-relative composite score) as the outcome. The overall model was again significant, R^2 = .06, *F*(2, 152)= 5.21, *p*= .01, with daughters' implicit stereotyping emerging again as the only significant predictor, *B*= -1.17, *t*(154)= -3.07, *p*=.003. Lastly, the model using daughters' liberal arts ability was not significant, R^2 = .02, *F*(2, 153)= 1.65, *p*= .20.

[7] Despite the overall model not being significant, daughters' own explicit stereotypes were again a significant predictor of daughters' math attitudes, *B*= -.40, *t*(55)= -2.40, *p*=.02, whereas daughters' implicit stereotypes were in the same direction but not a significant predictor by conventional standards, *B*= -1.26, *t*(55)= -1.80, *p*=.08.

Daughters' self-reported math (versus arts) ability scores (i.e., the difference scores) were then regressed on daughters' implicit and explicit stereotypes, as well as on mothers' implicit and explicit stereotypes, and math attitudes. The overall model was significant, $R^2 = .11$, $F(5, 105)= 2.60$, $p= .03$, however, only daughters' own implicit stereotypes were a significant predictor, $B= -1.98$, $t(109)= -3.16$, $p=.002$, see Table 7. Next, the same model was re-run using daughters' self-reported math ability scores (i.e., the composite scores) as the outcome. Again, the overall model was significant, $R^2 = .11$, $F(5, 106)= 2.62$, $p= .03$, and daughters' own implicit stereotypes were the only significant predictor, $B= -1.50$, $t(105)= -3.42$, $p=.001$. The same model was re-run with daughters' arts ability as the outcome, however, the overall model was not significant, $R^2 = .08$, $F(5, 107)= 1.81$, $p= .12$.

The models were then re-run using fathers' data. With this smaller sample of daughters, the overall model (with the difference score) was not significant, $R^2 = .12$, $F(5, 51)= 1.44$, $p= .23$, see Table 8. When the model was re-run with the math ability composite score as the outcome, the model was significant, $R^2 = .21$, $F(5, 52)= 2.83$, $p= .03$. Again, daughters' own implicit stereotypes were a significant predictor, $B= -2.08$, $t(56)= -2.95$, $p=.005$. In addition, fathers' math attitudes were also a significant predictor, $B= .31$, $t(56)= 2.04$, $p=.046$.[8] Lastly, the model was re-run using daughters' arts ability scores as the outcome variable. The overall model was not significant, $R^2 = .11$, $F(5, 52)= 1.23$, $p= .31$.

[8] In order to examine whether fathers' math attitudes versus arts attitudes were driving this effect, the same model was re-run using fathers' math attitudes composite score (i.e., the mean math attitude score) as a predictor. A similar pattern of results emerged. The overall model was significant, $R^2 = .26$, $F(5, 53)= 3.72$, $p= .01$. Both daughters' own implicit stereotypes, $B= -1.91$, $t(57)= -2.86$, $p=.01$, and fathers' math attitudes, $B= .46$, $t(57)= 2.76$, $p=.01$, were significant predictors of daughters' math ability.

General Discussion

The goal of the present research was to increase our understanding of implicit math-gender stereotyping among daughters and their parents at a critical period of development not previously studied, specifically, late adolescence. First, I examined whether daughters and parents showed an implicit math-gender stereotype and whether the extent to which they implicitly stereotyped this academic field differed. In the current study, daughters did not differ from their mothers or their fathers in the magnitude of implicit math-gender stereotyping. Daughters similarly did not differ from their fathers in their levels of explicit math-gender stereotyping, and fathers did not explicitly stereotype more than mothers. Moreover, girls in late adolescence, their mothers, and their fathers showed significant math-gender stereotyping at both an implicit and explicit level.

These findings replicate previous findings in the literature, and extend them to a new age group. Specifically, previous studies have found young boys and girls aged six to ten years (Cvencek, Meltzoff, & Greenwald, 2011), participants in early adolescence (Steffens & Jelenec, 2011), undergraduate women (Ramsey & Sekaquaptewa, 2011), and even older men and women (Kiefer & Sekaquaptewa, 2007; Nosek, Banaji, & Greenwald, 2002) implicitly gender stereotype math on comparable measures. This was also found to be the case in a diversity of cultures (Nosek et. al., 2009). As such, this finding replicates previous findings and extends the results to a new age group: girls in late adolescence. Taken together with previous research, the current findings serve to further highlight the pervasiveness of this implicit math-gender stereotype.

Despite the fact that the magnitude of implicit stereotyping was comparable, no significant relationship emerged between daughters' and either parent's implicit stereotyping. It is unclear why this is the case. It seems possible that at the group level, participants have received comparable societal reinforcement of these associations, but that these similarities are not reflected in the same way within families. However, more research would be helpful to determine why this is the case, and specifically whether this is driven by a lack of relation between parent and children's implicit stereotyping or due to specific aspects of this measure.

Similarly, no relationship emerged between implicit and explicit stereotyping for daughters, mothers, or fathers, despite all groups explicitly endorsing a math-gender stereotype. This result is consistent with previous studies that, despite finding significant levels of implicit and explicit stereotyping, did not find a significant relationship between the two (Lane, Goh, & Driver-Linn, 2012; Rae & Olson, 2018). It seems possible again that although, as a group, participants endorse this stereotype, at an individual level the degree of explicit stereotype endorsement reflected people's individual differences in their motivation to not endorse stereotypes, as opposed to individual differences in implicit math-gender stereotyping.

A second aim of this research was to determine whether adolescent girls' math attitudes and self-reported ability in math was predicted by their own math-gender stereotypes. In the current research I found that daughters' math attitudes *were* significantly predicted by their own implicit and explicit math-gender stereotypes, such that greater stereotyping, at both the implicit and explicit level, was associated with less positive math attitudes. In addition, daughters' self-reported math ability was predicted by their implicit, but not their explicit, stereotypes. These results are consistent with past research suggesting that by early adolescence, young women implicitly gender stereotype math (Regner et. al., 2014; Simpkins, David-Kean, & Eccles, 2005; Steele, 2003), and that greater explicit levels of the math-gender stereotype are associated with more negative math attitudes (Kiefer & Sekaquaptewa, 2007; Nosek, Banaji, & Greenwald, 2002). The current finding replicates this result with a novel age group during an important transitional period of development: late adolescence. In the present study, young women near the end of adolescence who are on the verge on embarking on their post-secondary educational journey demonstrated similar results, whereby daughters' who implicitly and explicitly stereotyped math to a greater extent also expressed less positive math attitudes and reported having less ability in mathematics.

A final goal of this study was to determine whether mothers' and/or fathers' math stereotypes and attitudes predicted daughters' explicit attitudes and ability in math. Previous research has found that parents with stronger math-gender stereotypes transmit these beliefs directly and indirectly onto their children, resulting in their children having decreased perceptions of math ability (Bhanot & Jovanovic, 2005) and lower math attitudes (Casad, Hale, & Wachs, 2015). Past research has also found differences between mothers' and fathers' levels of math-gender stereotyping, and the way in which this shapes their children's math ability and math attitudes (Bhanot & Jovanovic, 2005; Jacobs & Eccles, 1992; Yee & Eccles, 1998).

In the current study, mothers' math-gender stereotypes and math attitudes did not predict daughters' self-reported math attitudes or their self-reported math ability. This was the case for relative scores (i.e., math-arts scores) and composite scores (i.e., the mean math rating and mean arts rating), for both daughters' math (arts) attitudes and math (arts) ability. Interestingly, fathers' math attitudes predicted daughters' self-reported math ability, but not daughters' math attitudes. Neither fathers' implicit nor explicit math-gender stereotypes predicted daughters' math attitudes or math ability. Only daughters' own implicit math-gender stereotypes consistently predicted their math attitudes and math ability, such that greater implicit stereotyping predicted more negative math attitudes and decreased self-reported math ability. Notably, daughters' implicit stereotypes predicted their math, but not arts, ability, suggesting that the implicit math-gender stereotype is likely driven by perceptions of math, rather than liberal arts. Contrary to past research suggesting that parents' attitudes and stereotypes shape their children's' stereotype development (Bhanot & Jovanovic, 2005; Gunderson, Ramirez, Levine, & Beilock, 2012; Simpkins, David-Kean, & Eccles, 2005), similar effects did not emerge in this study among adolescents. Rather, similar to the result of Bhanot and Jovanovic (2005) who found that fathers' reported higher perceptions of their child's math ability, the current study found that as fathers' math attitudes increased, their daughters' self-perceptions of math ability also increased.

These results may also be partially explained by the Eccles (1983) Expectancy-Value model. According to the model, there are multiple external sources of information, such as cultural influences, parental attitudes and expectations, and one's own past experiences, which combine to influence a child's self-perceptions of abilities, and influences their future values and expectations. In addition, the child's own beliefs and perceptions subsequently influence future expectations, thereby shaping actual behaviors, choices and performance. Thus, the model suggests that there is a link between parental attitudes and behaviors towards mathematics, and their children's subsequent beliefs and academic values. Parents' actions, even if indirect, can have an important effect on their child's beliefs. Although there were no relationships with parents' math-gender stereotyping in the present study, when considering the other sources of potentially biasing information (e.g., cultural norms and/or past experiences with math), it is possible that these may be playing a larger role in shaping daughters' math-gender stereotypes at this stage in development.

Limitations and Future Directions

The present study had several limitations. The majority of adolescent daughters recruited were interested in pursuing a Bachelor of Arts, particularly within the field of psychology. Thus, my examination of adolescent daughters interested in pursuing a Bachelor of Science, particularly within a STEM field, was limited. Future research should address this further by comparing a more representative sample of adolescent girls interested in pursuing a wider range of academic fields. It is possible that adolescent girls interested in pursuing STEM fields would demonstrate differences in terms of their levels of math-gender stereotyping, particularly when compared to their parents. Alternatively, it is possible that parents with less math-gender stereotyping nurture an interest in STEM fields for their daughters, leading their adolescent daughters to similarly display decreased math-gender stereotyping. Given the relative dearth of research examining the transmission of implicit attitudes and stereotypes, these questions are worthy of future longitudinal investigation.

A second limitation to the current research is that the majority of adolescents participated with their mothers, so my sample of fathers was much smaller. In addition, because the adolescent participants often arrived with only one parent, there was insufficient power to compare mothers and fathers within the same family. Ideally, future longitudinal research would involve both parents at different stages of their children's development, in order to determine whether and when parents' implicit stereotypes predict their daughters' attitudes and performance. Future research should also examine in greater depth the influence of implicit math-gender stereotypes on young women's decisions to pursue STEM fields, and whether interventions can be used to change not only these associations but also young women's likelihood of pursuing a post-secondary degree within a STEM field, and ultimately her career decisions. A related limitation of this study was the relatively modest sample size. It seems possible that with a large sample, relationships between parents' math-gender stereotypes, and their adolescent daughters' stereotypes, attitudes, and self-reported ability would emerge.

Theoretically, this project contributes to the existing body of research examining the relationship between parents' and daughters' attitudes and stereotypes by examining these relationships during an important transitional period of development. As daughters are at a critical time point when they must decide which program (i.e., BA versus BSc) to pursue, the academic domain they enter can have significant implications for their future, as it will determine their major focus and future career opportunities. This research suggests that daughters who implicitly gender stereotype math to a greater extent are more likely to have negative math attitudes and self-reported math ability, potentially limiting their likelihood of pursuing a STEM degree. Ultimately, this can prevent them from obtaining lucrative and prestigious STEM careers (Jacobs, 2014). Although parents' stereotypes did not predict the stereotypes or attitudes of their daughters, it seems likely that parents still have the potential to influence children's career choices in other ways. It would be useful to determine whether these relationships would emerge earlier in development and/or whether interventions directed to parents might have lasting effects on their daughters' self-perceptions and ultimate career goals.

Moreover, this project has applied benefits as it can help to raise awareness about the math-gender stereotype that persists within our society. By highlighting the importance of addressing adolescents' implicit and explicit math-gender stereotypes, these findings have the potential to help reduce the stigma around girls and math. By ensuring that both parents and teachers are aware of the negative stereotypes young women hold towards STEM subjects, more programs and interventions may be tailored towards reducing these stereotypes amongst young women in high school, prior to their selection of a post-secondary major. Previous research suggests that certain targeted interventions may effectively reduce young women's (especially first-year undergraduate females) levels of the math-gender stereotype (Dasgupta, Scircle, &

Hunsinger, 2015; Dennehy & Dasgupta, 2017; Ramsey, Betz, & Sekaquaptewa, 2013; Walton et. al., 2015). For example, female peer mentors can increase young women's confidence and feelings of belonging within STEM, decreasing rates of attrition amongst women in post-secondary STEM programs (Dennehy & Dasgupta, 2017). Increasing young women's exposure to female STEM peers can also decrease feelings of threat, while increasing their participation in program-related activities (Dasgupta, Scircle, & Hunsinger, 2015).

Finally, it is important to note that if we truly wish to increase women's participation in STEM fields it will be not only important to challenge math-gender stereotypes among young women and their families, but also among the men that may ultimately serve as employers, colleagues, and mentors. Breaking down barriers and decreasing the "leaky pipeline" (Steffens, Jelenec, & Noack, 2010) can only happen if stereotypes are challenged, discriminatory practices are reduced, and STEM careers are increasingly welcoming for women. Through continued research in this area, it is hoped that we can decrease barriers to women's participation in STEM fields and create more equitable opportunities for women in the future.

References

Barres, B. A. (2005). Arrogance Imperils Plans for Change at Harvard. *Nature*, *434,* 697. doi:10.1038/434697a

Barres, B. A. (2006). Does Gender Matter? *Nature*, *442*, 134 – 136.

Bhanot, R., & Jovanovic, J. (2005). Do parents' academic gender stereotypes influence whether they intrude on their children's homework? *Sex Roles, 52*(9-10), 597-607. doi: 10.1007/s11199-005-3728-4

Bleeker, M. M., & Jacobs, J. E. (2004). Achievement in math and science: Do mothers' beliefs matter 12 years later? *Journal of Educational Psychology, 96*(1), 97-109. doi: 10.1037/0022-0663.96.1.97

Casad, B. J., Hale, P., & Wachs, F. L. (2015). Parent-child math anxiety and math-gender stereotypes predict adolescents' math education outcomes. *Frontiers in Psychology, 6*, 1-21.

Cvencek, D., Meltzoff, A. N., & Baron, A. S. (2012). Implicit measures of attitudes for preschool children. In J. A. Banks (Ed.), Encyclopedia of diversity in education.

Thousand Oaks, CA: Sage.

Cvencek, D., Meltzoff, A. N., & Greenwald, A. G. (2011). Math-gender stereotypes in elementary school children. *Child Development, 82*(3), 766-779. doi:10.1111/j.1467-8624.2010.01529.x

Cvencek, D., Kapur, M., & Meltzoff, A. N. (2015). Math achievement, stereotypes, and math self-concepts among elementary-school students in singapore.*Learning and Instruction, 39*, 1-10. doi: 10.1016/j.learninstruc.2015.04.002

Dasgupta, N., Scircle, M. M., & Hunsinger, M. (2015). Female peers in small work groups enhance women's motivation, verbal participation, and career aspirations in engineering. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 112*(16), 4988-4993. doi:10.1073/pnas.1422822112

Dennehy, T. C., & Dasgupta, N. (2017). Female peer mentors early in college increase women's positive academic experiences and retention in engineering.*PNAS Proceedings of the National Academy of Sciences of the United States of America, 114*(23), 5964-5969. doi:10.1073/pnas.1613117114

Eccles, J. S. (1983). Expectancies, Values and Academic Behaviors. In Spence, J. T. (Editor). *Achievement and achievement motives: Psychological and sociological approaches (75 – 146)*. San Francisco: W.H. Freeman.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology, 74*(6), 1464-1480. doi: 10.1037/0022-3514.74.6.1464

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and Using the Implicit Association Test: I. An Improved Scoring Algorithm. Journal of Personality and Social Psychology, 85(2), 197-216. doi:10.1037/0022-3514.85.2.197

Gunderson, E. A., Ramirez, G., Levine, S. C., & Beilock, S. L. (2012). The role of parents and teachers in the development of gender-related math attitudes. *Sex Roles, 66*(3-4), 153-166. doi: 10.1007/s11199-011-9996-2

Gunderson, E. A., Ramirez, G., Levine, S. C., & Beilock, S. L. (2012). New directions for research on the role of parents and teachers in the development of gender-related math attitudes: Response to commentaries. *Sex Roles, 66*(3-4), 191-196. doi: 10.1007/s11199-011-0100-8

Hart, S. A., Ganley, C. M., & Purpura, D. J. (2016). Understanding the home math environment and its role in predicting parent report of children's math skills.*PLoS ONE, 11*(12), 30.

Jacobs, P. (2014, July 09). Science And Math Majors Earn The Most Money After Graduation. Retrieved from http://www.businessinsider.com/stem-majors-earn-a-lot-more-money-after-graduation-2014-7

Jacobs J. E. & Eccles, J. S. (1992). The Impact of Mothers' Gender-Role Stereotypic Beliefs on Mothers' and Children's Ability Perceptions. Journal of Personality and Social Psychology, *63(6), 932-944*.

Kiefer, A. K., & Sekaquaptewa, D. (2007). Implicit stereotypes, gender identification, and math-related outcomes: A prospective study of female college students. *Psychological Science, 18*(1), 13-18. doi: 10.1111/j.1467-9280.2007.01841.x

Lai, C. K., Hoffman, K. M., & Nosek, B. A. (2013). Reducing implicit prejudice. *Social and Personality Psychology Compass, 7*(5), 315-330. doi: 10.1111/spc3.12023

Lane, K. A., Goh, J. X., & Driver-linn, E. (2012). Implicit science stereotypes mediate the relationship between gender and academic participation. Sex Roles, 66(3-4), 220-234. doi:http://dx.doi.org/10.1007/s11199-011-0036-z

Lewis, N. A., Jr., & Sekaquaptewa, D. (2016). Beyond test performance: A broader view of stereotype threat. *Current Opinion in Psychology, 11*, 40-43. doi: 10.1016/j.copsyc.2016.05.002

Maloney, E. A., Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2015). Intergenerational effects of parents' math anxiety on children's math achievement and anxiety. *Psychological Science, 26*(9), 1480-1488. doi: 10.1177/0956797615592630

Nelson, S. (2008). Feeling thermometer. In P. Lavrakas (Ed.), *Encyclopedia of survey research methods.* (p. 277). Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781412963947.n183

Nosek, B. A., Banaji, M. R., & Greenwald, A. G. (2002). Math = male, me = female, therefore math ≠ me. *Journal of Personality and Social Psychology, 83*(1), 44-59. doi: 10.1037/0022-3514.83.1.44

Nosek, B. A., & Smyth, F. L. (2011). Implicit social cognitions predict sex differences in math engagement and achievement. *American Educational Research Journal, 48*(5), 1125-1156. doi: 10.3102/0002831211410683

Nosek, B. A., Smyth, F. L., Sriram, N., Lindner, N. M., Devos, T., Ayala, A., . . . Greenwald, A. G. (2009). National differences in gender–science stereotypes predict national sex differences in science and math achievement. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 106*(26), 10593-10597. doi: 10.1073/pnas.0809921106

Passolunghi, M. C., Rueda Ferreira, T. I., & Tomasetto, C. (2014). Math–gender stereotypes and math-related beliefs in childhood and early adolescence.*Learning and Individual Differences, 34*, 70-76. doi: 10.1016/j.lindif.2014.05.005

Plante, I., de la Sablonniere, l. S., Aronson, J. M., & Théorêt, M. (2013). Gender stereotype endorsement and achievement-related outcomes: The role of competence beliefs and task values. Contemporary Educational Psychology, 38(3), 225-235. doi:10.1016/j.cedpsych.2013.03.004

Rae., J. R. & Olson, K. R. (2018). Test-Retest Reliability and Predictive Validity of the Implicit Association Test in Children. Developmental Psychology, *54(2), 308-330.*

Ramsey, L. R., Betz, D. E., & Sekaquaptewa, D. (2013). The effects of an academic environment intervention on science identification among women in STEM.*Social Psychology of Education: An International Journal, 16*(3), 377-397.

Ramsey, L. R., & Sekaquaptewa, D. (2011). Changing stereotypes, changing grades: A longitudinal study of stereotyping during a college math course. *Social Psychology of Education, 14*(3), 377-387. doi:10.1007/s11218-010-9150-y

Régner, I., Steele, J. R., Ambady, N., Thinus-Blanc, C., & Huguet, P. (2014). Our future scientists: A review of stereotype threat in young girls from early elementary school to middle school. *International Review of Social Psychology [Special Issue: Stereotype threat in children], 27*, 13-51.

Schwartz, Z. (2015, April 21). Why there are still far too few women in STEM. *Macleans.* Retrieved February 16, 2018, from http://www.macleans.ca/society/life/why-there-are-still-far-too-few-women-in-stem/

Shendruk, A. (2015, June 18). Gender inequality in the sciences? It's still very present in Canada. *Macleans.* Retrieved February 16, 2018, from http://www.macleans.ca/society/science/gender-inequality-in-the-sciences-its-still-very-present-in-canada/

Simpkins, S. D., Davis-Kean, P., & Eccles, J. S. (2006). Math and science motivation: A longitudinal examination of the links between choices and beliefs. *Developmental Psychology, 42*(1), 70-83. doi: 10.1037/0012-1649.42.1.70

Smith, J. (2014, November 14). These Are The Jobs Parents Want Their Kids To Have. *Business Insider.* Retrieved February 16, 2018, from http://www.businessinsider.com/the-job-parents-most-want-their-kids-to-have-2014-11

Spelke, E. S. (2005). Sex differences in intrinsic aptitude for mathematics and science?: A critical review. *American Psychologist, 60*(9), 950-958. doi: 10.1037/0003-066X.60.9.950

Spencer, S. J., Logel, C., & Davies, P. G. (2016). Stereotype threat. *Annual Review of Psychology, 67*, 415-437.

Statistics Canada (2015). Gender differences in science, technology, engineering, mathematics and computer science (STEM) programs at university. Retrieved December 15, 2017, from https://www.statcan.gc.ca/pub/75-006-x/2013001/article/11874-eng.htm

Steele, J. (2003). Children's gender stereotypes in mathematics: The role of stereotype stratification. *Journal of Applied Social Psychology, 33(12),* 2587-2606.

Steele, C. M., Spencer, S. J., & Aronson, J. (2002). Contending with group image: The psychology of stereotype and social identity threat. In M. P. Zanna (Ed.) *Advances in Experimental Social Psychology, vol. 34,* pp. 379 - 440. San Diego: Academic Press.

Steffens, M. C., & Jelenec, P. (2011). Separating implicit gender stereotypes regarding math and language: Implicit ability stereotypes are self-serving for boys and men, but not for girls and women. Sex Roles, 64(5-6), 324-335. doi:10.1007/s11199-010-9924-x

Steffens, M. C., Jelenec, P., & Noack, P. (2010). On the leaky math pipeline: Comparing implicit math-gender stereotypes and math withdrawal in female and male children and adolescents. *Journal of Educational Psychology, 102*(4), 947-963. doi: 10.1037/a0019920

TD (Toronto-Dominion Bank) Economics (2017). Women and STEM: Bridging the Divide (pp. 1-13). https://economics.td.com/domains/economics.td.com/documents/reports/bc/wistem/Women-and-STEM.pdf

Velleman, P. F. & Hoaglin, D. C. (2004). Exploratory Data Analysis. APA Handbook of Research Methods in Psychology, Vol. 3. Data Analysis and Research Publication (pages 51 – 71). doi: 10.1037/13621-003.

Walton, G. M., Logel, C., Peach, J. M., Spencer, S. J., & Zanna, M. P. (2015). Two brief interventions to mitigate a "chilly climate" transform women's experience, relationships, and achievement in engineering. *Journal of Educational Psychology*, *107*, 468-485.

Yee, D. K. & Eccles, J. S. (1988). Parent Perceptions and Attributions for Children's Math Achievement. Sex Roles, *19(5), 317 – 334*.

Appendix A

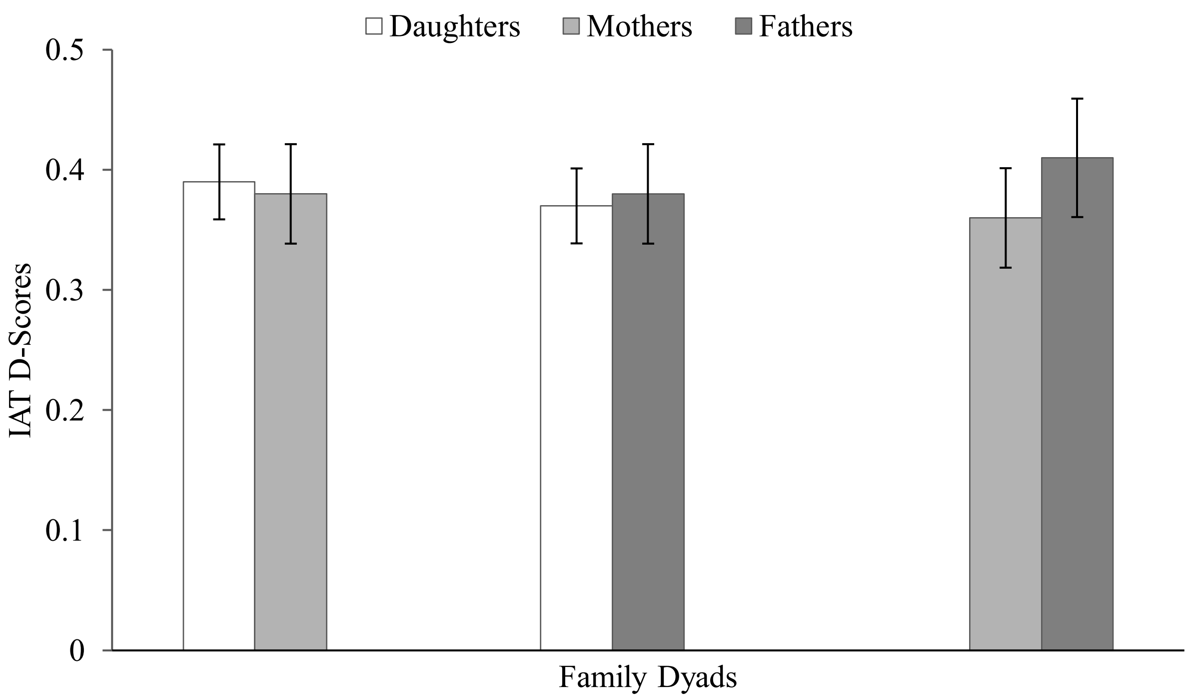

Figure 1. Implicit stereotyping for daughters, mothers, and fathers. Error bars represent standard error.

Appendix B

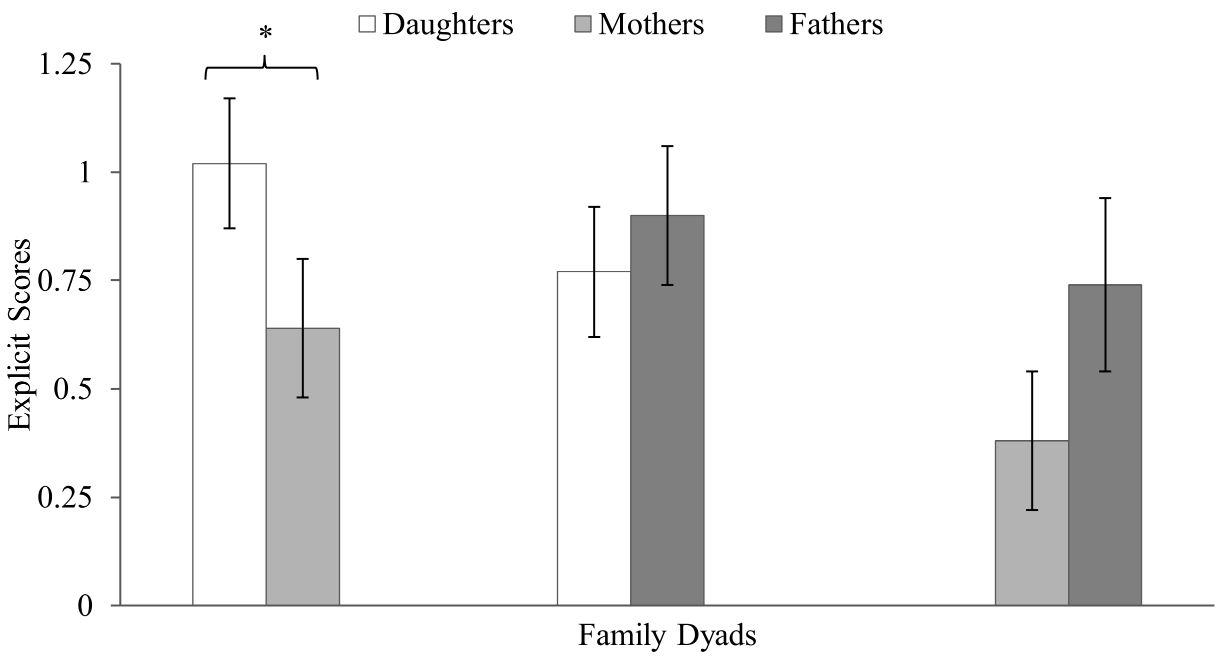

Figure 2. Explicit stereotyping for daughters, mothers, and fathers. As this is a relative (math versus arts) measure, scores could range from -6 to 6. Error bars represent standard error. *$p<.05$.

Appendix C

Table 1. Average implicit stereotypes, explicit stereotypes, math (versus arts) attitudes and math (versus arts) ability scores for daughters, mothers, and fathers.

	M	*SD*	*t-value*	*df*	*Sig.*	*95% CI*
Implicit Stereotype						
Daughters	.40	.33	14.96	157	<.0001	[.34, .45]
Mothers	.39	.36	12.38	133	<.0001	[.32, .45]
Fathers	.37	.39	7.85	68	<.0001	[.27, .46]
Explicit Stereotype						
Daughters	.98	1.79	7.39	181	<.0001	[.72, 1.24]
Mothers	.55	1.36	4.80	136	<.0001	[.33, .78]
Fathers	.89	1.75	4.56	79	<.0001	[.50, 1.28]
Math Attitudes						
Daughters	- 1.91	1.93	-13.2	177	<.0001	[-2.20, -1.62]
Mothers	- .46	1.96	-2.79	140	.006	[-.79, -.13]
Fathers	.38	1.60	2.11	77	.038	[.02, .74]
Math Ability						
Daughters	-1.51	2.31	-8.83	181	<.0001	[-1.85, -1.17]
Mothers	.01	2.33	.07	140	.94	[-.37, .40]
Fathers	1.19	1.91	5.64	81	<.0001	[.77, 1.61]

Note. All measures are relative scores, such that higher values represent greater math- (versus arts) gender stereotyping, more positive math (versus arts) attitudes, or more positive self-reported math (versus arts) ability.

Appendix D

Table 2. Bivariate Correlations Between Each Implicit and Explicit Measure

Measure	*1.*	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*	*9.*	*10.*	*11.*	*12.*
1. Daughter IS	-											
2. Mom IS	.03	-										
3. Dad IS	.02	.28	-									
4. Daughter ES	.02	.08	-.06	-								
5. Mom ES	-.09	.04	.15	.06	-							
6. Dad ES	-.07	-.23	.13	.22*	-.21	-						
7. Daughter Attitudes	-.25*	-.13	-.07	-.20*	-.15	.12	-					
8. Mom Attitudes	-.08	-.27*	-.20	.10	-.26*	.01	.21*	-				
9. Dad Attitudes	.21	.11	.12	.07	.21	.17	.18	.01	-			
10. Daughter Ability	-.22*	-.08	-.01	-.05	-.12	-.08	.78**	.10	.05	-		
11. Mom Ability	-.08	-.27*	-.10	-.01	-.16	.05	.15	.81**	.04	.02	-	
12. Dad Ability	.11	-.08	.12	-.01	.17	.28*	.28*	.06	.72**	.13	.10	-

Note. All variables are relative scores.
IS = Implicit stereotypes
ES = Explicit stereotypes
** = p <.05, ** = p <.001*

Appendix E

Table 3

Summary of Multiple Regression Analyses for Variables Predicting Daughters' Explicit Attitudes (N=153 relative math attitudes, N=156 math attitudes, N=156 arts attitudes)

	(Relative) Math Attitudes			*Math Attitudes*			*Arts Attitudes*		
Variable	B	SE B	β	B	SE B	β	B	SE B	β
Daughters Implicit Stereotype	-1.42	.45	-.25*	-1.27	.35	-.28**	.29	.29	.08
Daughters Explicit Stereotype	-.20	.09	-.17*	-.16	.07	-.18*	.04	.06	.06
R^2		.09			.11			.01	
F		7.51*			9.64**			.75	

Note. For both math measures, higher values represent more positive math attitudes. For the arts measure, higher values represent more positive attitudes towards liberal arts.
B represents the unstandardized regression coefficient, while β *represents the standardized regression coefficient.*
**p<.05. **p< .001.*

Appendix F

Table 4

Summary of Multiple Regression Analyses for Variables Predicting Daughters' Explicit Attitudes (N=115 relative math attitudes, N=117 math attitudes, N=116 arts attitudes)

	(Relative) Math Attitudes			*Math Attitudes*			*Arts Attitudes*		
Variable	B	SE B	*β*	B	SE B	*β*	B	SE B	*β*
Daughters Implicit Stereotype	-1.54	.54	-.26*	-1.51	.40	-.34**	.06	.34	.02
Daughters Explicit Stereotype	-.07	.11	-.06	-.05	.08	-.06	.01	.07	.02
Mothers Implicit Stereotype	-.48	.53	-.09	-.19	.39	-.05	.31	.33	.09
Mothers Explicit Stereotype	-.15	.14	-.10	-.11	.10	-.10	.02	.09	.03
Mothers Math Attitudes	.08	.10	.08	.07	.08	.09	-.01	.07	-.02
R^2		.11			.15			.01	
F		2.62*			3.85*			.27	

Note. *For both math measures, higher values represent more positive math attitudes. For the arts measure, higher values represent more positive attitudes towards liberal arts. For all predictor variables, relative scores were used.*
B represents the unstandardized regression coefficient, while β represents the standardized regression coefficient.
**p<.05. **p<.001.*

Appendix G

Table 5

Summary of Multiple Regression Analyses for Variables Predicting Daughters' Explicit Attitudes (N=60 relative math attitudes, N=61 math attitudes, N=63 arts attitudes)

	(Relative) Math Attitudes			*Math Attitudes*			*Arts Attitudes*		
Variable	B	SE B	β	B	SE B	β	B	SE B	β
Daughters Implicit Stereotype	-1.68	.80	-.26*	-1.26	.70	-.24	.75	.58	.18
Daughters Explicit Stereotype	-.52	.19	-.06*	-.40	.17	-.33	.16	.14	.15
Fathers Implicit Stereotype	-.86	.68	-.09	.06	.60	.01	.64	.48	.18
Fathers Explicit Stereotype	.28	.16	-.10	.15	.14	.15	-.09	.12	-.12
Fathers Math Attitudes	.22	.17	.08	.15	.15	.14	-.06	.12	-.07
R^2		.23			.15			.08	
F		2.93*			1.82			.93	

Note. For both math measures, higher values represent more positive math attitudes. For the arts measure, higher values represent more positive attitudes towards liberal arts. For all predictor variables, relative scores were used.
B represents the unstandardized regression coefficient, while β represents the standardized regression coefficient.
**p<.05.*

Appendix H

Table 6

Summary of Multiple Regression Analyses for Variables Predicting Daughters' Self-reported Ability (N=156 relative math ability, N=157 math ability, N=158 arts ability)

	(Relative) Math Ability			Math Ability			Arts Ability		
Variable	B	SE B	β	B	SE B	β	B	SE B	β
Daughters Implicit Stereotype	-1.47	.55	-.21*	-1.17	.38	-.24*	.37	.35	.09
Daughters Explicit Stereotype	-.12	.11	-.09	-.07	.08	-.07	.10	.07	.12
R^2		.05			.06			.02	
F		4.35*			5.21*			1.65	

Note. For both math measures, higher values represent stronger self-reported math ability and skills. For the arts measure, higher values represent stronger self-reported liberal arts ability and skills. For all predictor variables, relative scores were used.
B represents the unstandardized regression coefficient, while β *represents the standardized regression coefficient.*
$^*p<.05$.

Appendix I

Table 7

Summary of Multiple Regression Analyses for Variables Predicting Daughters' Self-reported Ability (N=157 math ability, N=158 arts ability)

	(Relative) Math Ability			Math Ability			Arts Ability		
Variable	B	SE B	β	B	SE B	β	B	SE B	β
Daughters Implicit Stereotype	-1.98	.63	-.29*	-1.50	.44	-.32*	.56	.43	.12
Daughters Explicit Stereotype	-.04	.13	-.03	.01	.09	.01	.10	.09	.11
Mothers Implicit Stereotype	-.51	.62	-.08	-.29	.43	-.06	.35	.42	.08
Mothers Explicit Stereotype	-.28	.16	-.16	-.11	.11	-.10	.22	.12	.20
Mothers Math Attitudes	-.02	.12	-.02	-.001	.08	-.002	-.02	.08	-.02
R^2		.11			.11			.08	
F		2.60*			2.62*			1.81	

Note. For both math measures, higher values represent stronger self-reported math ability and skills. For the arts measure, higher values represent stronger self-reported liberal arts ability and skills. For all predictor variables, relative scores were used.
B represents the unstandardized regression coefficient, while β represents the standardized regression coefficient.
**p<.05.*

Appendix J

Table 8

Summary of Multiple Regression Analyses for Variables Predicting Daughters' Self-reported Ability (N=63 relative math ability, N=63 math ability, N=63 arts ability)

	(Relative) Math Ability			Math Ability			Arts Ability		
Variable	B	SE B	β	B	SE B	β	B	SE B	β
Daughters Implicit Stereotype	-2.10	1.06	-.27	-2.08	.71	-.38*	.32	.69	.06
Daughters Explicit Stereotype	-.39	.26	-.21	-.24	.17	-.18	.30	.17	.25
Fathers Implicit Stereotype	-.82	.90	-.12	-.69	.59	-.15	.59	.57	.14
Fathers Explicit Stereotype	.28	.21	.19	.11	.14	.10	-.16	.14	-.17
Fathers Math Attitudes	.07	.23	.05	.31	.15	.27*	.15	.15	.15
R^2		.12			.21			.11	
F		1.44			2.83*			1.23	

Note. For the math measure, higher values represent stronger self-reported math ability and skills. For the arts measure, higher values represent stronger self-reported liberal arts ability and skills. For all predictor variables, relative scores were used.
B represents the unstandardized regression coefficient, while β represents the standardized regression coefficient.
*$p<.05$.