K-5 pupils' responses to culturally responsive computing lessons

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ABSTRACT

We describe a pilot study to investigate the effect of engaging with culturally responsive computing lessons on primary (K-5) students' interest in computing. We use the Integrated Interest Development for Computing Education Framework (IIDfCEF) as a framework for collecting and analysing the data, and interpreting the results. We conducted three focus groups in primary schools in London and the South of England. Our participants (n=12) felt more represented in their computing lessons and in particular felt their interests were recognised. The findings are an initial validation of the IIDfCEF assertion that introducing culturally relevant pedagogy into computing lessons can trigger students' interest in computing through the key factor of relevance.

CCS CONCEPTS

• **Social and professional topics → K-12 education**; **Race and ethnicity**.

KEYWORDS

K-12 education, culturally responsive computing, student interest

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1 INTRODUCTION AND MOTIVATION

In the last decade, efforts have been made across the world to make computing education more inclusive. However, many groups are still underrepresented in the IT industry. For example, a 2022 report on gender diversity among IT specialists in the UK revealed that only 22% are female [2]. Research suggests that employing culturally relevant and responsive strategies in the computing classroom can broaden student participation and address systemic inequity in education [5]. There is little published data on the responses of K-5 pupils to participating in culturally relevant activities. This small-scale, qualitative study contributes by piloting the use of the Integrated Interest Development for Computing Education Framework (IIDfCEF) as a lens to explore how K-5 pupils respond to culturally responsive computing lessons.

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2 BACKGROUND AND LITERATURE

Culturally relevant pedagogy and culturally responsive teaching are theories that seek to incorporate the cultural backgrounds and experiences of pupils into the curriculum [5]. Prior work has applied these theories to computing and recognised the importance of supporting students to engage with technology creatively and meaningfully, considering their cultural interests and intersectional identities [5]. A number of studies have explored student outcomes from participating in culturally responsive computing lessons, including increased achievement, sense of belonging and interest in computing [5]. However, this research has largely been conducted in the USA with students aged 11 - 18 and less is known about outcomes for K-5 students in other countries, including England.

The Integrated Interest Development for Computing Education Framework (IIDfCEF) is a toolkit for use by researchers and resource developers in computing education [6]. The framework is organised around three dimensions of interest: value, knowledge, and belonging, and the framework presents key factors that link each dimension to strategies that can be employed in computing education contexts to help develop student interest. For example, in the knowledge dimension, it is proposed that the key factor of **relevance** can be achieved by designing learning activities that are culturally relevant for students. In the belonging dimension, it is argued that environments that expand **who does computing** and **what computing is** can trigger students' interest in computing.

We address the evidence gap in student outcomes and use the IIDfCEF for the first time in this context with the following research question: **What is the effect on engaging with culturally responsive computing resources on K-5 pupils in England?**

3 METHOD

Three focus groups were conducted with twelve students aged 8 - 10 years old after they had taken part in a unit of computing lessons about image editing or vector graphics which had been adapted to be culturally relevant [3]. The students attended three different primary schools in London and the South of England. We purposively sampled students for the groups by asking a teacher at each school to select participants based on gender balance, cultural diversity and full lesson participation. Parents consented for their child to participate, and at the start of the focus group, each student assented to take part and had the right to withdraw at any time.

The protocol for conducting the focus groups was developed following guidance outlined in [1] and each group was led by two researchers, including the first and third authors. The questions were structured according to the dimensions outlined in the IIDfCEF [6]. Each focus group was recorded, transcribed, anonymised and imported into Nvivo 12. The second author, an experienced teacher, teacher trainer and education researcher, analysed the transcripts deductively against the dimensions and key factors of

interest in the IIDfCEF [6]. Due to the second author's expertise in education research, and the simple form of coding against an existing framework, inter-rater reliability was not performed [4].

4 FINDINGS

Data from the focus group transcriptions showed that students described three key factors from the IIDfCEF after taking part in culturally responsive computing lessons: what computing is, who does computing, and relevance of computing.

When asked about **what computing is**, the participants most frequently (n=18) referenced manipulation of graphics and fewer (n=11) made references to programming and algorithms. For example, one student explained that *"we've been learning the skill about vector graphics and how to order and layer"* (Student 301-3).

Participants responded to questions about **who does computing** by mentioning the importance of someone who kept trying, who didn't give up, or who was resilient (n=9). For example, one student said: *"I've learnt that you need to be a bit patient, and sometimes you need to set out a plan before you just do something"* (Student 102-2). Additionally, some participants referred to the fact that computing was for everyone (n=4), with one student saying: *"anyone can be good at computing if they have the passion to do it"* (Student 301-4). There were two references to suggest that computer scientists need to be clever or intelligent to do computing (n=2).

Multiple references (n=8) suggested that students felt the lessons enabled them to incorporate **relevant** ideas that related to their own lives. One student explained this was enjoyable *"...because we know much more about ourselves than we would about other things"* (Student 401-2). The results also indicate that students felt their interests (n=6) and cultural background (n=3) could be represented in the work they completed. For example, one student said: *"it was nice to do something that actually represented you in many different ways like your culture and your background"* (Student 301-2).

5 DISCUSSION

Students often relate learning computing with stereotypical ideas of programming or engineering. However, in this study, participating students recognised the importance of creating images and graphics, likely because this was the most recent topic the learners engaged with. Demonstrating that computing is a broad discipline allows students to feel that their interests can align with computing [6].

Learners associated being good at computing with effort rather than ability, moving beyond the 'geeky' computing stereotype [6]. However, whether this shift was due to engaging with the culturally adapted resources is unclear and warrants further research.

Engaging with an adapted unit led learners to feel that their interests were recognised as well as, to a lesser extent, their cultural backgrounds. This suggests that K-5 learners may identify their practical interests as the most important part of their background, and want to share this in class[3]. When students see that computing is relevant to their lives, they may maintain their interest in pursuing computing as a subject for further study [5, 6].

Analysis of responses against the IIDfCEF [6] showed that culturally adapted lessons increased students' interest in computing through the framework's belonging dimension, making them aware of who engages in computing and what it entails. Students also found computing relevant, which links to the knowledge dimension. However, the value dimension was less discussed, suggesting the activities didn't feel as personally useful or meaningful to students. This may be due to the focus on a single topic, and further research is needed to see if these findings hold across other areas of the computing curriculum.

5.1 Limitations

Schools in this study were geographically located in London and the South of England which limits the generalisability of these findings. Additionally, students knew they were participating in a research study, which may have introduced elements of social desirability such as participant or peer conformity in their answers[1].

6 CONCLUSIONS

The findings suggest that engaging with culturally responsive resources help K-5 learners feel a sense of belonging and representation in computing lessons. The adapted unit led them to feel that their interests were recognised as well as, to a lesser extent, their cultural background. Our findings validate the assertion in the IIDfCEF framework that introducing culturally relevant pedagogy into computing lessons triggers students' interest in computing, because they make connections between the content and their own lives. We found it useful to structure focus group questions around the three dimensions of the IIDfCEF. The results of this pilot show promise to build on with a larger sample of K-5 students to explore broader implications and scalability of culturally responsive pedagogy in elementary computing education.

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