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Cornell Institute for
Women in Science

Teacher-Facilitator Materials for “Cornell Institute for Women in Science” Video Series

Cornell Professor and Former NFL Lineman Matt Miller Talks Engineering with Daughter Chaney

Summary of Video Content:

Former NFL Lineman Matt Miller, today an engineering professor at Cornell University, talks to his daughter, Chaney, about the many challenges facing engineering students at Cornell. Some young women drop out of majors like engineering when they realize how tough the courses are. Matt reminds Chaney that she is not the only person struggling to win: The courses are difficult for everyone, and Matt stresses that she must focus on her many successes and on how far she has come. Chaney's story illustrates that life is not a straight line from Point A to Point B. Many people encounter obstacles and take detours on the path to success, just as Chaney did when she switched from the humanities to engineering, and just as Matt did when he left pro football to become an IvyLeague professor of mechanical and aerospace engineering. Chaney describes her feelings of growing competence as an engineer, and notes that she finally feels like she belongs when she walks into the engineering building. Matt concludes by telling the story of the Roadrunner and the Coyote—the Coyote would run off the edge of a cliff and be moving along fine until he made the mistake of looking down. Matt's advice to young women in engineering and science more generally is to keep moving forward and "Don't Look Down"— this is Matt's secret to success.

Background:

In this video, Chaney, the daughter of Cornell mechanical engineering professor Matt Miller, describes how she got “body-slammed” in her first year as an engineering major at Cornell University: she got only 30 correct out of 100 on her tests and this almost convinced her that engineering was not for her. Research illuminates two key points that Chaney makes.

First, a number of surveys have reported that females are far more likely than males to drop out of science and engineering majors. Christopher Strenta and his colleagues studied over 5,000 high school graduates who expressed the plan to major in science or engineering. All of these students' abilities were very high in math and science, judged by their high school grades and math and science SAT scores. (All of them matriculated in one of four Ivy League universities.) Yet, despite these students' high ability, many of them either dropped out of college or switched to a non-science major. And, as already noted, females were more likely to drop out of science than were males: smaller proportions of women (48 percent) than of men (66 percent) persisted as science/engineering majors.

Students who defected from science did so for a variety of reasons. One oft-cited reason was the attractiveness of non-science majors. Although this reason was given by nearly all students who switched, males and females were equally likely to drop out for this reason. A big criticism offered by females was their perception that science courses were overly competitive and the instruction was inferior, along with the view that the work was too difficult. Chaney was nearly derailed by her poor performance in her early tests.

Ask your students to guess which of the following reasons were given by males and females for switching out of science majors (see figure on next page). Several items were taken from Strenta et al.'s (1999) survey, and others are from recent NSF surveys. As you can see, only three of the twelve reasons for dropping out of science were chosen by females more than males. The others were listed equally often by both sexes, and thus cannot explain why fewer females persist in science.

The second aspect of Chaney's story that is supported by research is that her high ability in nonscience fields (e.g., languages) gives her the option of switching out of science into another domain in which she is equivalently capable. Recall that she described herself as someone who had been drawn to the humanities and arts; before venturing into engineering, she had been studying Spanish and Mandarin. After a few months in mechanical engineering, she felt like she did not belong in the hard sciences and was an "imposter". This is a surprisingly common complaint of female science and engineering majors. In another video in this series, we focused on research showing that females are more likely than their male counterparts to be excellent at both math and nonmath domains (see video titled: **Fostering interest in science**). In that video, we noted that math-talented females are more likely to have a perfect 800 score in math as well as a perfect 800 score in verbal proficiency, whereas math-talented males are more likely to have a single perfect 800, in mathematics alone. This **Percentage of men and women giving stated reasons for dropping out of science and engineering majors**.

QUESTION	MALES	FEMALES	Is Gender Difference Significant?
Other fields were more interesting	89%	90%	No
Other fields made better use of my talent	60%	71%	Yes
Science courses were too competitive	38%	54%	Yes
Work in science was too difficult	41%	48%	No
Class members were demeaning about my abilities	23%	27%	No
Quality of science instruction was inferior	42%	37%	No
Classes required too much memorization	36%	37%	No
Science classes were too large	32%	36%	No
Did poorly in introductory courses	21%	38%	Yes
Professors were not accessible when I needed help	24%	25%	No
Other fields provided more career opportunities	23%	17%	No
Grades based on curve	17%	20%	No

This means that females with exceptional math talent can choose between careers that depend heavily on either type of talent. In contrast, males who score highly in math often do not have exceptional verbal ability, so for them the career decision is straightforward—be an engineer, physicist, computer scientist, or mathematician. A recent analysis of nearly 1,500 intellectually capable adolescents revealed that mathematically-talented students who were also high in verbal talent were more likely to pursue non-science careers than were comparably math-talented peers who were not also verbally talented. The important point in Wang et al.'s finding is that significantly more females than males comprised the “high math/high verbal” talent group.

Some Thought Questions:

It almost seems as if having too-broad talent is a bad thing because it permits students (particularly women) to opt out of science majors. What are your feelings about this? Chaney was ready to drop out of engineering after doing poorly on her early tests. Fortunately, her father was able to build her confidence in a way that few of our parents could, because he teaches these courses and knows what it takes to succeed. He kept advising Chaney that it is hard for everyone and “don’t look down”. But one could argue that courses should not be graded so harshly because this policy leads to hemorrhaging of students from science who could be very successful if they were not graded on a bell curve. Do we need to be this competitive in grading, particularly at excellent universities that admit only highly-competent students in the first place? How many potentially fine doctors, for example, are lost to such practices?

Suggested Readings

Strenta, A. C., Elliott, R., Adair, R. Matier, M., & Scott, J. (1994). Choosing and leaving science in highly selective institutions. *Research in Higher Education*, 35, 513–547.

Wang, M-T, Eccles, J., Kenny, S. (in press). Not lack of ability but more choice: Individual and gender differences in STEM career choice. *Psychological Science*.