Social motivators and inhibitors for women entering software engineering through coding bootcamps vs. computer science bachelor's degrees

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Introduction

- The computer science industry lacks female engineers
- "Coding bootcamps," short, intensive, focused coding schools that provide students with critical skills and career placement are now prevalent
- In 2016, 35% of coding bootcamp graduates were women while 18% of CS undergrads are women
- This study examines the reasons for this disparity

Materials and methods

- Interviews conducted using semi-structured instrument to gather qualitative data
- 50 questions were asked about backgrounds, success and failure, social motivators and inhibitors, self-esteem, industry perceptions, and demographic info
- Interviews were recorded & ranged from 30-90 minutes

Sample questions:

1. *Can anyone become a software engineer or are people "born that way"?*
2. *Do you think you're good at math?*
3. *Where there "know-it-alls" in your computer science classes?*
4. *On a scale of 1-10, how comfortable are you voicing your opinion around men? Around women? Around both?*

Summary Statistics

- Eight female interviewees from east and west coast
- Four CS graduates and four coding bootcamp graduates
- Three coding bootcamp graduates are employed as software engineers
- Four CS graduates are employed
- Ages bootcamp women changed careers were 22, 23, 27 and 31 (mean age 25.75)
- Ages CS women decided on majors were 12, 17, 18, and 19 (mean age 16.5)

Results

- A factor in bootcamp students' hesitancy to study CS in college was low mathematical self-efficacy
- All bootcamp graduates believed the field and major would be math intensive
- No bootcamp graduates and all CS graduates thought they were good at math
- No participants currently believe mathematical skills are required to do their coding job
- All bootcamp graduates and one CS graduate were surprised by what coding entailed when they first started – they thought it would be harder
- The CS graduate who realized coding was easier than perceived switched her major from math to CS
- Three bootcamp graduates were discouraged from coding while one of the CS majors was discouraged
- Another female influenced every bootcamp graduate's and half of CS graduates' decisions to code
- All of the CS students were exposed to coding before college while only one bootcamp graduate was
- All interviewees expressed insecurities inflicted by "know-it-alls" and fear of appearing to have inferior knowledge persists in their professional lives
- All believed coding is a skill anyone can learn
- Three CS graduates and three bootcamp graduates rated their confidence around women higher than their confidence around men
- All mentioned peers as an important factor in their success

"Coding is everything that [women] are. It's art, it's a lot of logic, it's abstract thinking, it's the yin and yang of everything."

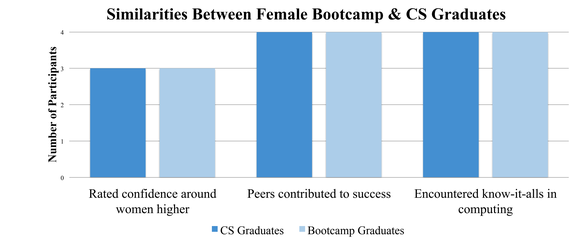
- Coding bootcamp graduate

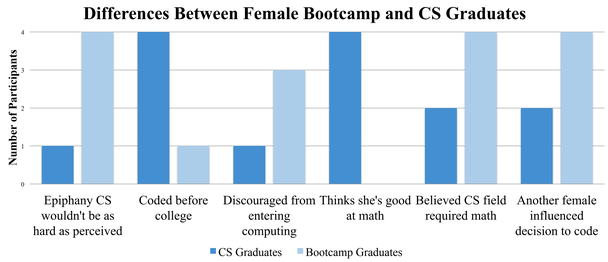
"I made my first 'Hello World!' application and it was almost like I was coming out…It's been a long time coming but I'm here!"

- Coding bootcamp graduate

"I was successful in the class 100% because the class was set up so "smartasses" who took computer science in high school couldn't be better because they solved the problem before."

- Computer science graduate





Conclusions

- Interviewees demonstrated fear of failure manifesting as:
  - low mathematical self-efficacy
  - concern they would not be able to do such challenging work
  - Intimidation and discouragement by arrogant peers
- Additional findings include:
  - The importance of peer support, especially from other females
  - The importance of exposing females to code at an early age
  - Some women may avoid CS because they're less comfortable around men

Literature cited

- Beyer, S., Rynes, K., Perrault, J., Hay, K., & Haller, S. (2003) Gender differences in Computer Science students, Proceedings of the 34th SIGCSE technical symposium on Computer Science education. Pages 49-53
- Dweck, C. Mindsets and math/science achievement (2008). Carnegie Institute for Advanced Study, Commission on Mathematics and Science Education.
- Course Report (2017) Coding Bootcamp Market Size Study, www.coursereport.com/reports/ 2017-coding-bootcamp-market-size-research, accessed October 10, 2017.
- Course Report (2016) Coding Bootcamp Outcomes, www.coursereport.com/reports/2016-coding-bootcamp-job-placement-demographics-report, accessed October 10, 2017.
- Hughes, R. M., Nzekwe, B. & Molyneaux, K.J.(2013), The Single Sex Debate for Girls in Science: a Comparison Between Two Informal Science Programs on Middle School Students' STEM Identity Formation Research in Science Education, 43(5) 1979–2007
- Koch, S.C. Muller, S. M., Sieverding, M. (2008) Women and computers. Effects of stereotype threat on attribution of failure, Computers & Education, 51(4), pp 1795-1803
- Lewis, C. M., Yasuhara, K., Anderson, R.E. (2011) Deciding to major in Computer Science: a grounded theory of students' self-assessment of ability, Proceedings of the seventh international workshop on Computing education research, pp 3-10
- National Center for Women in Technology (NCWIT, 2017), www.ncwit.org/bythenumbers, accessed October 10, 2017
- Osunde, J., Windall, G., Bacon, L. & Mackinnon, L. (2014) , Female Under-Representation in Computing Education and Industry - A Survey of Issues and Interventions, International Journal of Advanced Computer Science and Applications, Vol. 5, No. 10
- Issues and Interventions, International Journal of Advanced Computer Science and Applications, Vol. 5, No. 10

Acknowledgments

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