22 Students' gendered experiences of male-dominated Computing and Engineering courses

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Research Domains

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Abstract

How does it feel to be in a gender minority on a STEM programme? Does it have an impact on individual students? Via an online survey (n=255), undergraduate students on Computing and Engineering programmes were asked whether they felt that gender had an impact on their experience of their course, inviting them to 'tell us a little more'. While most students said that their gender did not have an impact, there was a significant difference between the experience of male and female students, and examples of impact were provided in response to the open question. Tackling gender imbalance in STEM is a focus of evolving government equality policies, including encouraging girls to consider careers in Computing and Engineering and supporting women STEM students. Universities need to explore how to support potentially isolated women students who may feel encouraged by their peers to discount any perception that their experience is gendered.

Full paper

Introduction

Scottish Government policies aim to 'promote equality within STEM and tackle stereotypes and unconscious bias' (2022); for example, through strategies such as Skills Development Scotland's recent 'Women into STEM pipeline project' (ibid.). In UK universities, only 22.78% of 'Computing' students and 20.47% of 'Engineering and Technology' students are women (HESA 2023). Lack of women is a problem for these sectors, which need more skilled employees and also diversity to create appropriate products and systems. Explanatory theories focus on stereotypes dissuading women from pursuing STEM careers (Cheryan, Master, and Meltzoff 2015) and role models to encourage (Gladstone and Cimpian 2021). However, discrimination is also a factor (Rubery 2019).

At an individual level, women are missing opportunities for influential and well-paid work. In Higher Education (HE), women Computing students express feelings of isolation (Taylor-Smith et al. 2022; Winter, Thomas, and Blair 2021). This study focuses on the perceptions of STEM students, of any gender, exploring whether and how they feel gender has had an impact has on their experience of their course.

Online survey

The data comes from an online survey (with ethics board approval) of undergraduates studying computing, engineering, and the built environment. From a larger survey looking at student engagement, three questions underpin this study: students were asked to specify their gender and asked the closed question 'Do you think gender has had an impact has on your experience of your course?' [Yes / No /To some extent]; followed by the open question: 'Please could you tell us a little more?'

Gender impact

Most students who answered the closed question (n=255) chose 'No' (85.5%); 9% felt gender might have an impact 'To some extent'; and 5.5% said 'Yes'. However, the response was itself gendered ($p<.001$), with female students more likely to suggest gender has an impact (27.6% chose 'Yes' or 'To some extent') and male students much less likely to recognise its impact (8.7% chose 'Yes' or 'To some extent').

The open question responses (n=69) were analysed using reflexive thematic analysis (Braun and Clarke 2020), identifying thematically-organised patterns across the whole, heteroglossic dataset (Braun et al. 2020). After exploring and coding the data, themes were developed and refined, then mapped, visually and intuitively. Mapping indicated two poles of opinion (left to right on Figure 1): the theme 'No impact: all genders treated equally on course' contrasted with the two themes 'Gendered interactions and discrimination' and 'Male-domination causes difficulties'. A more neutral theme, 'My course is mostly male', stated or lamented the gender imbalance. Comments below are extracts from the free text responses.

Figure 1: mapping themes

The theme '**No impact: all genders treated equally on course**' stressed the equality of teaching and opportunity. For example '*Doesn't matter what gender you identify with get taught all the same'; 'All genders are being treated equal*'.

An opposite theme '**Gendered interactions and discrimination**' included examples of students experiencing negative gendered interactions, from lecturers or other students. Some interactions were observed: '*Unfortunately, the male attitude towards women in the room was not always the best…I often saw some younger girls being drowned by the voices of men who thought they knew better*'; some were experienced: '*a few interactions with students and staff that I believe would have been different or wouldn't have happened if I was the opposite gender*'.

The related theme '**Male-domination causes difficulties**' described ways in which the gender imbalance could be intimidating and isolating: '*Being female on a computing course is difficult as it is a male dominated course. It is harder to meet other girls and make friends*'; '*There are not many other females in my class, and male dominance is quite intimidating*'.

A more neutral theme '**My course is mostly male**' focused on the gender imbalance among students and lecturers: '*I can't really say as my course is 90% male*'; '*Male dominated subject, only had male lecturers*.'

Conclusions

While most students did not experience the impact of gender on their course, other students, especially women, experienced negative impacts of male dominance, such as isolation, and also incidents of sexism, such as men

talking over or down to women. In this context it is especially important for us to support our minority gender students, lest they, like Winter et al.'s (2021) students, blame themselves for any (gendered) negative experiences. We are working with our students to create a network and events to combat isolation and further their aspirations. We are also planning focus groups to identify ways to create a welcoming and inclusive department at all levels.

References

Braun, V. and Clarke, V. (2020). One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology*, 18 (3): 328-352. https://doi.org/10.1080/14780887.2020.1769238

Braun, V., Clarke, V., Boulton, E., Davey, L., and McEvoy, C. (2020).The online survey as a qualitative research tool, *International Journal of Social Research Methodology*, 24 (6): 641-654. https://doi.org/10.1080/13645579.2020.1805550

Cheryan, S., Master, A., and Meltzoff, A.N. (2015). Cultural stereotypes as gatekeepers: increasing girls' interest in computer science and engineering by diversifying stereotypes. *Frontiers in Psychology*, 6. https://doi.org/10.3389/fpsyg.2015.00049

Gladstone, J.R., and Cimpian, A. (2021). Which role models are effective for which students? A systematic review and four recommendations for maximizing the effectiveness of role models in STEM. *International Journal of STEM Education*, 8 (59). https://doi.org/10.1186/s40594-021-00315-x

HESA (2023). *Percentage of HE student enrolments in science subjects by personal characteristics, academic year 2021/22*. https://www.hesa.ac.uk/data-and-analysis/students/what-study#characteristics

Rubery, J. (2019). A Gender Lens on the future of work. *Journal of International Affairs*, 72 (1): 91-106. https://jia.sipa.columbia.edu/gender-lens-future-work

Scottish Government. (2022). *STEM education and training strategy - refresh: annual report*. Learning Directorate, Scottish Government. https://www.gov.scot/publications/stem-education-training-strategy-refresh/pages/4/

Taylor-Smith, E., Barnett, C., Smith, S., Barr, M., and Shankland, C. (2022). Participant-centred planning Framework for effective gender balance activities in tech. *Proceedings of the United Kingdom and Ireland Computing Education Research (UKICER) Conference (UKICER 2022)*, September 1st-2nd, 2022, Dublin, Ireland. https://doi.org/10.1145/3555009.355501

Winter, E., Thomas, L., and Blair, L. (2021). 'It's a Bit Weird, but it's OK'? How Female Computer Science Students Navigate Being a Minority. *Proceedings of 26th ACM Conference on Innovation and Technology in Computer Science Education (ITiCSE 2021)*, ACM, New York. https://doi.org/10.1145/3430665.3456329