

Quantifying Children's Perceived Gender Roles and Attitudes Towards Women in Computing Science

Ava Solez, Connie Yuen, Maria Cutumisu

Department of Educational Psychology, University of Alberta, Canada

Abstract

This research aims to address the acute issue of the retention of female students in STEM domains. Specifically, this work proposes a three-year longitudinal study surveying the attitudes and beliefs of junior high-school students towards gender roles in computing science. This study will contribute to the understanding of how role models influence students' attitudes towards computing science.

1. Introduction

There is a well-documented lack of gender parity in computing science enrolment at university and a subsequent dearth of females in the technology sector. Current estimates suggest that only 14.1% of North American computing science bachelor's degree graduates are female [1]. Previous studies have shown that the presence of female role models positively impacts a girl's decision to pursue Science, Technology, Engineering, and Mathematics (STEM) careers [2], but the social atmosphere in a computing science classroom can waylay even that desire [3]. In an effort to encourage female inclusion in what has hitherto been a male-dominated computing science social sphere, researchers need to reassess the direction of interventions designed to encourage female participation in computing science. Specifically, researchers need to begin to look at how the attitudes of males can be more inclusive to females and not solely at how females can be encouraged to overcome their misgivings in the current situation.

2. Literature Review

This study accounts for the need to change social realities in the computing science classroom, while considering the limited resources of public schools, to guide future interventions aimed at normalizing female participation in STEM careers. The proposed study builds on the positive findings of the effectiveness of 1) female role models on the attraction and retention of girls in technical fields [2, 4, 5] and 2) reconciling the perception and self-

identification with the personal attributes of computer scientists [6]. Thus, the objective of the current study is to quantify any changes in both girls' and boys' perceived gender roles and attitudes towards women in computing science.

This study will contribute to the understanding of how role models can change the gender dynamics of a traditionally-male social domain, such as computing science. In addition to providing a better understanding of the use of role models to encourage female participation in computing science, this study will provide insights about how female role models affect male participants' perceptions of computing science. This is of particular importance because recent studies suggest that the social exclusion experienced by female computing science students from their male peers is a leading factor in female attrition from, and avoidance of, the discipline. The lack of highly qualified female role models in computing science at the junior high level may contribute to male students perceiving their female peers as outsiders in the field of computing science, despite documented parity in overall STEM achievement at the secondary school level [7]. Therefore, the research will test the hypotheses that female role models will 1) help girls identify computing science as a viable career choice and 2) change boys' perception of computing science as a male-dominated discipline to a gender-neutral discipline. Thus, this study will make new inferences about how changes to male perceptions of gender and computing science can be achieved and potentially implemented within the school by emphasizing the positive effect that female role models have shown to exhibit on female students. By uncovering methods that foster a gender-inclusive culture in computing science, this study will encourage female students to pursue and continue in the discipline.

3. Methodology

The study will be conducted over three years at a local junior high school in a core-subject classroom in Western Canada. Grover, Rutstein, and Snow have shown that middle school students have misconceptions about computing science and that an

introduction to computational thinking can spark an interest in this career path [8]. Middle school is an ideal time to change student opinions of computing science, as past studies suggest that children self-select an interest in computing science before high school [9]. Additionally, the use of a core subject classroom will allow for a participant pool that is more representative of the general population and consistent year-to-year, as participants' attitudes change with age.

A pre-intervention survey of attitudes and beliefs towards gender roles in computing science will be administered to the participants. This will be followed by an intervention consisting of an instructional session featuring a female computing scientist working and teaching in a confident and effective manner. The manner of instruction is very important for the study, as previous studies including interventions by female leaders have shown that the self-efficacy of teachers is important to the interpretation of message received by participants [10]. Following the intervention, participants will complete a post-intervention survey to measure any changes in their attitudes and beliefs compared to the pre-test. This process will be repeated annually to track changes over time. Any changes due to continued exposure to female role models will be recorded and analyzed to determine the extent to which computing science culture can be affected.

4. Conclusion

This research proposes a three-year longitudinal study of junior high-school students' attitudes and beliefs towards gender roles in computing science. This work will help inform the design of future interventions targeting the retention of female students to ensure gender parity in STEM domains.

5. Acknowledgements

We would like to express our gratitude to the Faculty of Education (*Support for the Advancement of Scholarship Grant # G018000473*) and to the University of Alberta (*Roger S. Smith Undergraduate Research Award*) for their generous support.

6. References

- [1] Zweben, S., & Bizot, B. (2015). 2014 Taulbee Survey. *Computing Research News*, May 2015, 27(5), p. 20. Retrieved from <http://craorg.c.presscdn.com/crn/wp-content/uploads/sites/7/2015/06/2014-Taulbee-Survey.pdf>
- [2] Stout, J. G., Dasgupta, N., Hunsinger, M., & McManus, M. A. (2011). STEMing the tide: Using in-group experts to inoculate women's self-concept in science, technology, engineering, and mathematics (STEM). *Journal of Personality & Social Psychology*, 100(2), 255-270. doi:10.1037/a0021385
- [3] Leaper, C. (2015). Do I belong?: Gender, peer groups, and STEM achievement. *International Journal of Gender, Science & Technology*, 7(2), 166.
- [4] Bagès, C., & Martinot, D. (2011). What is the best model for girls and boys faced with a standardized mathematics evaluation situation: A hardworking role model or a gifted role model? *British Journal of Social Psychology*, 50(3), 536-543. doi:10.1111/j.2044-8309.2010.02017.x
- [5] Shin, J. E. L., Levy, S. R., & London, B. (2016). Effects of role model exposure on STEM and non-STEM student engagement. *Journal of Applied Social Psychology*, 46(7), 410-427. doi:10.1111/jasp.12371
- [6] Semmens, R., Piech, C., & Friend, M. Who are you? we really wanna know... especially if you think you're like a computer scientist. *Proceedings of the Third Conference on GenderIT*, Philadelphia, PA, USA. 40-43. doi:10.1145/2807565.2807711
- [7] Voyer, D., & Voyer, S. D. (2014). Gender differences in scholastic achievement: A meta-analysis. *Psychological Bulletin*, 140(4), 1174-1204. doi:10.1037/a0036620
- [8] Grover, S., Rutstein, D., & Snow, E. What is A computer: What do secondary school students think? *Proceedings of the 47th ACM Technical Symposium on Computing Science Education*, Memphis, Tennessee, USA. 564-569. doi:10.1145/2839509.2844579
- [9] Campbell, G., Denes, R., & Morrison, C. (2000). *Access denied*. Oxford ;New York: Oxford University Press.
- [10] Lang, C., Fisher, J., Craig, A., & Forgasz, H. (2015). Outreach programmes to attract girls into computing: How the best laid plans can sometimes fail. *Computer Science Education*, 25(3), 257.