Who Chooses Science and Why?

by Patricia Hausman

Several recent reports offer important new insights about who is most likely to pursue a scientific career—as well as the factors that shape the choice of a specific discipline.

The reports cover findings from a longitudinal study of gifted youth led by Camilla Benbow and David Lubinski of Vanderbilt University. Benbow is dean of the university's Peabody College of Human Development; Lubinski is a professor of psychology. Along with colleagues at Vanderbilt and Iowa State, Benbow and Lubinski have been tracking more than 500 individuals identified as gifted when they were between the ages of 12 and 14.

Subjects took a battery of tests including the SAT and the Differential Aptitude Test (DAT). Unlike tests commonly used to assess academic aptitude, the DAT includes two subtests that measure spatial skills. One of these is space relations, which examines the ability to visualize and mentally manipulate objects. The other is mechanical reasoning, which tests for recognition of routine physical forces and principles. Scores from these two subtests were combined to create a composite for spatial visualization.

Participants also completed follow-up surveys at ages 18, 23, and 33. Almost 60% of the original cohort remained active after 20 years.

Results from the 20-year follow-up show noteworthy associations between ability profiles in early adolescence and ultimate college major and occupation. Subjects who majored in math, computer science, or electrical engineering had ability profiles that favored math and spatial skills over verbal ability; those who chose biology, social sciences or the humanities tended to more gifted in verbal than other domains. Spatial ability, which varied dramatically among the group, was superior to mathematical ability at predicting their educational and occupational outcomes.

The authors stress the costs of failing to identify students with unusual spatial aptitudes in a society that is increase-ingly dependent on technical skills. Accord-ing to one calculation, selecting the top 3% in mathematical and verbal ability will result in failure to identify more than half of those in the uppermost 1% of spatial ability.

Given that assessment of spatial skill is rarely incorporated into testing programs, the authors suggest that educators and counselors be alert to informal signs of spatial giftedness. These include hobbies that involve building, repairing, or creating; preference for science fiction over nonfiction; and achievement patterns that favor science and laboratory classes over other subjects.

In a separate analysis of the 20-year follow-up data, the team reported on almost 2000 subjects who had scored in the top 1% of mathematical reasoning ability when originally tested. Although all were mathematically gifted, pronounced sex differences in choice of major were clear. Males were much more likely than females to earn degrees in physical sciences and engineering. By contrast, more females than males received degrees in the life sciences, health, or medicine.

Sex differences also became more pronounced at higher degree levels. At the undergraduate level males outnumbered females among recipients of degrees in math or the physical sciences by a factor of about 2. At the doctoral level the male/female ratio increased substantially, with males earning four to six times as many degrees in these fields.

Although about 15% of females were homemakers at age 33, there was no evidence of differences in career satisfaction: about two-thirds of males and females alike described

themselves as satisfied or very satisfied. Males who worked full-time out-earned females by about 20%, yet females were slightly more likely than males to describe themselves as "successful" or "very successful."

These outcomes suggested that sex differences in interests and life goals contribute to sex differences in occupational choice. Responses to questions about life priorities were in line with such a conclusion. Males and females gave similar ratings to the importance of education, developing their skills, and a happy marriage. Where they most differed were on questions about the importance of part-time vs. fulltime work—females rated the former more highly, and males the latter.

Males also gave greater importance to being well-off financially, inventing or creating something, and being successful at work. By contrast, females gave higher ratings to spiritual life, friendships, and living close to their parents and relatives. All of these differences, however were considerably smaller in magnitude than those regarding part-time vs. full-time work. These results indicate that in making career decisions, females may consider the compatibility of a particular field or position with their desire for part-time work.

Summarizing the implications of their findings, the authors note:

> *Finally, if the United States is to remain true to the ideals that al students be given access to opportunities for developing their potential and that people be allowed to choose their life paths freely, this might require questioning whether males and females should be equally represented across the full educational-vocational spectrum. Although there is no reason to anticipate sex differences in the proportion of advanced educational credentials achieved by intellectually precocious youth, our data suggest that there may be a need to consider a degree of unequal representation in both directions across various disciplines. Is it acceptable, for example, to have greater numbers of women than men in high-power careers in medicine and law but the inverse in engineering and the physical sciences? The data reported here and elsewhere suggest that such gender-differentiating outcomes are likely to ensue if intellectually talented adolescents and young adults are allowed to choose freely how they would like to develop.*

The papers cited are:

- Daniel L. Shea, David Lubinski, Camilla P. Benbow. Importance of assessing spatial ability in intellectually talented young adolescents: a 20-year longitudinal study. Journal of Educational Psychology 93 (3): 604-614, 2001.

- Camilla P. Benbow, David Lubinski, David Shea, and Hossain Eftekhari-Sanjani. Sex differences in mathematical reasoning ability at age 13: their status 20 years later. Psychological Science 11(6): 474-480. 2000.

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