

## When do girls lose interest in math and science?

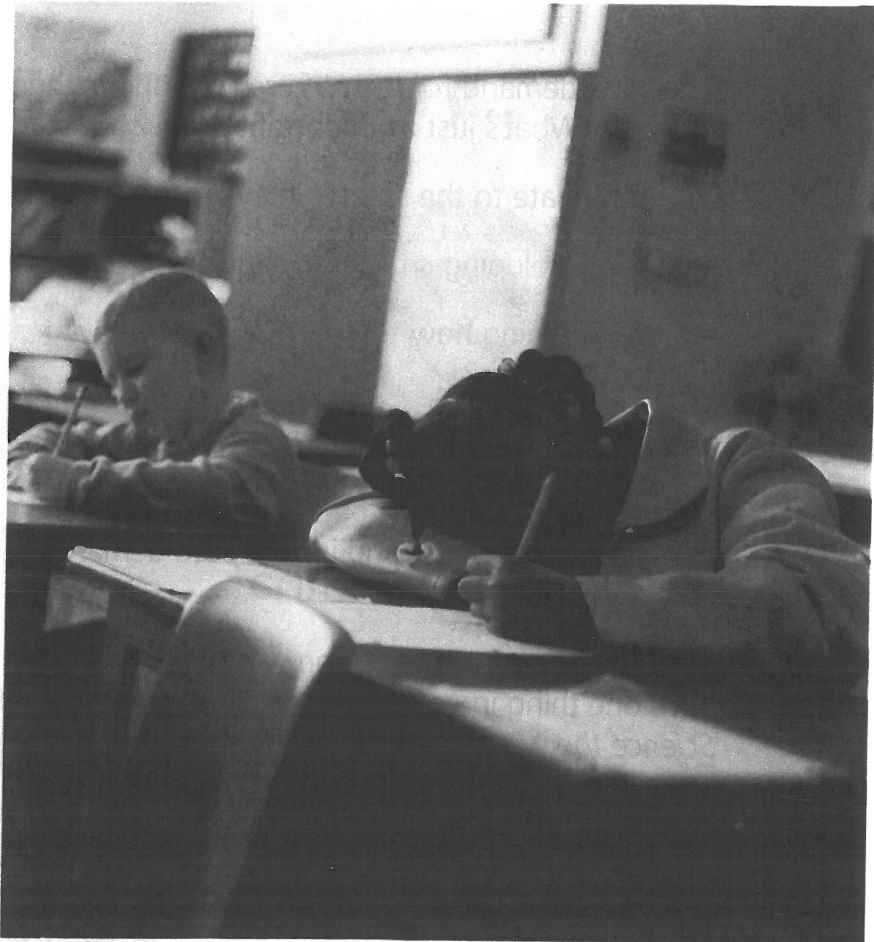
Girls start kindergarten interested in math and science, but leave high school with that interest far diminished (AAUW 1992). Girls and boys enter kindergarten with the same measured math abilities. By the time they graduate from high school, however, girls are behind boys in both math ability and self-esteem (AAUW 1992). Previous studies have shown that students' interest in science declines as they go through school (Orborne, Simon, and Collins 2003; Prokop, Prokop, and Tunnicliffe 2007). Surveys of students in 4th, 8th, and 12th grades found that, at all three grade levels, about 5% more boys agree with the statements, "I like math" and "I like science" than girls do (NSF 2003).

The same study found that about 10% more boys agree with the statements, "I am good at math" and "I am good at science" than girls do (NSF 2003). Differences in self-esteem have been linked to boys' and girls' different experiences in school and out of school (Jones et al. 2000; Jones, Howe, and Rua 2000; Orenstein 1994). At all ages, girls get less attention from teachers than boys do (AAUW 1992; Kahle and Lakes 2003; Sadker and Sadker 1994).

Although the gender differences on standardized math tests are small (Hyde et al. 2008), differences on standardized science tests persist (NAEP 2005). Women in the United States also get a smaller percentage of bachelor's degrees in science than men do (Ivie and Ray 2005). At some point, the enthusiasm that female students bring to science in kindergarten wanes.

### Our survey

We surveyed female students in grades 4 through 8 in several school districts in southwestern Ohio to try to answer three questions: (1) Do girls stop liking science? If so, at which grade? (2) Do girls stop liking



math? If so, at which grade? and (3) Do girls like science and math less than they like language arts and social studies? The female students were asked, "How do you feel about school in general?" and "How do you feel about the following subjects in school?" with language arts, social studies, science, and math listed. Students circled a number between 1 (strongly dislike) and 5 (really like) (see Figure 1). Hundreds of girls in each grade completed the questionnaire. There were 439 fourth-grade girls, 407 fifth-grade girls, 344 sixth-grade girls, 357 seventh-grade girls, and 448 eighth-grade girls, for a total of 1,997 students from the five grades, answering the questions. All of these students were girls going to school in southwest Ohio; 1,476 of them were from urban districts and 521 from rural districts.

### At which grades do girls start liking math and science less?

To answer the first two questions (Do girls stop liking science? If so, at which grade? And do girls stop liking math? If so, at which grade?), we first looked at the modes, the number between 1 (strongly dislike) and 5

(really like) chosen most by the girls from each grade. These results are shown in Figure 2. Girls in fourth grade chose 5 most often for both math and science. As this was the most positive choice available to them, we conclude that fourth-grade girls like both math and science. The mode for both math and science was also a 5 in both fifth and sixth grade. The first time that the mode drops for either math or science is in seventh grade. The mode of the seventh-grade girls' responses was a 3 for both math and science. Because 3 is in the middle of the scale, we interpret a 3 as a neutral feeling, halfway between the options of 1 and 5. The mode of the responses about science increased to 4 (halfway between neutral and "really like") in eighth grade, while the mode of the responses about math remained a 3 (neutral).

From looking only at the modes, we might conclude that girls stop liking math and science in seventh grade. To take a closer look, we also examined means. The means of the girls' responses are in Figure 3. The means get lower each year from fourth

to seventh grade, and then rise in the eighth grade (though not to the fourth-grade levels). One pleasing result is that all the means in the girls' rating of science were higher than 3, which means more positive than neutral. This was also true of the means in the girls' rating of math until grade 7; the means dropped slightly below 3 for both seventh and eighth grade.

The first question was, "Do girls stop liking science? If so, at which grade?" To answer the first part of this question, we did an ANOVA (analysis of variance) on the science means. We found that the science score changes with grade significantly ( $p < 0.0001$ ). The answer to the first part of the first question is therefore that girls' rating of science does drop significantly after its initial high in fourth grade. We also asked at which grade the drop in ratings occurred. To find out, we did a follow-up Dunnett multiple comparison. The first significant change from the fourth-grade mean is in fifth grade ( $p = 0.0072$ ). Fifth-grade girls in our study report liking science significantly less than fourth-grade girls do.

The second question was, "Do girls stop liking math? If so, at which grade?" We found that the math score changes significantly with grade ( $p < 0.0001$ ). The answer to the first part of the first question is therefore that girls' rating of math does drop significantly after its initial high in fourth grade. We also asked at which grade the drop in ratings occurred. The follow-up comparison shows that the first significant change from the fourth-grade mean is at sixth grade ( $p = 0.0108$ ). Sixth-grade girls in our study report liking math significantly less than fourth-grade girls do.

As we had designed our survey to be short, we did not ask the girls reasons for their opinions about school in general or about the specific subjects. We know that, at least for some subjects at some grade levels, understanding of science depends in part on understanding of math. One hypothesis might be that a decrease in positive ratings of science could be caused by a decrease in positive ratings of math. (To be fair, it was only Jennifer, who teaches university physics, who had this hypothesis.) This does not appear to be the case with the girls we sur-

**FIGURE 1** Questionnaire

Please take your time and answer the questions to the best of your ability and please be honest. This will not be graded and will be kept confidential.

How do you feel about the following subjects in school?

**Language Arts**

1 2 3 4 5  
strongly dislike really like

**Social Studies**

1 2 3 4 5  
strongly dislike really like

**Science**

1 2 3 4 5  
strongly dislike really like

**Math**

1 2 3 4 5  
strongly dislike really like

Thank you so much for your time and honesty.

veyed. In nearly every grade, the girls' mean attitude toward science was more positive than their mean attitude toward math. The one grade in which this was not the case was sixth grade, which is also the grade with the smallest difference in means (0.01 on a 5-point scale).

## Do girls like science and math less than they like language arts and social studies?

The third question was, "Do girls like science and math less than they like language arts and social studies?" In many cases, the answer to this question is no.

Looking first at the modes, we noted that fourth-, fifth-, and sixth-grade girls did not seem to like any subject better than they liked science and math. Their most common response to the question "How do you feel about" the subjects science and math was 5 ("really like"). The only other subject with a mode of 5 in those three grades was fifth-grade language arts. In both seventh and eighth grade, there were no longer any subjects whose mode was a 5. In fact, only one subject in each grade had a mode of 4 (halfway between "neutral" and "really like"). In seventh grade, that subject was not science or math, but social studies. In eighth grade, the one subject with a mode of 4 was science.

Looking at the means gives very similar results. Fourth-, fifth-, and sixth-grade girls had higher means for science and math than they did for language arts or for social studies. In seventh grade, the highest mean was in social studies, and in eighth grade, the highest mean was in science. One sobering result is that the means for nearly all subjects get lower, indicating less favorable ratings, every year. The one notable exception is the increase in the mean of the girls' rating of science from seventh to eighth grade.

As a follow-up, we checked to see if there were differences between urban and rural girls. There were no significant differ-

ences between these groups at any grade for any of the ratings.

## Discussion

It is important to note that ours is not a longitudinal study. Rather than tracking one group of girls for five years, we have taken a snapshot of the girls in our region, with a grade range of five years. Even so, our survey of almost 2,000 girls yielded some robust results. We expect that we would get similar

**FIGURE 2** Modes (1 = Strongly dislike, 5 = Really like)

Grade/Number of students	Language arts	Social studies	Science	Math
4th/439	5	4	5	5
5th/407	4	3	5	5
6th/344	3	3	5	5
7th/357	3	4	3	3
8th/449	3	2	4	3
All/1,997	3	3	5	5

**FIGURE 3** Means (1 = Strongly dislike, 5 = Really like)

Grade/ Number of students	Language arts	Social studies	Science	Math
4th/439	3.5	3.5	4.1	3.8
5th/407	3.5	3.2	3.8	3.8
6th/344	3.4	3.1	3.5	3.6
7th/357	3.2	3.1	3.1	2.9
8th/449	3.0	2.9	3.3	3.0
All/1,997	3.3	3.2	3.6	3.4

results from a longitudinal study, or a study of girls in other states, but that is, of course, subject to further study.

Not all of our results surprised us. We expected the finding that girls like both math and science less as they get older. Even finding that the drops occurred early (by sixth grade for math and fifth grade for science) was not surprising, given the experience Debra has had teaching those grades. When Debra taught third and fourth grade, she noticed that girls were always excited when there was an experiment. Now that she teaches fifth and sixth grade, she sees more of the girls celebrating when there isn't time for science.

We wondered for a moment whether changes in opinions from one grade level to another might reflect different content, perhaps reflecting a preference for life science over physical science, for example. However, in Ohio, where our study was done, each grade learns some life science, some physical science, and some Earth science. In mathematics, each grade spends some time on the big three benchmarks: numbers and number systems, meaning of operations, and computation and estimation.

We were surprised to see that, in general, the girls do not report disliking either science or math. The modes and means both stay above 3 (neutral) in all grades but one. The fact that even middle school girls completing an anonymous survey do not report disliking math or science is encouraging to both of us. In addition, we were surprised to see that girls report liking math and science more than other subjects at almost every grade. This is in contrast to Jennifer's experience at the university level; women do not major in science and math more than they major in other subjects. We hope that teachers will take this information into account, and acknowledge that girls do like science and math.

We would be interested in knowing more about why girls like the subjects they do. Does the hands-on nature of science make it many students' favorite subject? Also, if even eighth-grade girls like math and science more than they like language arts or social studies, why are there more English and psychology majors than there are science and math majors? Further study is needed in this area.

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## Resource

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