How the Transition to College Affects School and Math Self Concept

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Abstract

Students experience many changes during the transition to college. This transition may negatively affect a student's school and math self-concept, particularly when their gender group is negatively stereotyped in the academic domain (e.g., women in math). In this study, college students were primed to think about an academic transition or a daily routine. Then participants were primed with gender stereotype threat or no threat followed by a math task. Results found women rated their math self-concept lower than men. Women also scored lower on the math task than men. This is consistent with previous research when women face stereotype threat, suggesting that our "no threat" manipulation was ineffective in the math task. Although a manipulation check suggested that the transition prime did not make students feel explicitly more "in transition," there was a marginally significant interaction between gender, transition manipulation, and type of self-concept scores. As hypothesized, women reported lower math self-concept scores than men only in the transition condition; no gender differences emerged in school self-concept scores. In future research this experiment could be tested on students transitioning to secondary school.

Keywords: School self-concept, Math self-concept, educational transition, gender

How the Transition to College Affects School and Math Self Concept

Throughout the stages of education, students are faced with the challenge of transitioning into new school environments. The way the education system is designed periodically places students in a new school. Such changes negatively impact students' academic self-concepts, which refer to students' perceptions of their own interests and abilities in the classroom. While this change affects students' overall school self-concept, there is strong evidence that students specifically decline in math self-concept. Furthermore, various student populations face negative stereotypes in the classroom that may exacerbate these negative effects. For example, female students may feel additional pressure in math situations because they fear their actions will confirm the stereotype; this is known as stereotype threat. Overall the transition to a new school can create self-doubt in academics. The present experiment addresses the unique challenges that students face in their transition from high school to college.

School Self Concept

School self-concept refers to the students' perceived level of confidence in the classroom (Hensley, 2010). The construction of self-concept uses previous experiences to build a view of one's capabilities and to interpret how one can perform in a situation (Oyserman, 2001). Research has discovered that students' overall school self-concept declines over time. For example, in one longitudinal study, researchers tracked students from first grade to twelfth grade with periodic measurements of school self-concept and motivation in the classroom. The study found as students aged, perceived academic ability and interest in the classroom declined (Archambault, Eccles, & Vida, 2010). This change in attitude is not an abrupt event in a student's life, but one that gradually happens over time. Differences in perceived ability can be traced as far back as elementary school. One longitudinal study found a decline in self-rated school performance for fourth graders compared to first graders in English, Math, and Music classes (Eccles, Wigfield, Harold, & Blumenfeld, 1993).

Transitions before college

Although confidence in academic abilities trends downward over time, transitions between schools create even further self doubt in academic abilities. In one longitudinal study, experimenters followed a set of students for five years, beginning in the third grade. Findings showed a significant decrease in middle school students' school self-concept (Molloy, Ram, and Gest, 2011). The shift during this time period could have resulted from the new changes in middle school. Middle schools tend to have more students than elementary schools, which creates an opportunity for students to receive less individual attention in the classroom (Hensley, 2010). Grading systems change in middle school. In elementary school, students are evaluated on individual effort while middle schools grade based on comparative standards (Schunk, Pintrich, & Pearson, 2007).

Furthermore, middle school students are experiencing the changes of puberty. Adolescents are focused on fitting in and social cliques, which may result in lowered self-confidence and self doubt in one's ability (Pipher, 1994). In Hensley's review of literature, she discusses the transition experience for adolescents. The transition to middle school coincides with students' physical, psychological, and peer changes. These simultaneous changes have a negative effect on a student's school self-concept (2010).

After middle school, students are again faced with a new challenge to adapt to high school. Compared to elementary and middle school, high school is a more competitive atmosphere. Students must adapt to new expectations in the classroom. High schools increase in size creating a more anonymous environment (Schunk et al., 2007). It is also possible for students to experience the big-fish-little-pond effect. This is when students report a lower school self-concept and perform worse in competitive high schools than in low-ability high schools. Students of equal ability perform better in an environment where they can excel as the top achiever (Marsh, 1987). The change to a bigger high school may provide new talent in the classroom and many students must adjust to this competitive environment during their freshmen year.

Transition to college

The transition to college creates a new setting for undergraduates distinct from the changes in middle school or high school. Although these changes are unique to previous transitions, they still create an environment of self-doubt and uncertainty. Freshmen may have trouble balancing academics, social life, and extracurricular activities without the set structure of high school. For many, this is the first time the student has lived away from home. Many undergraduates live in a dormitory and will share the space with one or more roommate(s). Students are forced to create new friendships and handle the separation from former high school connections (Cleary, Walter, & Jackson, 2011). Some students may become caught up in this new social scene. One research investigation found higher levels of social integration (defined by students who believe they fit in with non-academic social networks) negatively predicted future academic performance (in the form of GPAs; Woosley & Miller, 2009). In addition, with no parental supervision, undergraduates have easier access to alcohol and drugs. According to Abar and Maggs, college students have an increased risk for issues with binge drinking than other young adults (2010). In general, alcohol use issues are highly prevalent in the college community (Cleary et al., 2011).

This change in environment can create many distractions for students. College students are expected to balance their social life and schoolwork. Sometimes this lack of structure may lead to frequent unexcused absents, late assignments, inefficient study habits, and poor sleeping patterns (Cleary et al., 2011). It takes time to learn how to study and prepare for college courses. During the transition period of freshman year, students may question their academic abilities.

In addition to the social changes at a university, many students struggle with the new expectations in the classroom and the overall change in teaching style. Students no longer receive individual attention and are required to seek out additional help on their own time. Students may feel overlooked in large class sizes (Cleary et al., 2011). After the first semester or first year of college, students can adjust to this new dynamic with professors and explore what helps them be successful in the classroom.

While it is possible that transitions are more influential for younger students' academic self-concepts, this experiment will investigate how freshmen who are reminded of their transition to a large university feel about their academic abilities. Specifically, we aim to experimentally manipulate the feeling of transition. Everyone is experiencing the transition to college during freshmen year, but our subject pool provides students in older class years as well. We predict that any student randomly assigned to be reminded of the transition process, regardless of year, will score lower on academic self-concept than students randomly assigned to think about stability.

Past research on transitions has followed real students experiencing real transitions, whereas we are attempting to create the transition experience in the lab. It may not be powerful enough to remind students of their transition phase in such a way that they doubt their overall school self-concepts. However, being reminded of the transition experience may be particularly negative for certain students in domains where they may already be prone to self-doubt. Such students may include women in math and math-intensive fields, due to stereotypes about women's lower ability in these fields relative to men.

Math Self Concept

While students lose confidence in their overall academic abilities, math classes are affected the most. In most studies, high school students report lower confidence in their math skills than elementary school and middle school students (Abarbanel, 2008; Steffens, Jelenec, & Noack, 2010). One study reported that ninth grade students were more likely to have a negative evaluation of their math skills than younger students in seventh and fourth grade. The students were more likely to continue with German classes than math classes. Finally, the study also found younger students received better math grades than older students (Steffens et al., 2010).

As they age, students continue to doubt their confidence in high school, especially math and science courses. One study found students' performance in math decline from 8th to 10th grade. Students' self-evaluation for math competence also declined in this time period (Abarbanel, 2008). While research has shown an overall decline in academic self-concept, there may be peaks of confidence. When a student finds a comfortable routine in their academic environment they may regain some confidence in the classroom. Further research presented evidence that students' perception of their math ability increases from the beginning of high school to mid-high school, but then decreases again in postsecondary education. This could be attributed to the transition period of a new environment, the start of high school or college (Shapka, 2009, p. 537).

Group Differences in Reactions to Transitions

Some groups of students face unique academic pressures derived from negative academic stereotypes. The situation of stereotype threat arises when a negative stereotype becomes activated and encourages the individual to counteract this stereotype, which distracts the individual from the task and interferes with their performance (Schmader, Johns & Forbes, 2008). The threatened group may divide their attention between the task and negative internal thoughts or worries (Schmader, 2010). During stereotype threat, there may also be a change in blood pressure or self perceived nervousness. In many studies, subjects experiencing stereotype threat reported increased levels of anxiety (Aronson, Fried, & Good, 2002).

Previous research has shown that women may experience stereotype threat in math and science courses. In research conducted by the American Association of University Women in the article "Why So Few?," researchers found difference in average scores differed in placement tests for women and men. In Calculus AB girls scored an average of 2.8 compared to boys who scored an average of 3.1. The same difference was seen on Calculus BC exams, girls scored an average of 3.5, while boys scored 3.8 (2009). This difference expands past high school into college majors. For example, 15.1% of women pursue a STEM field major compared to 29.3% of men (AAUW, 2009). In another recent study, researchers found the gender gap is closing in math for grades two to eleven. Yet after high school, the average engineer program consists of only 15% women (Hyde, Lindberg, Linn, Ellis, & Williams, 2008). In society the norm is for men to be good at math, not women. For example, Implicit Association Tests show participants are more likely to pair words related to the categories "math" and "boys" and to pair "German" and "girls" than vice versa (as language fields are typically female-stereotyped; Steffens et al., 2010). Our culture does not expect women to pursue an education in math and science. This may alter how women perceive pursuing a career in these fields.

Of interest to the scope of this study, this additional challenge of stereotype threat in math and science classes can alter women's perceptions of their math abilities. In one study, girls self-rated their geometry skills lower than the boys even though both completed the task with the same results (Huguet & Régner, 2009). In another experiment, women who watched a gender-unbalanced video of a math and science conference reported a lower sense of belonging to the event and less desire to attend. Furthermore, these female subjects showed greater skin conductance and increased heart rates during the video compared to female subjects who watched a balanced gender video. Males in the gender balanced versus gender-unbalanced conference did not show a significant difference in these measurements (Murphy, Steele, & Gross, 2007). Even when women have the same capabilities as men to compete in math and science majors, their negative perception of their abilities can interfere with their performance.

Identity-Based Motivation theory argues that people work harder on tasks that match what their group is expected to value or excel at (Oyserman & Destin, 2010). A task or field may feel identity incongruent after experiencing many moments of disidentification, which occurs when students handle stereotype threat by instead focusing on another sphere in which they thrive (Aronson et al., 2002). For example if a student receives a poor grade in a math class, they may come to believe that "math is for nerds" in order to dissociate with the subject. The student will find confidence in believing he or she is not labeled a nerd. After repeated failures in a domain, the student may permanently believe math is not for them (Aronson et al., 2002).

Over time, women experience a contradiction in their need to pursue their education and their desire to be feminine, a contradiction that becomes more salient with age (Pipher, 1994). By the end of elementary school, older students were more aware of stereotypes (McKown & Strambler, 2009). Further research used a gender implicit association test to discover math gender stereotypes were present for fourth, seventh, and ninth grade girls, but the most influential among grades seven and ninth (Steffens et al., 2010). As students advance into higher levels of academia, female students are more likely to stop competing with male students in math and science courses. This also discourages women from pursuing future careers in math (Steffens et al., 2010).

In other words, as women mature, they are faced with stronger discouragement to pursue math and science classes. While overall school self-concept declines for all students, female students experience additional decrease in math self-concept. Women may also feel discouraged to pursue math and science because their female peers are also not following this career. They may feel their group membership is threatened. According to Oyserman and Destin (2010), people act in accordance with their most prominent social identities to fit in with the group. In this scenario, women do not want to feel excluded from their female friends. During the college transition, then, the dual impact of a chaotic new environment and gender stereotypes may uniquely undermine women's math confidence or motivation. Therefore, in the present study, it is possible that women reminded of being in transition will rate their math self-concept more poorly than men. This gender difference may not emerge on broader academic self-ratings, where negative stereotypes about women are not prevalent. Further, we will attempt to experimentally add and remove threat to see if explicit threat combined with transition effect negatively affects female students' math performance.

Finally, it is also possible to experience positive effects from stereotype threat. If one belongs to the positively referenced group in a stereotype (e.g., men are stereotyped as being good at math), then members of the group may experience stereotype lift (Walton & Cohen, 2003). According to Walton and Cohen (2003), previous experiments with "stereotype relevant conditions" produced improved results for the non-stereotyped group compared to "stereotype-irrelevant conditions." Subjects responded to the positive stereotype pertaining to their in-group.

Perhaps using downward comparisons allowed these individuals to experience improved performance. In math classes, male students may feel more confidence because of the positive stereotype promoting their skills. Therefore, in this study, men who are reminded of gender stereotypes in math may do better on a math task than men who are told that gender differences are irrelevant.

In short, research has found that confidence in school self-concept diminishes over time, and that this change is particularly steep when facing periods of transition. This transition will also have a negative effect on student's math self-concept. The additional pressure of gender stereotype threat may contribute to the steeper decline in female students' math confidence. Stereotype threat may create a compounded negative experience for female students because they are transitioning (thus decreasing academic confidence) and feeling like others have certain expectations for them in the classroom (Steffens et al., 2010). To test this possibility we will (a) compare men's and women's scores in stereotype-relevant (math) and irrelevant (school) self-concepts, and (b) manipulate stereotype threat before participants complete a math task. The threat manipulation will take place after participants receive the transition prime and report their self-concepts, in order to isolate the main effect of transition on school and math self-concept before examining its dual impact on math task scores.

Hypotheses

Previous research has addressed many of the changes college students experience in this new environment. But many of these studies do not focus on the outcomes of these changes on students' perceptions of their intelligence. In addition, previous studies have compared students in different grades rather than manipulating the feeling of transition with a prime. This experiment will address how experimental reminders of the transitional period to college affects students at the University of Michigan. It is predicted students will rate their overall school self-concept lower after being primed to think about the transition to school.

In addition, there is a gap in previous research addressing how gender stereotypes come into play during transition periods, and in how gender stereotype threat affects male students. There have been many studies addressing how women are negatively affected but these experiments neglect how men react to this favorable stereotype. Therefore, is hypothesized female students will rate their math self-concepts more poorly than men when reminded of transition, but not their school self-concepts, because of the negative stereotypes relevant to women's math skills. Additionally, it is predicted there will be an additive main effect of transition and threat on math self-concept scores that will differ depending on gender. Female participants in the transition manipulation will do the most poorly on a math task because they are experiencing the negative effects of the transition reminder and stereotype threat. Male students in the control transition condition and the threat condition may experience the most powerful stereotype lift (i.e., do the best on a math task) because they are not distracted by their adjustment to the University and (b) and perform in accordance with the stereotype that men are better than women in math.

Method

Participants

A survey was conducted of 160 students in the University of Michigan Introduction to Psychology subject pool. They received one half-hour of course credit in return for their participation. The population was split into men, n = 68, and women, n = 93. Members from each class year were tested, freshmen n = 97, sophomores n = 46, juniors n = 15, and seniors, n =

3. Class year was separated into two groups. Freshmen were compared to “not freshmen” (the sophomores, juniors, and seniors combined).

The students identified their race as African American n = 8, Asian/Asian American n = 33, Caucasian n = 98, Hispanic n = 3, “other” n = 11, or mixed n = 8. The University of Michigan has a relatively affluent student population. In the socioeconomic class question, 22 students identified as upper income class, 72 categorized themselves as upper middle class, 49 chose middle class, 12 identified as lower middle class, and only 6 picked working class. The majority of the students surveyed were not on financial aid, n = 90. For students that were on scholarship, 26 were on need-based, 11 were on scholarship-based, and 33 were on both scholarship and need based scholarship. 13 students are the first generation to attend college.

Every college provides a different experience for undergraduates. This study investigates the transitional period for students at University of Michigan. To begin with, University of Michigan has a student population of 27,000 undergraduates. One third of the students are not Michigan residents and 4% are international status. Furthermore, 98% of the freshmen class chooses on-campus housing for their first year. According to the 2012 US News and World Report, Michigan was ranked the 28th best academic university in the country. The University has over 1,200 student organizations, clubs, sports, and extracurricular activities. Incoming freshmen are faced with many new obstacles at the University of Michigan.

Procedure

Participants came to a computer lab where the research assistant related the cover story. Students were told they would share their experiences at the University of Michigan. Then they first received a writing prompt, which primed “transition” or the control topic of “daily routine.” Afterwards, the students answered survey questions regarding their school and math self-concept. The students then received the stereotype threat manipulation and completed the math task. Finally, students answered background questions, then were debriefed and dismissed.

Materials

Transition prime. The students were asked to complete a writing prompt. The control group of participants read an excerpt about how students develop routines at college then explained their daily routine at the University of Michigan. This is to keep it as similar as possible to the transition condition. The manipulation group read an excerpt about the challenges one may face at the University of Michigan. For example, "entering a new educational environment such as college is a time of big change…". Students were asked to write a few sentences about some of the hardships they have experienced during their transition to the University of Michigan. See Appendix for full prompts.

School Self-Concept. The students evaluated their overall school confidence using a "school self-concept" measure (Simpkins, Davis-Kean, & Eccles, 2006; $\propto = .86$,). They answered questions like "How good at school are you?" "How much do you like school?" or "If you were to rank all the students in your grade from the worst to the best at school, where would you put yourself?" All of the questions used a seven-point scale; one represented low self-confidence while seven represented high self-confidence.

Math Self-Concept. The students then evaluated their overall math self-confidence using the math version of the school self-concept scale mentioned above (Simpkins et al., 2006; $\propto = .90$,). This portion of the survey included questions like "How good at math are you?," "If you were to rank all the students in your math class from the worst to the best at school, where would you put yourself?" or "How well do you expect to do in math this year?"

Stereotype Threat Induction. After the self-concept questionnaires and before the math task, the participants were randomly assigned to either a stereotype threat or no-threat condition. The research assistant explained to the threat-induced group that previous research showed gender differences on the math task results. The participants believed their scores would be used to assess their genders' math ability (Spencer, Steele, & Quinn, 1999). The control group was told men and women score similar results on this math task.

Math Test. After the questionnaire, the students completed a math task. The students were given 3 numbers (2, 3, and 7) to add, subtract, multiply, or divide in order to reach one number (36). Each student tried to find as many answers as possible. Their answers were coded for number of attempts and number of correct responses (Oyserman, Gant, & Ager, 1995). The number of attempts measured <u>math persistence</u>, and <u>math accuracy</u> was measured with a new variable named math ratio. This was created by dividing the number correct by the number of attempts. The threat condition was considered only during the analysis of the math task results.

Background Questions. The participants then answered background questions such as gender, race, residency (Michigan, out-of-state, or International) and high school education. The survey also asked if the student was a transfer student or a first generation college degree. Finally, students answered information about their socioeconomic status, financial aid, scholarships and work status on campus.

Manipulation check. At the end of the experiment students answered two questions to measure the effect the manipulation. Students responded to the statements "I feel comfortable at the University of Michigan" and "I am still transitioning to the college lifestyle." This was answered on a seven point scale ranging from agree to disagree. See Appendix for all survey items.

Results

Manipulation Check

The last two questions in the survey were analyzed to determine if the transition manipulation successfully induced feelings of being in transition. A one-way analysis of variance (ANOVA) revealed no effect of the transition writing prompt on the participants' self-reported feelings of being in transition, although the means for both statements were in the expected direction. The results for the first statement ("I feel comfortable at the University of Michigan"), found that the control group, $M = 1.89$, $SD = 1.19$, scored nonsignificantly higher than the transition group, $M = 1.73$, $SD = .90$, $F(1, 158) = .90$, $p = .34$. The second statement ("I am still transitioning") also produced insignificant results, $F(1, 158) = .65$, $p = .42$, but again, the transition group, $M = 4.69$, $SD = 2.04$, scored higher than the control group, $M = 4.42$, $SD = 2.17$.

School Self-Concept

A factorial analysis of variance (ANOVA) tested the effect of transition manipulation, gender, and class year on school self-concept. The full model included each main effect and each interaction. The model was not a significant overall predictor of school self-concept scores, $F(7, 152) = 1.27$, $p = .27$. However, class year was marginally significant, $F(1, 152) = 3.74$, $p = .055$. Freshmen reported lower school self-concepts, $M = 5.38$, $SD = .80$, compared to non-freshmen, $M = 5.59$, $SD = .90$. There were no other significant variables in the model (all F's < 2.63 , all p's > .11).

Based on the moderate sample size and moderate predictors, a simpler ANOVA was analyzed. Because no interactions were expected for school self-concept, this model tested only the main effects of transition, gender, and class year on school self-concept, without testing any interactions. The model was also not a significant predictor of school self-concept scores $F(3, 156) = 1.04$, $p = .38$. The effect of class year was in the hypothesized direction but was not a significant predictor of school self-concept scores, $F(1,156) = 2.29$, $p = .13$. No other variables in the model were significant (all *F'*s < 2.29 , all *p'*s > .37). See Table 1 for all school self-concept means.

Math Self-Concept

The same analysis of variance (ANOVA) tested the effect of transition manipulation, gender, and class year on math-self concept. The full model was not significant, $F(7, 152) = 1.59$, $p = .14$, but gender was a significant predictor in the model, $F(1, 152) = 5.58$, $p = .02$. Female students, $M = 4.57$, $SD = 1.32$, reported a lower math-self concept than male students, $M = 5.02$, $SD = 1.05$. Class year was marginally significant, $F(1, 152) = 3.05$, $p = .08$. Freshmen reported lower math self-concept scores, $M = 4.62$, $SD = 1.26$ compared to other class years, $M = 4.97$, $SD = 1.17$. The other predictors and interactions in the model were not significant (all *F'*s < .932 , all *p'*s > .37).

A simpler ANOVA was run to test the hypothesized main effects of transition, gender, and class year and the hypothesized transition by gender interaction on math-self concept. In contrast to the full model, the overall math self-concept model was significant, $F(4,155) = 2.46$, $p < .05$. A closer look at gender again found a significant result, $F(1, 155) = 5.45$, $p = .02$, with the means in the same direction as previously reported. Class year was almost a significant variable in the model, $F(1, 155) = 2.68$, $p = .10$. Unfortunately, the effect of transition and the transition by gender interaction were not significant (all *F'*s < .9, all *p'*s > .34). See Table 2 for all math self-concept means.

School vs. Math Self concept

Because we predicted a different gender by transition interaction for math compared to school self-concept scores, a repeated measures General Linear Model compared School and

Math Self-Concept to test for within-subject statistical differences by type of self-concept. The 2 (transition manipulation) x 2 (gender) x 2 (class year) x 2 (self-concept type) found a significant difference between self concept type, $F(1, 159) = 47.52$, $p < .001$. School Self-Concept means, $M = 5.46$, $SD = .85$, were higher than Math Self-Concept, $M = 4.76$, $SD = .12$.

The interaction between transition manipulation, gender, and type of self-concept was marginally significant, $F(1, 159) = 3.56$, $p = .06$. A multivariate analysis of variance (MANOVA) was used to test the simple effect of gender within each transition condition within each type of self-concept. The effect of gender was significant for math self-concept scores within the transition condition, $F(1, 156) = 6.36$, $p = .01$. In contrast, the effect of gender within the transition condition was nonsignificant for school self-concept, $F(1, 157) < .01$, $p = .99$. The effect of gender was also nonsignificant within the control condition for both school, $F(1, 156) = 1.65$, $p = .20$, and math self-concept, $F(1, 156) = .60$, $p = .44$ (see Figure 1).

A marginally significant interaction emerged between transition manipulation, class year, and type of self-concept, $F(1, 159) = 2.93$, $p = .089$. It was hypothesized there would be a difference between gender by type of self concept but that interaction was not statistically significant, $F(1, 159) = 1.94$, $p = .17$. The other variables and interactions were not significant (all F's < 1.94, all p's > .17).

Math Task Persistence

A 2x2x2x2 analysis of variance (ANOVA) was used to analyze a full model estimating the effects of transition manipulation, class year, gender, stereotype threat condition, and all possible interactions on math task persistence (or number of attempts on the math task). The overall model, $F(15, 143) = 1.49$, $p = .12$ was not significant. However, there was a significant interaction between class year and stereotype threat condition, $F(1, 143) = 6.26$, $p = .01$. A simple effects MANOVA revealed that freshmen in the threat condition $M = 12.0$, $SD = 5.48$ made marginally significantly fewer attempts to complete the math task than freshmen in the non-threat condition, $M = 14.32$, $SD = 7.87$, $F(1, 156) = 3.36$, $p = .07$. Additionally, non-freshmen in the threat condition, $M = 16.65$, $SD = 9.55$ made significantly more attempts than the non-freshmen in the non-threat condition, $M = 12.40$, $SD = 6.96$, $F(1, 156) = 4.78$, $p = .03$ (See Figure 2). See Table 4 for all math persistence means.

In addition, there was a significant main effect for gender, $F(1, 143) = 4.15$, $p = .04$. Male participants, $M = 14.61$, $SD = 7.50$, made more attempts at the math task than female participants, $M = 12.51$, $SD = 6.96$. No other variables or interactions were close to significant (all F's < 2.72, all p's $> .10$). See Table 3 for all means.

A second analysis of variance (ANOVA) was used to test the simple model, looking only for a main effect of the transition manipulation, class year, gender, stereotype threat condition, and the interaction between gender and stereotype threat on the number of attempts in the math task. The overall model, $F(5, 153) = 1.17$, $p = .33$ was not significant. Gender as an individual variable was almost significant, $F(1,153) = 2.78$, $p < .10$. No other variables were close to significant (all F's < 1.44, all p's $> .23$). Thus, we failed to find a classic stereotype threat effect (i.e., a gender by threat interaction) on math task persistence.

Math Task Accuracy

An analysis of variance (ANOVA) tested the full model of transition manipulation, class year, gender, stereotype threat condition, and all possible interactions on the math task accuracy (calculated as the ratio of right answers to attempt). The full model was not significant, $F(15, 142) = .91$, $p = .55$. Gender was marginally significant, $F(1, 142) = 3.49$, $p = .06$. Male subjects, $M = .86$, $SD = .19$, were marginally more accurate than female subjects, $M = .79$, $SD = .24$, on the math task. Threat condition was also marginally significant, $F(1, 142) = 3.11$, $p = .08$. Contrary to our hypothesis, participants in the threat condition, $M = .85$, $SD = .17$, were marginally more accurate than those in the non-threat condition, $M = .79$, $SD = .27$. However, we again failed to find a gender by stereotype threat, or gender by stereotype threat by transition manipulation interaction.

A simpler analysis of variance tested the effect of transition manipulation, class year, gender, stereotype threat condition, and the interaction between gender and stereotype threat on the math task accuracy. This model was marginally significant, $F(5, 152) = 2.19$, $p < .06$. Gender $F(1, 152) = 4.93$, $p = .03$ was a significant predictor of the math accuracy score. The threat condition was not significant, $F(1, 152) = 2.37$, $p = .25$. Again, the interaction between gender and threat condition was not significant, $F(1, 152) = 1.20$, $p = .28$. All other variables were not significant (all F's < 1.85, all p's > .18). Thus, by failing to interact with gender, our stereotype threat manipulation failed to affect math accuracy in a stereotype threat consistent way. See Table 5 for all math accuracy means.

Correlations

Finally, a correlation analysis was run to analyze if there were any correlations between school self-concept, math self-concept, math persistence, and math accuracy. Math and School Self-concept were strongly correlated, $r(160) = .41$, $p < .001$. Math self-concept and math persistence were also correlated, $r(160) = .19$, $p < .05$. No other measurements were correlated (all p's>.12). See Table 6.

Discussion

Every school year, freshmen face the challenge to transition from high school to a University. These pressures can affect certain types of students in distinctive ways. It is interesting and important to investigate how students evaluate themselves and their capabilities in the classroom when transition is on their minds.

The main analysis of this study was an investigation of how the transition to college affects student's school and math self-concept. There was a significant difference between subjects' school and math self-concepts, such that school self-concepts were generally higher. There was also an interaction between gender and transition manipulation for only math self-concept. As predicted, female students reported lower math self-concept scores than male students only in the transition condition; there were no gender differences in school self-concept scores. Thus, we find some support for the unique impact of transitions on self-evaluations of stereotype-relevant skills. Judging by our nonsignficant manipulation check, it is possible that a stronger manipulation would create a more pronounced effect (e.g., an overall effect of transition on school self-concept scores).

In a separate analysis of math self-concept, and in accordance with my hypothesis, there was a significant difference in math-self concept scores based on gender alone. Female students reported lower math-self concept scores compared to male students. This result is consistent with previous research that has found female students rate their math skills lower compared to their male counterparts (Huguet & Régner, 2009).

Similar gender differences were found regarding the math task. The math ratio score found women had a marginally significantly lower percentage of correct answers compared to men. The number of attempts for each math task was significant based on gender. Female students were less likely to attempt multiple answers for the math task as male students. The difference in math task scores and number of attempts could result from stereotype threat. There exists a stereotype that men are better at math than women (Steffens et al., 2010). In a situation where a woman is aware she is being evaluated she may perform worse in fear she will confirm the negative stereotype (Schmader et al., 2008).

During the math task, experimenters randomly divided participants in the stereotype threat condition or the control. The stereotype threat group was told that previous results have found gender differences in the math task while the non-stereotype threat group was informed reports found no gender differences. Contrary to my prediction, there was no statistical data suggesting an interaction effect between threat and gender in the math task results. I believed female students in the stereotype threat condition would perform worse on the math task compared to male students in this same condition. It is possible that our "no threat" instructions failed to reduce the threat already inherent in a stereotype-relevant task. The lack of an effect from our threat manipulation could also have resulted from the study taking place in a psychology laboratory. Participants may have been skeptical of the script and disregarded the information that there is no gender difference on the math task. On the other hand, after one experiment, one participant explained that he knew there were no true gender differences and that it was a part of the study. Both sides of the threat manipulation may have thus failed to be convincing. One limitation to this experiment was our failure to measure each participant's level of suspicion to get a better sense of whether the manipulation worked on people who believed it. It is challenging to induce a true stereotype threat situation when participants may not take their scores seriously.

My main hypothesis was that transition condition would predict school and math self-concept scores. However, transition condition was not a strong predictor of school self-concept. This may be due to either low effectiveness of the transition priming procedure, or to the possibility that the high school to college transition is not as disruptive to the self-concept as predicted. Regarding the first explanation, the transition condition was determined by a writing prompt. Students either reported their struggles with transitioning to University of Michigan or one of their daily routines. It is possible we did not find an effect because the prime did not accomplish its purpose in dividing the participants into two groups: transition and control. The results did not find significant differences in the transition and control groups when responding to the manipulation check at the end of the survey. It may be difficult to have freshmen forget they are in a transition or for sophomores and upperclassmen to place themselves back in the freshmen year mentality. Nevertheless, further results suggested that the transition prime may have played a role in determining math self-concept for women (whose math skills are negatively stereotyped). Future researchers may develop a more efficient way to manipulate transition in students.

Additionally, since past researchers have found negative effects on academic confidence based on students' year in school, we measured students' class years. Class year on its own did not predict school self-concept (i.e., freshmen and non-freshmen were equal). However, the data found that class year was almost a contributing variable for math self-concept in the predicted direction (freshmen scored lower on math self-concept scores than sophomores and upperclassmen). Perhaps math self-concept is particularly susceptible to disruptions from transition states, as past research has found.

However, it is also possible the transition to college does not have as strong of a negative effect on student's school and math self-concept as the transition at other time points. There has been extensive research demonstrating the negative effects of entering middle school after elementary school (Schunk et al., 2007). Middle school students have to simultaneously handle the change is school environment and changes from puberty. There are also multiple experiments outlining the changes from middle school to high school. During this time period students are still adjusting to the hardships or adolescence and entering a competitive environment to prepare for college. For some students this transition is a loss of motivation to compete in the classroom (Schunk et al., 2007). To my knowledge, there is no research that explains how the transition to college affects students' sense of their academic abilities. It is possible students are most established post high school and come prepared to handle the rigorous workload at the University. It is feasible that students do not significantly decline in their overall school and math self concept when entering freshmen year. The only exception may be for people evaluating their skills in a domain where they are negatively stereotyped (e.g., women in math).

Limitations

My study was confined to the student population at University of Michigan. The pressures for students entering a University of this size are not universal for every person entering college. Furthermore my study pool was exclusively students from an Introduction to Psychology course. This class is biased to freshmen and female students in the Literature, Science, and the Arts program. Any significant findings I have discussed cannot be generalized to the entire student population. In addition, my sample size did not have equal cell sizes for class years. There were only 3 seniors and 15 juniors in the study. This was not a balanced representation of upperclassmen. This may skew our interpretation of results related to class year; that is, it may better reflect a freshman to sophomore comparison rather than a freshman to senior comparison.

Future Research

In the future, this study could be expanded to answer more research questions. To begin with, would the results of this experiment change if more upperclassmen completed the study? A senior is both more established at college and preparing to embark on the transition to the career or post-graduate world. A future study could aim for equal cell sizes from each class year. Also if students outside of psychology introduction course completed this study would the results change? University of Michigan has 12 different colleges not limited to the Literature, Science, and Arts school, and perhaps the rigors of different majors impose transitions that are more or less disruptive.

Previous research has shown that academic transition has a negative impact for students entering middle and high school. But past research did not attempt to manipulate transition and has relied on differences in class year. If this same experimental procedure were used on sixth, seventh, and eighth graders, would there be a more profound effect of transition reminders than we found for college students? Would the effect be larger for sixth graders compared to seventh and eighth graders (Hensley, 2010)? Similarly, for high school students, would freshmen rate their school and math self-concept lower than upperclassmen, especially if primed to think about their recent transition (Schunk et al., 2007)? We found marginally different responses in college freshmen and older grades, would this effect be more pronounced at the middle or high school level?

While all students face the challenge to transition to college, female students face the additional pressure to overcome negative stereotypes in math. Women feel less confident about their math abilities than men, which may lead them to exert less effort in the subject. For women, negative math stereotypes combined with the transition to college can lower confidence in math ability.

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Table 1

School Self-Concept by Transition manipulation, Gender, and Class year.

Transition		
	Freshmen	Non-Freshmen
Men	5.40	5.56
Women	5.49	5.42
Control		
	Freshmen	Non-Freshmen
Men	5.34	6.15
Women	5.26	5.46

Table 2

Math Self-Concept by Transition manipulation, Gender, and Class year.

Transition		
	Freshmen	Non-Freshmen
Men	4.81	5.48
Women	4.34	4.60
Control		
	Freshmen	Non-Freshmen
Men	4.78	5.22
Women	4.68	4.74

Table 3

Math Persistence by Transition manipulation, Gender, Class year, and Stereotype Threat.

Threat

Transition

	Freshmen	Non-Freshmen
Men	13.31	19.00
Women	10.94	11.75

Control

	Freshmen	Non-Freshmen
Men	12.42	20.60
Women	11.80	14.91

Non-Threat

Transition

	Freshmen	Non-Freshmen
Men	19.75	12.22
Women	14.00	13.67

Control

	Freshmen	Non-Freshmen
Men	11.00	13.00
Women	12.6	11.33

Table 4

Math Persistence by Class year and Threat Condition.

	Freshmen	Non Freshmen
Threat	12.00	16.65
Non-Threat	14.32	12.40

Table 5

Math Accuracy by Transition manipulation, Gender, Class year, and Stereotype Threat.

Threat

Transition

	Freshmen	Non-Freshmen
Men	.84	.86
Women	.79	.91

Control

	Freshmen	Non-Freshmen
Men	.89	.91
Women	.84	.88

Non-Threat

Transition

	Freshmen	Non-Freshmen
Men	.88	.79
Women	.75	.65

Control

	Freshmen	Non-Freshmen
Men	.86	.91
Women	.76	.78

Table 6

Bivariate Correlations among Outcome variables.

	1	2	3	4
School Self Concept	--			
Math Self Concept	.41***	--		
Math Attempts	.12	.19**	--	
Math Ratio	-.028	.12	.051	--

*p ≤ .10; **p ≤ .05 *** p ≤ .01

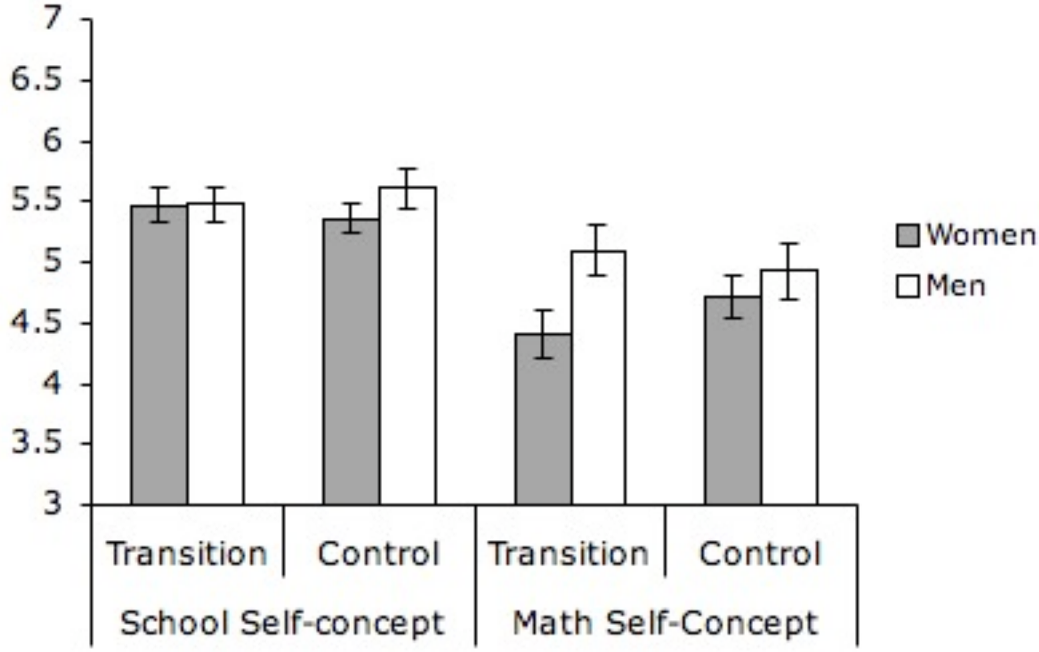

Figure 1: Self-Concept by Gender, Transition Manipulation, and Type of Self-Concept
Note: Significant gender differences are indicated by nonoverlapping error bars.

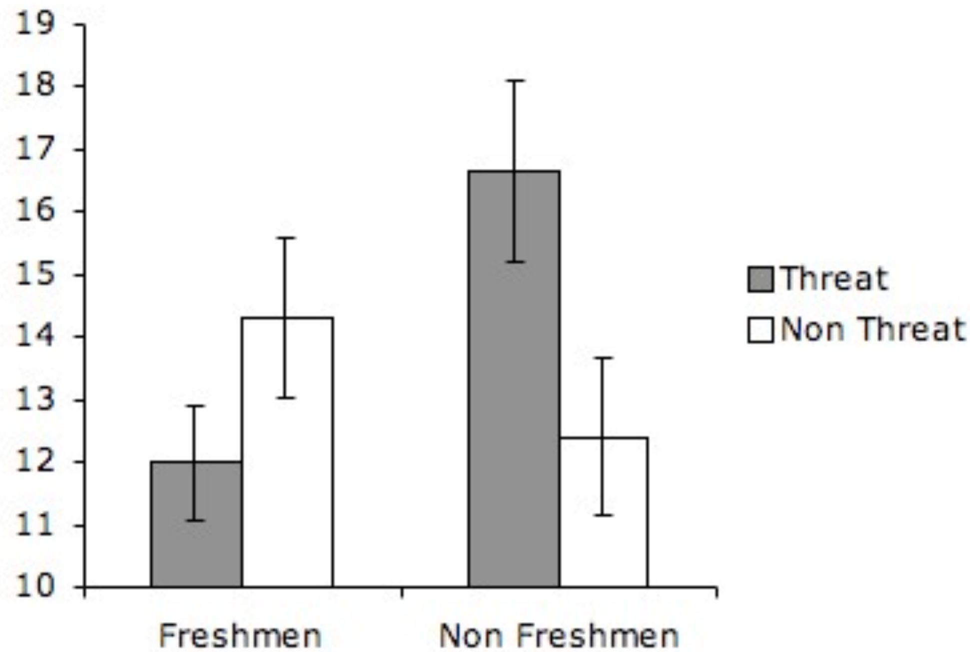

Figure 2: Math Attempts by Class Year and Threat Condition
Note: Significant gender differences are indicated by nonoverlapping error bars.

Appendix

University of Michigan
Psychology Pool Research Participant Consent Form: Reading/writing prompt

Principal Investigator: Diana Betz **email**: dibetz@umich.edu **phone:** (201)4018323
Co-Investigator: Leslie Monheit **email:** monheit@umich.edu **phone:** (301)3951048
Faculty Advisor: Denise Sekaquaptewa **email:** dsekaqua@umich.edu **phone:** (734)6479685

DESCRIPTION OF THE RESEARCH
You are invited to participate in a research study about people's reactions to reading and writing prompts. You must be at least **18 years of age** to participate.

WHAT WILL MY PARTICIPATION INVOLVE?
If you decide to participate in this research, you will be asked to react to a writing prompt. You will respond to a short answer prompt. Afterward you will fill out a survey and complete a math challenge. Your participation will fit within this same 30-minute session.

ARE THERE ANY RISKS TO ME?
There are no risks involved in participating in this experiment beyond those encountered in everyday life.

ARE THERE ANY BENEFITS TO ME?
The only benefit you may receive is increased familiarity with psychology research methods. At the end of the study, we will provide you with more information about it.

ARE THERE ANY ALTERNATIVES AVAILABLE TO ME?
You can meet your Introductory Psychology methods requirement by completing alternative assignments or other studies within the pool. For more information, please contact subjectpool@umich.edu

HOW WILL MY CONFIDENTIALITY BE PROTECTED?
You will not be linked to the data you provide in any way; it is completely anonymous. Your identifying information is taken only to report credit to the psychology subject pool, and is not connected to your activities in the study. The data collected during the study will be kept in a secured computer in a locked room and will be destroyed after 5 years.

WILL I BE COMPENSATED FOR MY PARTICIPATION?
This will count towards the 1/2 credit you receive for your half-hour session today. Credit count towards your Introductory Psychology experiment methods requirement. This portion is only considered one part of the study. Should you decide not to complete this part of the study, you will still receive the full half-credit.

WHO SHOULD I CONTACT IF I HAVE QUESTIONS?
You may ask any questions about the research at any time before, during, or after the study. If you have questions about the research, you should contact the researchers listed above. If you have questions about your rights as a research participant, or wish to obtain information, ask questions or discuss any concerns about this study with someone other than the researcher(s), please contact the University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board, 540 E Liberty St., Ste 202, Ann Arbor, MI 48104-2210, (734) 936-0933 [or toll free, (866) 936-0933], irbhsbs@umich.edu. You may request a copy of this consent form to keep.

IS MY PARTICIPATION VOLUNTARY?

Your participation in this study is completely voluntary. You may decide to stop the study at any time without any penalty. And you may decide to skip any question or portion of the study.

Your signature below indicates that you have read this consent form and have agreed to volunteer.

____

Print name Consenting signature Date

Transition prime

Entering a new educational environment such as college is a time of big change. While any student is forced to adjust to a new University, this is especially true at a big, state school the size of University of Michigan. Not only may you feel overwhelmed by the number of classmates, but you may also feel far away from home, nervous about the rigorous courses, or uncertain about the new social scene. Write a few sentences about some of the hardships you have experienced during your transition to the University of Michigan.

Control prime

Everyone seems to have a daily routine. Many students at many different types of schools have a consistent pattern. Some students choose to shower before class or make a specific breakfast. Other students always study at certain buildings or certain times. Write a few sentences about your daily routine at the University of Michigan.

Directions: Please answer these survey questions about your academic abilities.

1. How good at school are you?

1----------2----------3----------4----------5----------6----------7

not at all good very good

2. If you were to rank all the students in your from the worst to the best at school, where would you put yourself?

1----------2----------3----------4----------5----------6----------7

The Best The worst

3. How successful do you think you'd be in a career that required academic ability?

1----------2----------3----------4----------5----------6----------7

very successful not very successful

4. How well do you think you will do in school this year?

1----------2----------3----------4----------5----------6----------7

Not At All Well Very Well

5. In general, how useful is what you learn in school?

1----------2----------3----------4----------5----------6----------7

very successful not very successful

6. For me being good at school is…

1----------2----------3----------4----------5----------6----------7

Not At All Important Very Important

7. Compared to most of your other activities, how important is it to you to be good at school?

1----------2----------3----------4----------5----------6----------7

A Lot More Important Not As Important

8. Compared to most of your other activities, how much do you like school?

1----------2----------3----------4----------5----------6----------7

Not As Much A Lot More

9. In general, do you find working on school assignments…

1----------2----------3----------4----------5----------6----------7

Very Interesting Very Boring

10. How much do you like school?

1----------2----------3----------4----------5----------6----------7

A Little A Lot

11. In general, how hard is school for you?

1----------2----------3----------4----------5----------6----------7

very easy very hard

12. Compared to other students your age, how much time do you have to spend working on your school assignments?

1----------2----------3----------4----------5----------6----------7

Much More Time Much Less Time

Directions: Please answer these survey questions about your academic abilities.

1. How good at math are you?

1----------2----------3----------4----------5----------6----------7

not at all good very good

2. If you were to rank all the students in the last math class from the worst to the best at school, where would you put yourself?

1----------2----------3----------4----------5----------6----------7

The Best The worst

3. Compared to most of your other school subjects, how good are you at math?

1----------2----------3----------4----------5----------6----------7

Much Worse Much Better

4. If you were taking a math class this year, how well would you expect to do?

1----------2----------3----------4----------5----------6----------7

Not At All Well Very Well

5. How good would you be at learning something new in math?

1----------2----------3----------4----------5----------6----------7

Very Good Not At All Good

6. In general, how useful is what you learn in math?

1----------2----------3----------4----------5----------6----------7

Not At All Useful Very Useful

7. For me being good at math is…

1----------2----------3----------4----------5----------6----------7

Not At All Important Very Important

8. Compared to most of your other activities, how much do you like math?

1----------2----------3----------4----------5----------6----------7

Not AS Much A Lot More

9. In general, do you find working on math assignments…

1----------2----------3----------4----------5----------6----------7

Very Interesting Very Boring

10. How much do you like doing math?

1----------2----------3----------4----------5----------6----------7

A Lot A Little

11. In general, how hard is math for you?

1----------2----------3----------4----------5----------6----------7

Very Easy Very Hard

12. Typically, compared to other students your age, how much time do you have to spend working on your math assignments?

1----------2----------3----------4----------5----------6----------7

Much Less Time Much More Time

13. Compared to most other school subjects you have taken or are taking, how hard is math for you?

1----------2----------3----------4----------5----------6----------7

My Easiest Course My Hardest Course

<u>THREAT</u>:

"Past research has shown gender differences on math test scores. For this reason, we're also going to be comparing math scores across gender. To help us do that, we're going to use (each of) your individual score(s) from this game as an indicator of your gender's math ability in general."

or

<u>NO THREAT:</u>

"Although gender differences in test performance have been reported using traditional math materials, previous testing has shown that men and women perform equally well on this type of game."

Math Task

For this portion of the study, you will play the 36 game.

Use the numbers, **2, 3,** and **7** to obtain the number **36** in as many ways as you can.

<u>*Rules:*</u>

- Write your answers in the space below. Fill out as many spaces as possible.
- You may **add, multiply, subtract, and divide.**
- You may use each number **as many times as you like.**
- You may provide **as many solutions as you want.**
- Do not use a calculator, the computer, or your phone.

Now please answer some background questions.

Gender

- Male
- Female

Grade

- Freshmen
- Sophomore
- Junior
- Senior

Are you a transfer student?

- Yes
- No

Race
Please choose all that apply.

- African American/Black, non-Hispanic
- Asian American or Pacific Islander
- Caucasian, non-Hispanic
- Hispanic or Latino/a
- Native American
- Other

Residency
What type of tuition do you pay?

- In-state (Michigan)
- Out-of-state
- International

I attended a single sex high school.

- True
- False

What is the socioeconomic background of your family?

- Upper Income Class
- Upper Middle Class
- Middle Class
- Lower Middle Class
- Working Class

Are you on financial aid?

- No
- Yes, need-based
- Yes, merit-based
- Yes need and merit based

Do you work?

- Yes, full-time
- Yes, part-time
- No

Are you the first person in your immediate family to go to college?

- Yes
- No

I feel comfortable at the University of Michigan.

1----------2----------3----------4----------5----------6----------7

Agree Disagree

I am still transitioning to the college lifestyle.

1----------2----------3----------4----------5----------6----------7

Agree Disagree

University of Michigan
Psychology Pool Research Participant Debriefing Form
HUM00048190

Today you participated in a study that asked you to either write or read about an aspect of your college experience: either the feeling of transitioning to a new environment or your daily routine.

Next, the experimenter told you that you would be completing some surveys and doing a problem-solving task. You received one of two sets of instructions. You may have been told that we were interested in comparing men's and women's performance on a math task, and that your score would be serve as an estimate of your gender's math skills; this was meant to mimic an experience known as "stereotype threat." Specifically, when simple knowledge of a negative stereotype about your group—for women, this may include the stereotype that women have poor math skills—harms your performance on a task related to that stereotype—for instance, by lowering women's scores on a math test (Pronin, Steele, & Ross, 2004; Steele & Aronson, 1995)—this is known as stereotype threat. The remaining participants were told that no gender differences had been uncovered on this particular type of task—or that the test was "gender-fair"—and no mention was made about individual scores reflecting the skills of one's entire gender; this was the no-threat condition, as these instructions were expected to alleviate stereotype threat.

You then answered questions about your educational background, school self concept, and math abilities, and finally completed a math task.

We expect that participants made to think about "transitions" would reflect on the ways that they themselves are "in transition," (e.g., getting used to a new school environment) more so than reading or writing about typical days or habits. These participants may have felt less confident about their math or school abilities, and may have tried less on the math task.

Further, we expect that female participants in the stereotype threat condition would report weaker math self-concepts and try less on the math task, compared to men in the stereotype threat condition, to men and women in the no-threat condition, and to women's feelings about their school self-concepts (as women's general intelligence is not negatively stereotyped).

Finally, we hypothesize that women who are both reminded of stereotype threat and made to feel like they are in transition would feel least confident about their math abilities and persist least on the math task.

The results of this study will help us understand how being in academic transition affects how talented students think they are at academic tasks such as math classes, as well as how students with particular identities may respond to transitional feelings in particular domains (e.g., women in math). This has implications for new college students, as it may help us understand exactly how transitions and stereotype threat influence students and thus improve their academic experiences.

It was necessary to present the study to you without explicitly mentioning our interest in transitions or stereotypes in order to prevent anything outside of the study from influencing your survey answers or persistence on the math task. Knowing that we were studying the effects of thinking about transitions or the effects of stereotypes might have done just that.

Thank you very much for your help with this project. If you have any questions about the experiment, or anything you did in this study, the experimenter will remain in this room to answer them or you may contact either of the researchers listed below. You may also request a copy of the final report of this project from these researchers:

Principal Investigator: Diana Betz **email**: dibetz@umich.edu **phone:** (201)4018323
Co-Investigator: Leslie Monheit **email:** monheit@umich.edu **phone:** (301)3951048
Faculty Advisor: Denise Sekaquaptewa **email:** dsekaqua@umich.edu **phone:** (734)6479685

Should you have questions regarding your rights as a participant in research, please contact: Institutional Review Board 540 East Liberty Street, Suite 202 Ann Arbor, MI 48104-2210 734-936-0933 email: irbhsbs@umich.edu.

If you wish to talk with someone other than the researchers about this project, there are a number of resources. To alleviate any negative feelings that may arise, the University of Michigan's Counseling and Psychological services (CAPS) offers free and confidential services. Contact them at 734-764-8312 ,or visit them at 3100 Michigan Union, 530 S State Street, Ann Arbor, MI 48109, anytime from 8am to 7pm Monday through Thursday (8-5 on Fridays), or visit their website at the following address: http://www.umich.edu/~caps/. For academic support resources, you may also visit the CAPS website, as well as MiTalk.org.

If you are interested in learning more about this topic, please see these resources:

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