

Nielsen, B. L., Barth, J. M., & Gordon, A. (2012, March) *Boys think they are better at math and science, but girls will take the classes anyway: Sex differences in taking advanced classes*. Poster presented at the Society for Research on Adolescents Convention, Vancouver, Canada.

Boys Think They are Better at Math and Science, but Girls Will Take the Classes Anyway: Sex Differences in Taking Advanced Classes

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Introduction

- During adolescence career interests can shape the course students pursue in school. The decision to take advanced math and science classes can prepare students for a wide range of careers; however the decision to take only the minimal required math and science courses can leave students ill-prepared to pursue some of the highest paying jobs.
- Unfortunately, declines in self-perceptions of ability and interest in math and science over the course of schooling are well documented, especially during school transitions in preadolescence and adolescence.
- Eccles et al. (1993) proposed that school transitions negatively affect academic outcomes because children's developmental needs are not easily met in the social context of post-elementary schools.
- Gender differences in interest & efficacy are well documented in the transition research.
 - Although minimal, sex differences do exist in mathematical abilities (Ceci et al., 2009), where girls have consistently rated themselves less competent than boys at performing the skills necessary for math and science careers.

Purpose

The purpose of this study is to describe the factors relating to females' attrition in math and science related coursework and careers. Specifically, we investigated the relation between self-efficacy and tolerance for negative academic feedback in a systematic way at three adolescent time points. We explore if boys' and girls' tolerance for lower grades in advanced classes relates to math and science (M-S) efficacy and if this affects their willingness to enroll in M-S courses.

Method

Participants

- 339 adolescent students in 5th (121), 8th (103), and 11th (115) grades (55% females) participated in the study. 71% were Caucasian, 2% Asian, 25% Black, and 2% Hispanic, mixed race, other, or did not specify a race.
- Approximately one year later students were asked to complete the survey again. Retention rate was 94% (319) students).
- Students were compensated \$15 to \$20 for participating.

Procedure

- Students completed 355 item *Math, Science, & Technology* questionnaire in school. Second Factors in Career Decision Making Questionnaire (99 items) given 2-4 weeks later.
- Questionnaires were usually completed in 20-40 minutes.
- Questions used a multiple choice format and assessed several constructs in addition to those reported here.

- Efficacy and Interest scales were formed based on measures from previously published research: Bandura et al. (2001); Eccles et al., 1993); Midgley et al. (1989); Michigan Study of Adolescent and Adult Life Transitions (2006); Wilkins and Ma (2003).

Measures

- *Math & Science Efficacy.* Two separate measures were created at each time point, one for each subject area (four altogether). Items assessed student perceptions of their performance in school (e.g., self-ranking of ability and performance in math and science in comparison to other subjects) and items related to the ability to learn math or science. Items were averaged so that scores ranged from 1 (low) to 5 (high). Mean *alpha* = .72.
- *Math & Science Interest.* Two separate measures were created for math and science, one for each time point (four scales all together). Items assessed attitudes (liking, interest in taking more math or science) and the perceived importance and usefulness of math or science for the future. Items were averaged so that Interest scores ranged from 1 (low) to 5 (high). Mean *alpha* = .73.
- *Tolerance for Low Grades.* This measure (see below) was designed to measure students' tolerance for low grades. The measure first asks students to rate the likelihood to sign up for advanced classes in English, Math, Science, and Social Studies on a 4-point scale ranging from Not at all likely (1) to Very Likely (4). Next students completed 10 items assessing their tolerance for poor grades on a 5-point scale ranging from NOT at all true of me (1) to Very true of me (5). Mean *alpha* = .66.

Results

- Student Efficacy and Interest scores were highly correlated for boys and girls (range $r = .50$ to $r = .75$).
- Although boys scored higher on efficacy (for math 4.1 and 4.2 for girls and boys, respectively; for science 4.0 and 4.1 for girls and boys, respectively), both sexes expressed similar interest in advanced classes.
- Tolerance and Efficacy for math and science were highly correlated indicating that greater grade tolerance was associated with higher efficacy (r 's ranging from .32 to .41).
- Repeated measures ANOVA demonstrated a significant sex X grade X course subject interaction (Figure 1).
- The effects relayed a significant developmental trend toward students becoming more accepting of poorer grades as they age.

Conclusions

- Surprisingly, the only sex difference was in younger adolescents' interests in taking advanced English classes, with boys less likely to take these courses than girls.
- Within the limits of the cross sectional design, these results suggest that girls and boys hold a similar tolerance for poor grades in math and science classes and thus, this construct does not likely explain why girls appear less likely to continue in math and science.
- Furthermore, tolerance for poor grades is related to students' perceptions of their abilities in math and science.

Please read this paragraph and answer the questions that follow.

Imagine that next year you will have the choice to sign up for either advanced or regular level classes. Advanced classes are usually more interesting than regular classes and if you make an “A” in the advanced classes, it looks much better on your school record than an “A” in the regular classes. But, the advanced classes are more challenging and require more work. Sometimes even good students cannot make an A in these classes. How likely would you be to sign up for an advanced class in each of these subjects? Please use the following rating scale:

_____ 1 _____ 2 _____ 3 _____ 4 _____
Not at all likely Not Likely Likely Very Likely

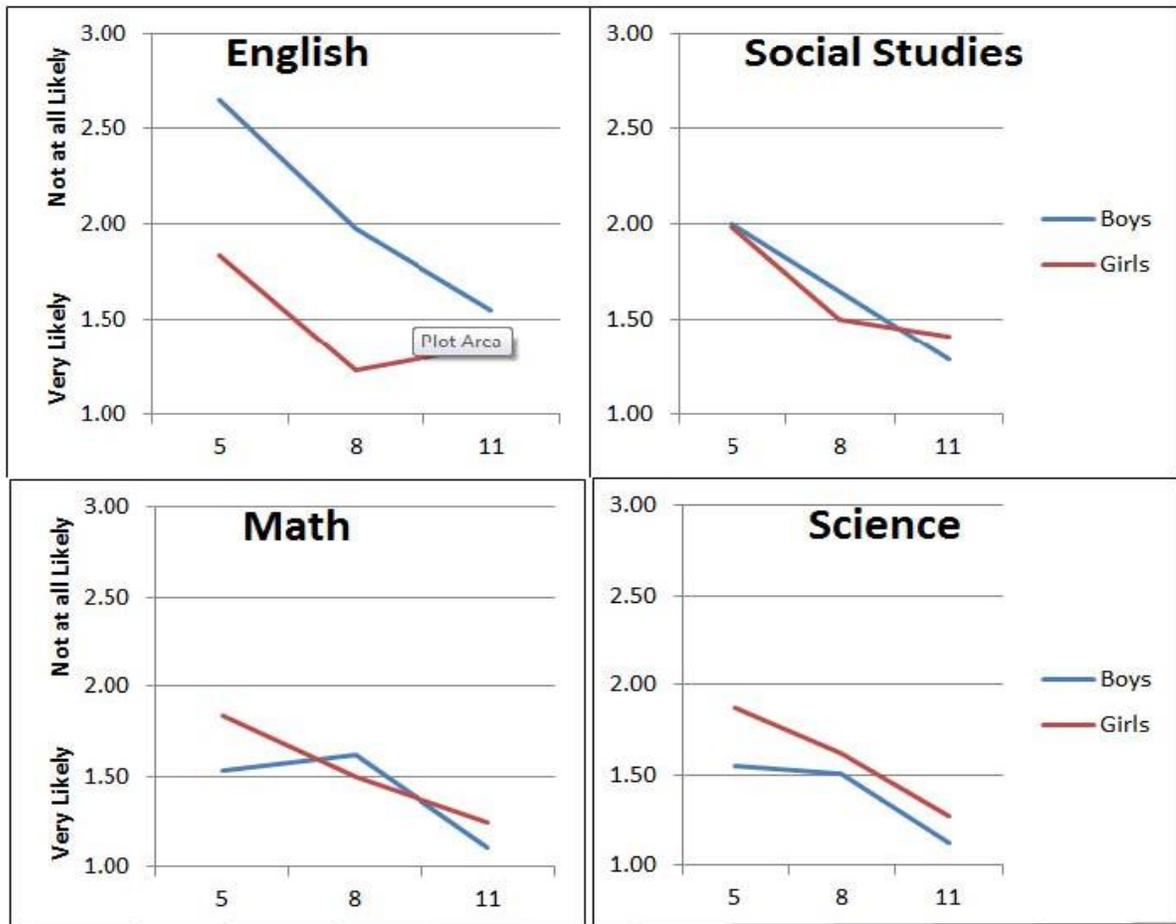
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|----|--------------------------|
| 1. | English or Language Arts |
| 2. | Math |
| 3. | Science |
| 4. | Social Studies |

Directions: For each of the following statements rate how true it is for you. Use the following rating scale.

_____ 1 _____ 2 _____ 3 _____ 4 _____ 5 _____				
NOT at all true of me	Sort-of NOT True	Unsure	Sort-of True	Very true of me

- | | |
|-----|---|
| 5. | I often worry about making good grades. |
| 6. | I feel like my grades are a reflection of my true ability. |
| 7. | Making good grades is more important to me than enjoying a class. |
| 8. | I would not sign up for advanced classes because I am afraid of making poor grades. |
| 9. | Getting good grades is what’s important in school not how much you really learn. |
| 10. | If I don’t think I can get an “A” from a teacher, I would change to a different class if I could. |
| 11. | When I don’t get a good grade in a class, I just want to give up. |
| 12. | I set higher goals for myself than most people. |
| 13. | I hate being less than the best at things. |

Figure 1. Boys and Girls' Interest in Taking Advanced Classes



Note: Scores range from 1 to 4; High scores indicate that a student is *less* likely to take an advance class.