



# Problem Based Learning as a Tool in Addressing Gender Bias

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# Why the Gender Gap?

- In “Ethical and Social Issues in Computing,” students examine moral and ethical dilemmas created by computer technology.
- One outcome is awareness of complex social issues such as the Gender Gap in computer professions
- While in some engineering and technical fields percentage of women pursuing degrees is increasing steadily, in Computer Science, this number peaked around 1986, and is decreasing.





# The Original Assignment

- Write a paragraph on why you think that there are so few women in engineering, the sciences, computer sciences, etc., paying special attention to whether you think there is any bias involved.
- AFTER writing the paragraph, go to the web site at <https://implicit.harvard.edu/implicit/demo/takeatest.html>
- Click on "I wish to proceed" and select the Gender-Science IAT
- Do a screen print (if possible) of your results (if not, tell what they are), and then write your reaction to your score—was it what you expected? If not, in what way was it not? [4]



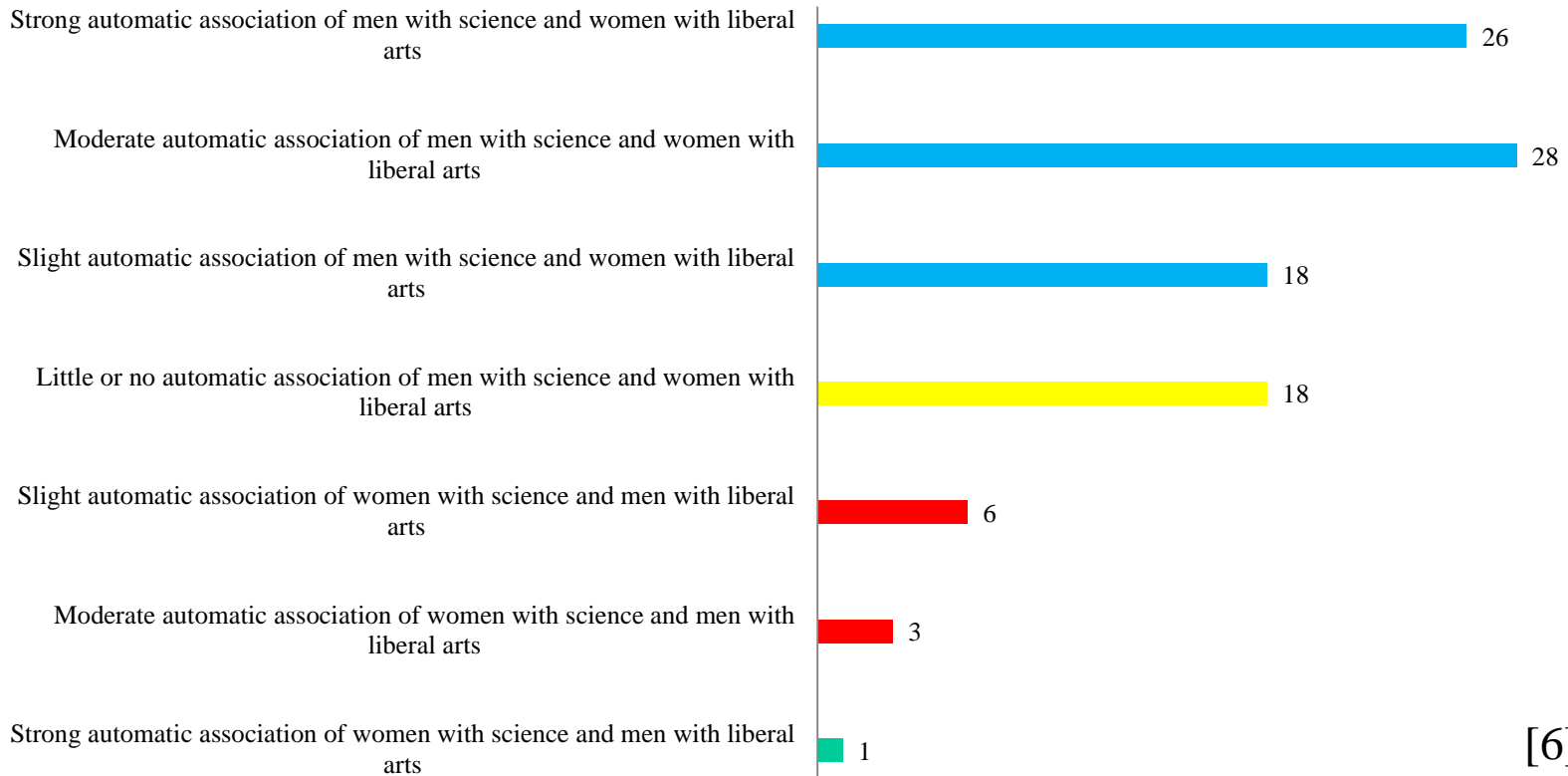


# Implicit Association Test

- Participants are asked to sort lists of words into two groups using only two letters on the keyboard.
- A score is calculated based on difference in reaction time in sorting mixed lists into combined categories.
- Studies have indicated the efficacy of Implicit Association Tests in capturing underlying attitudes, resistance to faking, and repeatability. [3]



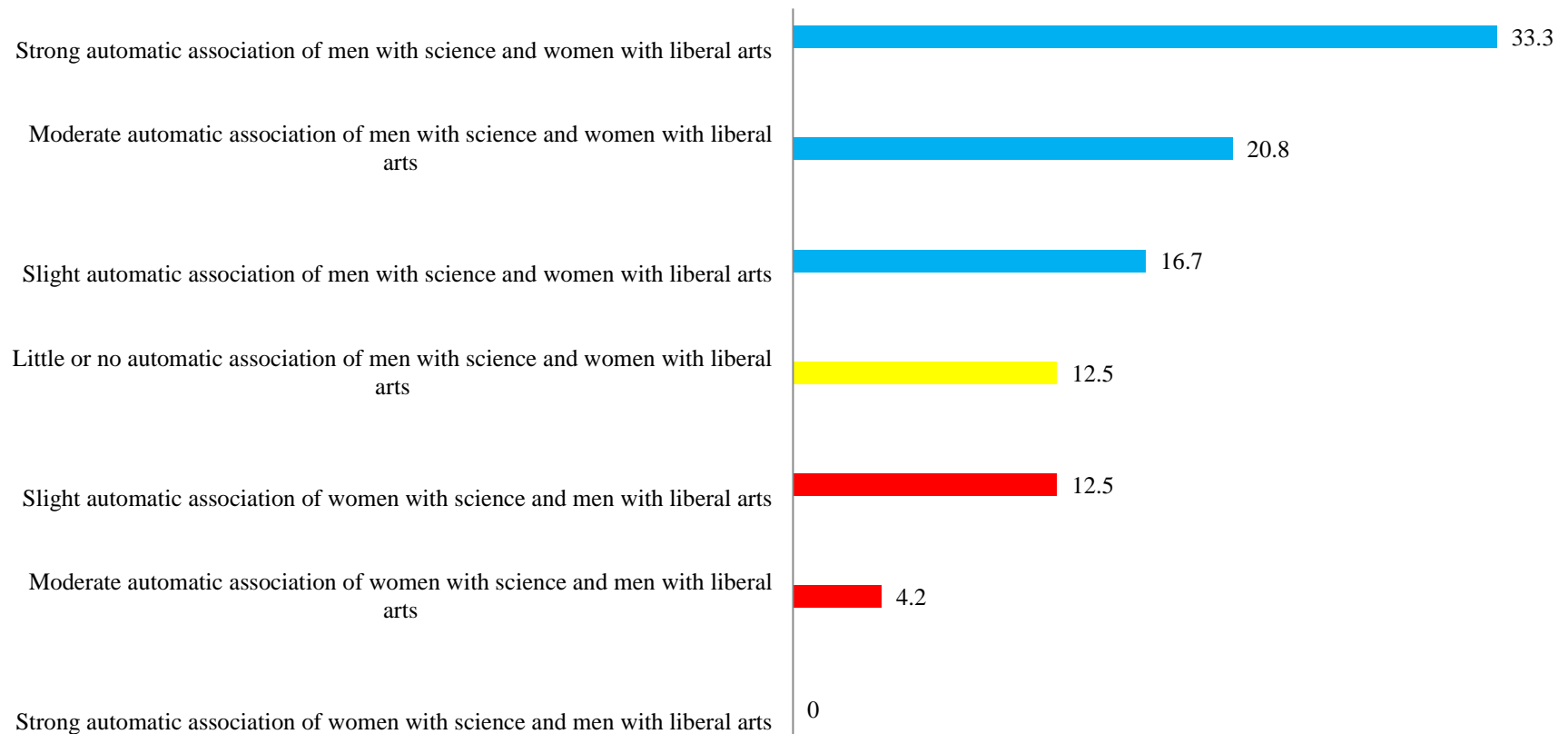
## Harvard IAT Results



[6]



## Responses from CPSC 3610 Spring 2011





## Comments from UTC Students

- “Girls just aren’t interested in stuff like computers”
- “Women’s brains can’t handle the advanced math—it’s a right brain, left brain thing”
- “Women are better at nurturing than at technical things”





# Reasons given were similarly disturbing

- “Engineering has been, and always be, a male-dominated field.”
- “It’s nothing to do with societal bias—it’s how girls are raised.”
- “[One] reason that a woman would have a hard time getting [into] and progressing through an engineering or computer science career is that sometimes men have too much pride. There are men who would not tolerate knowing that a woman could do a better job.”







# Reasons given were similarly disturbing

- “...women usually draws [sic] maximum benefits from their employers. If employers do not want to give a lot of benefits to an employee, they would most likely hire a male. I do not really believe there is any bias involved with this because the company just does not want to spend extra money on benefits.”



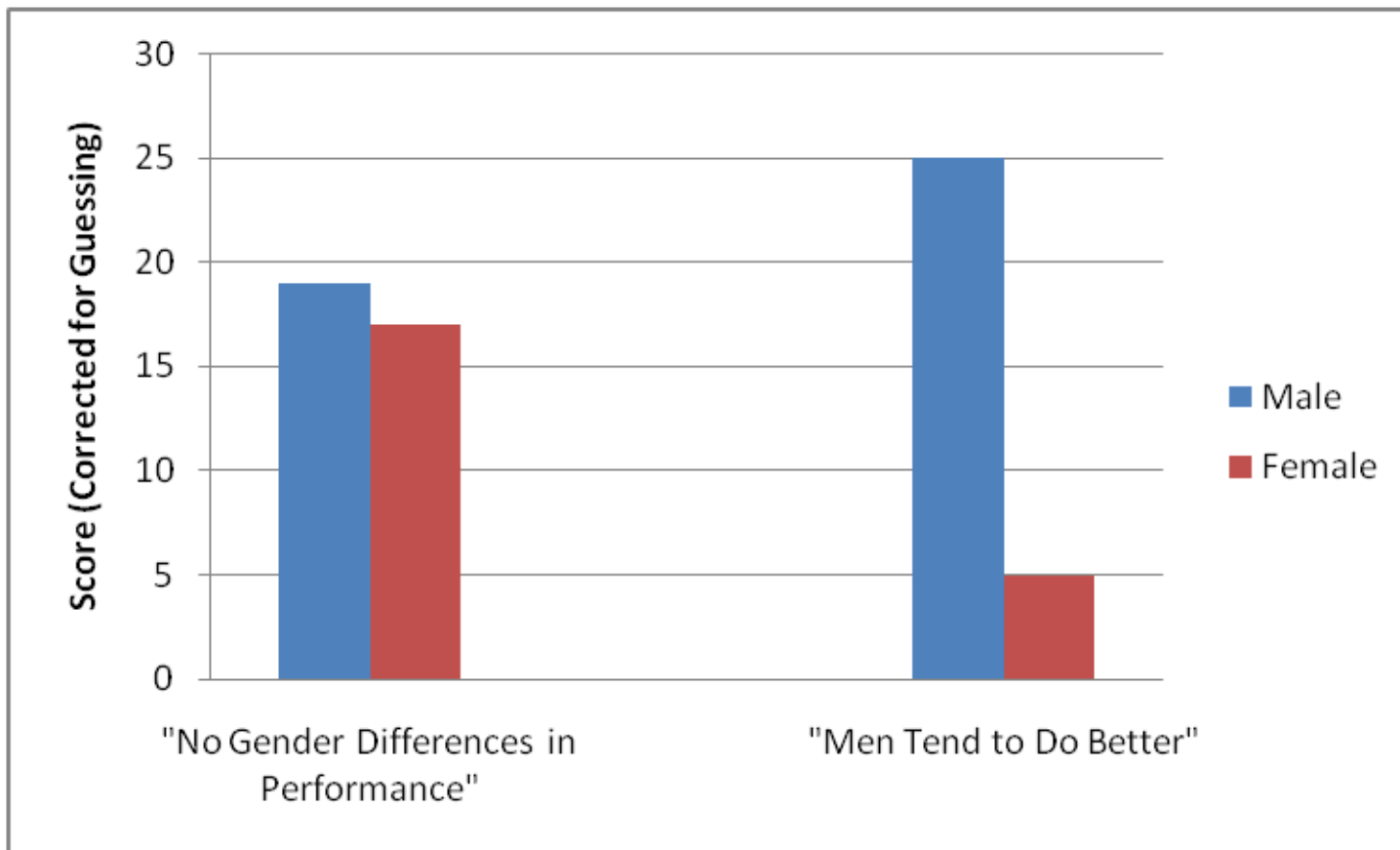


# Other Studies

- Based on two IAT studies including over 110,000 college graduates and students:
  - Male students who have the strongest automatic association between men and science are the most likely to major in these fields
  - Women with similarly strong associations were least likely to do so.
  - Women who majored in scientific fields tended to have the least automatic association of men with science. [7]



# Why is This a Problem?



[2]





# What Next?

- Obviously, the original assignment on the Gender Gap failed to provide the desired introspection and increased levels of awareness in UTC students.
- Given the troubling nature of student comments, a single assignment is unlikely to be sufficient to significantly change student attitudes.
- A more extensive Problem Based Learning assignment was developed for inclusion in the Spring 2014 course.





# Problem-Based Learning

- Students ...have the responsibility for their own learning.
- Problems ... must be ill-structured and allow for free inquiry.
- Collaboration is essential.
- What students learn during their self-directed learning must be applied back to the problem with reanalysis and resolution.
- A closing analysis of what has been learned from work with the problem and a discussion of what concepts and principles have been learned are essential.
- Self and peer assessment should be carried out at the completion of each problem ....[8]





# This Assignment had Four Parts

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- Preliminary (baseline) assessment
- Group project
- Evaluation of team-members
- Follow-up assignment





# Group Project

- Your goal is to determine
  - Whether the Gender Gap in technical fields is really a problem;
  - If so,
    - Are we ethically compelled to address it?
    - How?
- You should also address possible causes for under-representation.
- Your research should include, but is not limited to,
  - Demographics, government studies, social science studies, etc.;
  - Interviews with local businesses and women currently in technical fields;
  - Relevant current events.





# Evaluation of Team Members

Your name:

What was your main contribution to the project?

Other than yourself, who had the strongest contribution to the project, and what was it?

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Name:

Strongly Disagree      Mostly Disagree      Neutral      Mostly Agree      Strongly Agree

Strong contribution						
Showed originality						
Critical to success						
Cooperative						
Work done on time						

Main contribution to the project:

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# Follow-up Assignment

- What is the most interesting (and/or transformative) thing that you discovered in researching your own team's project?
- What was the most interesting (and/or transformative) thing that you heard in one of the other team's presentations?
- What was the item (in your project or another team's) that surprised you the most?
- What was the possible solution to the gender gap that you believe to be the most promising? Why?
- Based on your ethical viewpoint (rather than just your opinion), are we ethically compelled to address the gender gap?
- Has this project changed your views on the gender gap at all, and if so, how?





# Group Results Were Mixed

- Some groups were much more thorough than others in gathering information, particularly with interviews.
- All groups concluded that the Gender Gap was a problem that should be dealt with, but some used sexist language or stereotypes in their presentations.





# Individual Results Appear Promising

- The most common comments began “I didn’t realize...” or “This opened my eyes...”
- After the project, most students felt that the Gender Gap was a problem that needs to be addressed—a much higher proportion than before the assignment.
- The most common solutions suggested were early intervention to engage girls in play relevant to STEM fields.



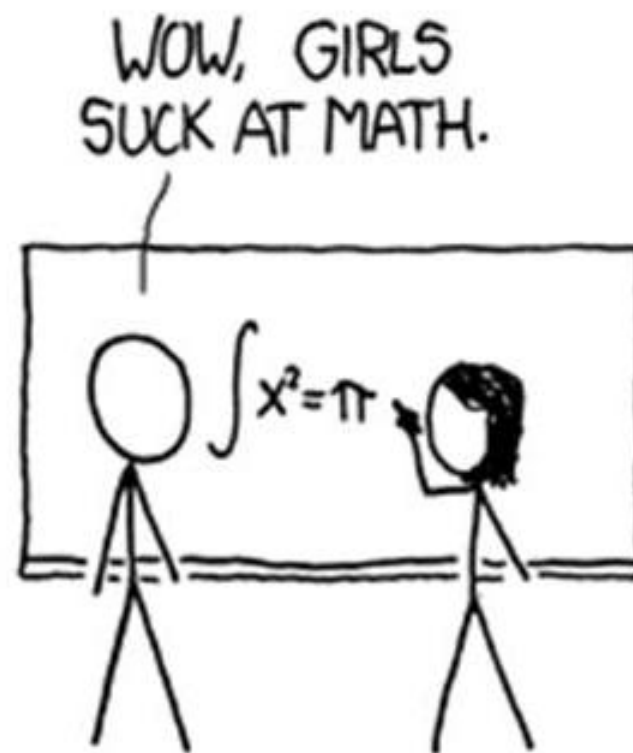
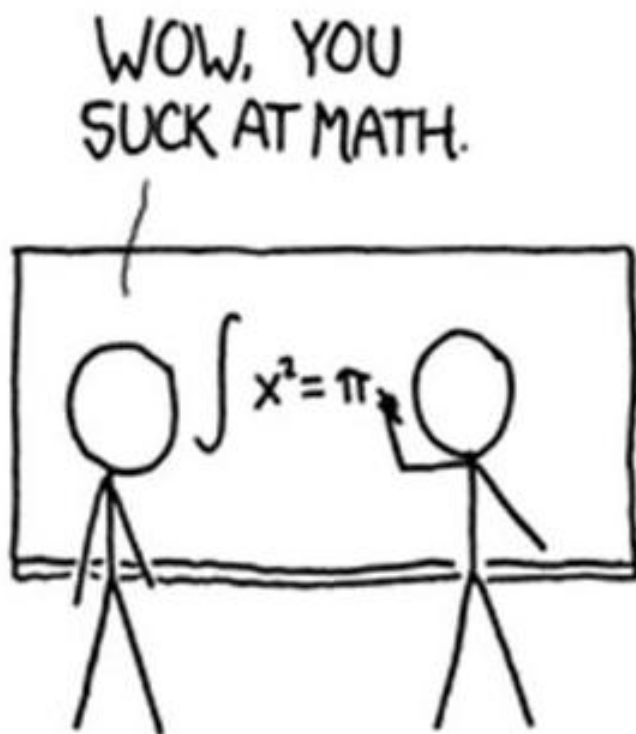


# Concluding Remarks

- The initial Implicit Association Test assignment failed to produce introspection and raise awareness of the Gender Gap.
- Student responses indicated more bias than had been previously suspected.
- The Problem-Based Learning team assignment seemed to impact awareness, but results are preliminary.
- This assignment will be refined and used in two sections of the class in fall 2014.



# Questions?



“How it Works”  
from [www.xkcd.com](http://www.xkcd.com)

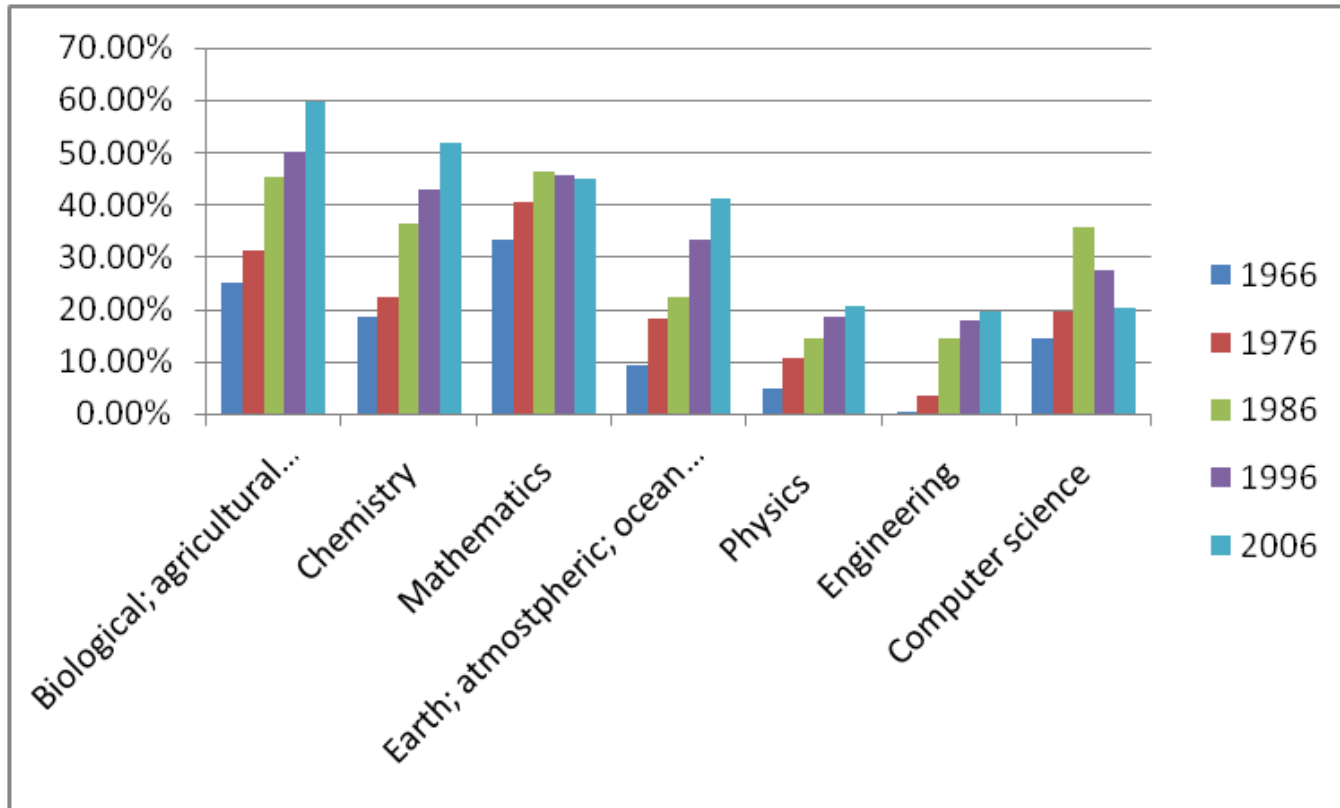


# References

- [1] *2013-14 Undergraduate Catalog*, University of Tennessee at Chattanooga, Chattanooga, TN, 2013, available from <http://catalog.utc.edu>, accessed 12/1/13.
- [2] Hill, Catherine, Corbett, Christianne and St. Rose, Andresse, “Why So Few? Women in Science, Technology, Engineering, and Mathematics,” AAUW, Washington, DC, 2010. available from <http://www.aauw.org/resource/why-so-few-women-in-science-technology-engineering-and-mathematics/> accessed 12/1/13.
- [3] Greenwald, A. G., Poehlman, A., Uhlmann, E., & Banaji, M. R., “Understanding and interpreting the Implicit Association Test III: Meta-analysis of predictive validity,” *Journal of Personality and Social Psychology*, Vol. 97, No. 1, 17–41, 2009, available from <https://www.projectimplicit.net/papers.html>, accessed 12/1/13.
- [4] McCullough, Claire, CPSC 3610, “Ethical and Social Issues in Computing,” University of Tennessee at Chattanooga, Chattanooga, TN, Fall Semester, 2013.
- [5] Gender-Science IAT Instructions, <https://implicit.harvard.edu/implicit/Study>, accessed 12/1/13.
- [6] Gender-Science Attitude, <https://implicit.harvard.edu/implicit/demo/background/gensciinfo.html>, accessed 12/1/13.
- [7] Smyth, F. L., Greenwald, A. G., and Nosek, B. A., “Implicit gender-science stereotype outperforms math scholastic aptitude in identifying science majors,” Unpublished manuscript, 2009, available from <https://www.projectimplicit.net/papers.html>, accessed 12/1/13.
- [8] Hitt, Joseph, “Problem-Based Learning in Engineering,” Center for Teaching Excellence, United States Military Academy, West Point, NY, 2010,



# Bachelor's Degrees Earned by Women in Selected Fields, 1966–2006



Source: National Science Foundation, Division of Science Resources Statistics, 2008,  
*Science and engineering degrees: 1966–2006* (Detailed Statistical Tables), NSF 08-321, Arlington, VA\*



