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# An Early Exploration of Gender Imbalance in Computing

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**Abstract.** This paper draws on initial findings from research carried out as part of the second phase of a Doctor of Education programme of study. The aims of the study respond to a reported gender imbalance in the subject of computing in England. Whilst girls are reported to outperform boys in the subject, Computer Science at GCSE attracts only 21% of girls. The preliminary findings allow the researcher to consider the results from an early study of images of secondary school computing classrooms provided by trainee teachers. Early findings give an account of the trainees conflict with their ‘habitus’ in their placement classrooms, and the gender preferences of the trainees in their choice of space. The ongoing study aims are to provide recommendations for revising curriculum material and classroom design for initial teacher educators in England.

**Keywords:** Habitus, Gender, Trainee Teacher, Photo-elicitation, Images, Computer classroom.

## 1 Computing in English Schools

Reflecting a need in industry to provide for a growing demand of skills for the future, the subject of Computing in English schools has undergone significant change, since Computer Science (CS) replaced Information Communication Technology (ICT) in the curriculum in 2014 [1]. This echoes a pattern found in the subjects of science, technology, engineering and mathematics (STEM), the WISE Campaign (2019) found that just 21% of pupils taking the General Certificate of Secondary Education (GCSE) in CS were girls [2]. Reported reasons for this, range from girls not being interested in the subject, schools not offering it, and perceptions that it was not relevant for future plans, and/or too difficult [3]. Furthermore, subtle aspects of classroom environments, such as the gender ratio of students or posters associated with masculine CS stereotypes, reportedly impacts upon academic engagement of females [4]. As a Senior Lecturer in Computing Education, my role involves observations of lessons in computing classrooms in the North West of England. This paper considers the impact of the curriculum change focussing on classroom design. An aim of the study is to explore images of classroom design through the lens of trainee teachers. The research asks the question of what I can learn in my role as a teacher educator on the gender imbalance in the subject, from an early exploration of computing classroom images.

## 2 Background

The research considers how changes introduced in a University programme impact upon trainee teachers when they are in the computing classroom. The course is a one-year course training postgraduate students in secondary school computing education. A key aim of the course is to prepare trainee teachers for the computing classroom in two alternative school placements. As part of the course, I visit the trainees to observe a lesson, and give feedback on their pedagogical practice and progress towards teaching standards [1]. The structures of ‘habitus’ that exist are unconscious, but form the basis of perception and appreciation of all subsequent experiences. It is important to have a clear understanding of what might be meant by ‘habitus’. It is formed as part of our early familial relationships and external factors, for example, morality, tastes, cares [5] thus ultimately influencing our preferences and practice. Using sociologist theory in a study of a computing classroom may not be seen as relevant to some. As with many scientific studies, quantitative data gathering through a positivist lens would be my initial preference. However, this small-scale study considers the use of a visual approach to the data collection as appropriate at this early stage of the research. Through the use of photo-elicitation, a deliberate attempt to move away from my preference of a more positivistic approach to data gathering offered me a methodological approach that allowed an exploration of the study ‘beyond the role of traditional interviewees and research subjects’ [6]. In an aim to counter the complexities that exist within the field, and calls for innovative approaches [3], it was apparent for the need for credible alternative ways of thinking. Photo-elicitation afforded an opportunity to gather data through this less traditional method in the field, and to understand the social field of the trainee teacher, rather than my own viewpoints. A further reason for this method was to allow trainee teachers to discuss the image they provided without influence from the researcher.

## 3 Study Methods

As a University lecturer, I had access to fertile ground in which my data could be gathered, in this early exploration of computing classrooms. All of the trainee teachers were from the 2018-19 Secondary Computing Education course. A representative demographic mix was considered as part of the selection; ages ranged from mid-twenties to mid-fifties, and an equal number of females and males. The trainee teachers were asked to provide an image of their preferred classroom design in my motivation to understand and explore the unconscious dispositions of the trainee teachers. This was the only request that was made of them.

The data gathering was undertaken in two stages. The trainees were sent an email asking them to provide one image of their ideal computer classroom. Out of the 28 trainees, 5 responded to the question providing an image as requested, 2 of the respondents were females and 3 were males. In an aim to limit power relations as a lecturer on their course, the second stage of the data collection was to be a recorded interview. The second stage of the data collection was a group interview. The trainee

teachers were asked to discuss the image they had provided. The trainees had not seen each other's images. There was no input from the interviewer; the discussion was recorded and then transcribed.

To ensure the study was following ethical procedures, the participants were reminded they could withdraw from the study at any time, including the images they had supplied. Consent and anonymity were obtained, in line with University ethical considerations. Even with 'signed consents do not imply that researchers have the right to use images in unlimited ways' [6], specifically when taking pictures in schools. Particular care was taken that no pupils were present when pictures were taken. This is a limitation of the study, and in further work ethical clearance would be required to obtain data 'in its entirety' [6]. The images collected through an email allowed the trainee teachers to express their view of a classroom through imagery and not words. The trainee teachers provided images in the form of 4 photographs and 1 graphical representation. All images had computers in the room; 3 of the images had a central space for group work (Fig. 1). A copy of all the images can be found online [7]. Through my analysis of the images and support from the transcripts, the discourse has been drawn out. In this paper, the early themes that I have identified from the images are critically reflected upon, through the lens of Bourdieu's theory of habitus, in an aim to better understand how the trainees' 'habitus', or set of dispositions and values, influenced their choice of image of a computing classroom. A full copy of the transcription can be found online [8].

#### **4 Discourse: group work in computing**

The tensions in the discourse are highlighted by the trainee teacher's identifying that whilst group work takes place in computing lessons how the space is used presents differences.

'...you've got a table area if you want to do group work and a table area to do demonstrations and stuff like that...' (Trainee A)

'...that they are all scattered across the room and grouped in four and the first thing I looked at is if I wanted to group work you've already got groups there already so if you plan in advance you can set the tables in such a way that the groups you want them to work in ...' (Trainee C)

'I like walking about and I am always roaming around quite easily and with the tables if I choose to do group work I can just stick the tables in the middle and take up the space and all I do is just move the chairs and tables and then I can do group work...' (Trainee E)

Trainee C talks of computers in the room in banks of four which are 'all scattered across the room', but important for Trainees A, B and C are spaces without computers to enable group work to take place. Here a preference for computers in the room is evident; the image provided showed computers grouped in four, rather than a space in the centre of the room.

Although Trainees C and D were more accepting of computers in the classroom, Trainee D stated '...I hadn't thought about having tables in the classroom... A big

round one in the middle or something like that...’ Whilst the accepted practice of Trainee D was in contrast to the other trainees, through reflecting on Bourdieu’s earlier statement, what was natural to some of the trainees was not to another [5]. Through the discussion on images, the trainee was able to see, as Nolan states ‘a transformed pedagogy would demand more deliberate action on the part of agents to disrupt the balance’ [9]. A critical question for educators is how trainee teachers can be encouraged to challenge and disrupt practice in the field. Computer Science Unplugged is recognised as a widely used collection of activities and ideas to engage a variety of audiences with useful ideas from computer science, without having to learn programming or even use a digital device [10]. To what extent the unplugged pedagogical method is used in trainee teacher’s computing classroom is an area for further exploration in the field of computer science education.



**Fig 1.** An example of an image from the study

The limitations in the data analysis for this study would allow for further discourse in the field of computing classrooms. What is notable is that the two female teachers have both provided an image with a central space for undertaking group activities away from the computer. Only one of the male trainee teachers provided an image with a space for group work, rather than desks in the middle. This is a point for further exploration in a future study.

## 5 Conclusion

The early findings in this paper are very much like the early stages of the research into the practices in the field of CS. The trainee teachers who took part in the study are now in their first year of teaching the subject. As part of the further data collection, trainee teachers will be taking part in a series of workshops at the University, which will be prior to their placements in the classroom. This will then enable them to consider the classroom design as part of the university sessions, and lessons will be planned using alternative approaches to teaching the subject. In using Bourdieu’s field

theory, the conflicting and developing discourse on computing education has brought insights into the challenges that trainee teachers face in their classrooms. The design of the classroom can be further considered for engagement of gender in the classroom. It is clear that the accepted practices, which typify the field of computing, are not fixed, as evidenced through the trainee teachers' responses. What the study has shown is that the trainee teachers are considering alternative uses within the fixed space of the computing classroom; the 'CS unplugged' pedagogy is a preference in their pedagogical practice. These images, and interviews, could be used to initiate discourse before they enter their practice to encourage a more reflexive stance in the field. The discussion around the images proved valuable; the images provided a stimulus for the trainee teachers to explore their use of the classroom. For future studies, the analysis of data proved to be richer with the use of both methods. The discourse may not have been given such a central theme with the use of images alone. A further point of reflection, and one for further study, is to consider the viewpoints of pupils in the lesson to their preferred teaching spaces.

## 6 Acknowledgements

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