Do we belong? An innovation workshop for fostering a sense of belonging in Computer Science education

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1 INTRODUCTION AND BACKGROUND

Only 18% of Computer Science (CS) undergraduate students in 2018 were women [5]; academia and apprenticeships are also seeing fewer and fewer women choosing to pursue CS [13, 15]. This failure to engage women in CS education and training is recognised at a career-level too, with women comprising only 16% of UK IT professionals [14]. Because of this, efforts have been made to encourage women in the field [3], including initiatives that celebrate women in CS (e.g. AnitaB.org[1]) and inclusive CS education principles such as EngageCSEdu [4]. UK universities have also set gender equality commitments through the Athena Swan Charter,[2] aiming to create inclusive environments for all students and staff.

However, women are still under-represented in the sector [14], and prior work has shown that a main reason for this is that women do not feel a sense of belonging in CS [2, 7, 8, 10]. Through this workshop, we aim to build upon a focus group structure designed to uncover reasons for not belonging, and ideate around strategies to overcome this, to create a collaborative online space at UKICER 2021 where experts and professionals can reflect on their own experiences of belonging and their knowledge of CS education. By doing this, we aim to co-design solutions with the community that will help foster *all* students' belonging, regardless of their gender identity or membership of any underrepresented group. We also aim to gain participants' valuable feedback and insights for future iterations of the innovative focus groups that can be utilised and applied for other underrepresented groups and in other institutions, departments or settings.

2 WORKSHOP DETAILS

In order to draw upon the expertise of professionals and experts at UKICER, as well as their lived experiences in CS, workshop participants will act as both participants and researchers. The workshop is open to all, but we particularly encourage women and those in other underrepresented groups to attend.

For the participant role, our aim is to structure the workshop in a way that their knowledge can be used to propose solutions to encourage a greater sense of belonging in CS education. The main focus of the workshop is belonging, and therefore participants will first be asked about experiences where they felt they did and did not belong. Only then will the participants be asked to tailor their thoughts and experiences of belonging to proposing solutions for belonging in CS. Not only will this develop solutions that benefit students and educators, but it is our hope and experience from running prior workshops that participants will leave feeling a sense of belonging in CS *themselves*, after having shared experiences with others in the community who can empathise.

In their researcher role, participants will reflect on the innovative workshop through their research and professional lenses. From this, we will ask them to draw on their expertise to provide feedback on the method, and how it can be adapted for other underrepresented groups or for other institutions, departments and settings. Through sharing the structure of the focus group and reflecting on it with the community, we hope participants will take away ideas and thoughts that they can apply to their own research or teaching practices—enabling mechanisms for participants to encourage women, girls and underrepresented groups to pursue and enjoy CS education.

2.1 Workshop Schedule

The majority of the workshop will be in the form of an the innovative focus group. This uses innovation and ideation methods, building upon co-creation approaches in Human-Computer Interaction [e.g. 9], an adaptation of Adobe's KickBox practice [1, 6] and Silverstein et al.'s concept trees and imaginary brainstorming [11]. However, instead of the output being a digital product, it will be the participants' understanding of a sense of belonging and their experiences of this; these will be used to create a collective understanding of what belonging is and produce solutions for fostering it in CS education. The focus group structure is as follows, adapted from the method in our UKICER 2021 paper under review. Following introductions, participants will be asked to individually place into the chat what a sense of belonging means to them. After sharing these, the focus group will then focus on exploring and reflecting upon experiences where they have felt they have, or have not, belonged. This experiences will then be categorised and used as prompts for the ideation of solutions to improve the sense of belonging. Participants will then be asked to apply the solutions to CS education.

From this, we will have co-designed solutions for fostering belonging in CS—informed and inspired by participants' understanding of belonging. However, we also aim to gather the participants' feedback and insights on the focus group method itself—helping develop future iterations of the method to deploy for other underrepresented groups or at other institutions, departments and settings. We will therefore finish the workshop with a 10–15 min evaluation session covering: feedback on the focus group; the method used in comparison to others (e.g. quantitative surveys); as well as how the structure could be adapted for use by the participants, e.g. for their own institutions, departments or settings.

2.2 Practical Requirements

The aim is to run the workshop in three groups of five people, allowing for in-depth discussions. We will have a maximum of three

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break out rooms, each with six spaces (five participants and one facilitator). All facilitators will take notes during the workshop on the discussions, solutions and evaluative feedback. The workshop will be run using Microsoft Teams or Zoom (depending on the platform of the conference) with breakout rooms being used for the small groups, and using Miro to visualise discussion with virtual sticky notes.

2.3 Call for Participation

This workshop will unpack what it means to belong, how a sense of belonging can be created, and how this can be used to encourage active and enthusiastic participation in CS education. Anyone is welcome to attend, but the workshop is driven by the motivation to improve a sense of belonging for women, girls and underrepresented groups in CS education; thus the workshop may be most interesting to researchers and practitioners exploring issues of equality, diversity and inclusion in the discipline.

If you would like to attend, please email Alice Ashcroft (alice.ashcroft@lancaster.ac.uk), with the words "Sense of Belonging Workshop" in the subject line, and include 1–2 short paragraphs on your area of research and why you would like to participate. We will also pitch the workshop at the conference, and, subject to available places, invite further participation.

3 POST-WORKSHOP PLANS

The proposed output for this workshop includes a publicly available sketchnote [12] of the findings, which will be created during the session to provide an artistic representation of the discussion. Another sketchnote will be made based on the evaluation session feedback. These will be shared after the workshop to the wider community, via an email to participants, and online on *[redacted institution's]* research repository; all discussion shown in the sketchnote will be anonymised. Futhermore, a wider aim of the workshop is to create an opportunity for people to establish networks and collaborate. Thus, we will create a CS sense of belonging mailing list for participants to share experiences, research, and actionable changes for equality, diversity and inclusion in CS.

REFERENCES

[1] Alice Ashcroft. 2020. Gender Differences in Innovation Design. *OzCHI '20, December 02–04, 2020, Sydney, NSW, Australia* (2020).

[2] Lynne Blair, Kelly Widdicks, Alice Ashcroft, Emily Winter, Miriam Sturdee, Kathy New, and Lisa Thomas. 2021. *Women's Sense of Belongingin Computer ScienceEducation.* Project Report for Advance HE. Lancaster University. **https://www.researchbox.org.uk/advancehereport**

[3] Wendy M. DuBow, Beth A. Quinn, Gloria Childress Townsend, Rosario Robinson, and Valerie Barr. 2016. Efforts to Make Computer Science More Inclusive of Women. *ACM Inroads* 7, 4 (Nov. 2016), 74–80. **https://doi.org/10.1145/2998500**

[4] EngageCSEdu, The National Center for Women & Information Technology (NCWIT). 2021. EngageCSEdu Engagement Practices. **https://www.engage-csedu.org/engagement/grow-inclusive-student-community**, accessed January 2021.

[5] HESA. 2020. *What do HE students study? Personal characteristics, 2018–19 data.* **https://www.hesa.ac.uk/data-and-analysis/students/what-study/characteristics**, accessed January 2021.

[6] Kickbox Foundation. 2021. Adobe Kickbox. **https://www.kickbox.org/adobe-kickbox-material**, accessed April 2021.

[7] Colleen Lewis, Paul Bruno, Jonathan Raygoza, and Julia Wang. 2019. Alignment of Goals and Perceptions of Computing Predicts Students' Sense of Belonging in Computing. In *Proceedings of the 2019 ACM Conference on International Computing Education Research* (Toronto ON, Canada) *(ICER '19)*. Association for Computing Machinery, New York, NY, USA, 11–19. **https://doi.org/10.1145/3291279.3339426**

[8] Catherine Mooney and Brett A. Becker. 2020. Sense of Belonging: The Intersectionality of Self-Identified Minority Status and Gender in Undergraduate Computer Science Students. In *United Kingdom & Ireland Computing Education Research Conference.* (Glasgow, United Kingdom) *(UKICER '20)*. Association for Computing Machinery, New York, NY, USA, 24–30. **https://doi.org/10.1145/3416465.3416476**

[9] Elizabeth B-N Sanders and Pieter Jan Stappers. 2008. Co-creation and the new landscapes of design. *Co-design* 4, 1 (2008), 5–18.

[10] Linda J. Sax, Jennifer M. Blaney, Kathleen J. Lehman, Sarah L. Rodriguez, Kari L. George, and Christina Zavala. 2018. Sense of Belonging in Computing: The Role of Introductory Courses for Women and Underrepresented Minority Students. *Social Sciences* 7, 8 (2018). **https://doi.org/10.3390/socsci7080122**

[11] David Silverstein, Philip Samuel, and Neil Decarlo. 2013. *The Innovator's Toolkit* (2nd ed.). Hoboken, N.J.: Wiley. **https://doi.org/10.1002/9781118258316**

[12] Miriam Sturdee, Makayla Lewis, and Nicolai Marquardt. 2018. SketchBlog #1: The Rise and Rise of the Sketchnote. *Interactions* 25, 6 (Oct. 2018), 6–8. **https://doi.org/10.1145/3281661**

[13] Anna Vitores and Adriana Gil-Juárez. 2016. The trouble with 'women in computing': a critical examination of the deployment of research on the gender gap in Computer Science. *Journal of Gender Studies* 25, 6 (2016), 666–680. **https://doi.org/10.1080/09589236.2015.1087309** arXiv:https://doi.org/10.1080/09589236.2015.1087309

[14] WISE. 2019. 2018 Workforce Statistics - Welcome to the WISE Campaign. **https://www.wisecampaign.org.uk/statistics/2018-workforce-statistics/**, accessed January 2021.

[15] WISE. 2019. Women in STEM Apprenticeships 2017/18 - Welcome to the WISE Campaign. **https://www.wisecampaign.org.uk/statistics/women-in-stem-apprenticeships-2017-18/**, accessed January 2021.