

Take a break from your devices: Skills development for computing students

Introduction

The School of Computing has established a working group aimed at improving the first-year experience in the core Bootcamp and Studio courses (cohort sizes of up to 600 students taught in parallel workshop streams of up to 150 students). In this context, our aim is to design, implement and evaluate interactive group-based in-class activities that develop students' computational thinking and problem-solving skills. The project is inspired by the CS Unplugged approach (Bell et al., 2009), which demonstrates that abstract computing concepts can be taught effectively through hands-on, kinaesthetic tasks using everyday materials.

The large cohorts give us the opportunity to have multiple staff in the classroom: teaching lead (academic), tutors (casual staff), and student mentors (senior student from our discipline area). We regard our tutors and student mentors as important members of our teaching teams. We want to draw on their expertise in co-designing the 'unplugged' activities and strengthening our social capital within the team and affecting trust, relatedness and belonging (Bye et al., 2016).

Methods

Our 'unplugged' project group consists of four academics and ten tutors and student mentors who were selected based on expressions of interest and are being paid for their involvement from an RMIT STEM College grant.

We employ a design-based research methodology for the development of the unplugged activities. This methodology is valued for its strengths in bridging the gap between theory and practice (Tinoca et al., 2022). To support key learning outcomes across our courses, we chose the following unplugged activities which are at different stages of maturity:

- 'Muddy city' computational thinking activity: Introduced S2 2025, revised, applied S1 2026, improvements identified and scheduled for S2 2026.
- Fundamentals of web systems activity: Introduced S1 2026, improvements identified and scheduled for S2 2026.
- Key concepts of LLMs (Large Language Models) activity: Developed during S2 2026, roll-out in S2 2026.
- Key concepts of relational databases activity: Scheduled for development and roll-out in S2 2026.

The full project group held three workshops in S1 2026. In Workshop 1 the group was split into web systems and LLM subgroups. Numerous feedback and improvement suggestions were gathered for both activities. In Workshop 2, after team-internal test runs, the tutors and student mentors delivered the activities to eight invited guests from the RMIT community (professional and academic staff from various subject areas and professional teams). Further ideas for improvements were collected. Workshop 3 focused on testing of the LLM activity, reflections and planning for the next semester.

We collected feedback on the web systems activity from students (population of around 400 students across six cohorts) and teaching team members (academics, tutors and student mentors, population of about 35 individuals) via a survey conducted as course improvement activity.

Results

Working with our external guests in Workshop 2 was informative. We discovered the importance of careful consideration of the practical props. For the LLM activity this means careful selection of the training texts that need to be short and repetitive yet not too simple. For the web system activity, we learned that our material was too fine-grained, requiring some participants to be heavily involved while others lost interest waiting for their turns. For both activities we assumed too much prior knowledge. While everyone has heard about ChatGPT and knows how to use websites, we must scaffold very carefully to balance exploration with guidance. We learned to better anticipate the classroom situation where our student groups need to be able to work largely self-guided. While the workshop highlighted substantial areas for improvement, we were buoyed by the positivity of our invited guests, assuring us about their learning and appreciation for in-person classroom activities.

We received 31 responses from students and 9 responses from members of the teaching team (academics, tutors, and student mentors) for our survey related to the web system activity. Our first question asked how comfortable students felt in participating in the activity. We asked this as the activity was quite different from what we normally do in the classroom and required students to group up with new classmates. While most students were comfortable or at least neutral participating, some students were not. The reasons for feeling uncomfortable did not emerge from the freeform feedback. While most members of the teaching team saw the activity as manageable, feedback pointed towards the need for better training. This is understandable, as just as it is different for students, the activity requires different facilitation skills compared to our standard workshop interactions. In particular, the teaching team commented on the challenges of getting students up from their chairs to participate.

About 2/3^{rds} of respondents had limited knowledge before starting the activity. This is in line with expectations for our courses that do not require prior knowledge. Having a considerable number of students who already knew quite a bit is also characteristic of first year classes and reflects the diversity of incoming knowledge.

Overall, 2/3^{rds} of students reported that their knowledge increased through participation in the activity. Interestingly, this proportion is the same across all levels of prior knowledge, contrary to our expectations that the activity would be mostly beneficial to those students with lower incoming knowledge. The freeform comments provide some insights. Students reported being unclear on what to do or the activity being too complex. This might have prevented some students from engaging fully and gaining benefits and points to improvements we need to make regarding structure and facilitation.

Being asked to identify the most useful aspects for their learning in freeform comments, students reported on gaining knowledge about web systems, about getting away from their devices, and about the value of connecting and learning with others. Yet, several students suggested running this activity in an online collaboration tool like Miro or using smaller pieces of paper that fit more easily on a table (and cause less paper waste).

The members of the teaching team saw high value in the activity for helping students to understand web systems and regarded the activity as worthwhile. Their suggestions for improvements included splitting the activity into parts run across multiple sessions instead of trying to cover all at once. This links well with data from the students, especially the insights on some students with limited prior knowledge struggling to make sense of the more complex aspects.

Discussions

In the past semester we focused mostly on the web system activity (we have not yet used the LLM activity in the classroom). We noted multiple opportunities throughout the course to build on the material used in the activity for scaffolding learning. The feedback collected in our survey indicates the activity achieved its goals and that students increased their understanding of web systems.

The activity design revolved around physical material. This is intentional and based on findings such as by Przybylek and Kowalski (2018) who show that collaborative games in a non-digital form assist in connecting with others and lower barriers to participation in discussions. Student comments such as wanting to work online instead of with paper and teaching team comments describing the challenges getting students up and away from their desks indicate that more work needs to be done to normalise in-person activities in the classroom. We have started to investigate the literature on the development of social capital based on personal interactions in class settings and the related impact on academic and professional identity formation (see, for example,

Jensen & Jetten, 2015). This suggests the value of in-person activities, and we are working towards scaffolding activities throughout the semester to assist with socialisation.

We enjoy working with our tutors and student mentors. The atmosphere in our workshops was relaxed, with everyone collaborating and enjoying the challenges. In this first iteration, most tasks were directed by academic staff. We selected the topic areas for the activities and prepared the first iterations. Looking forward, we want to give our tutors and student mentors more autonomy. We also need to keep a close eye on our project budget. For both reasons we will reduce the larger workshops that everyone attends and create smaller working groups led and organised by tutors and student mentors. We are guided by the ideas of Students-as-Partners as described in Matthews et al. (2018) as students and staff working together towards transformative learning in trusting and respectful collaboration. While our tutors are not students, we see parallels in aspects such as the power imbalance and aim to learn from the Students-as-Partners principles in working towards co-creation of our unplugged learning activities

Contributions

1. A practice-based, design-based research account of creating and iteratively refining unplugged, group-based activities for large first-year computing cohorts, extending CS Unplugged ideas to university scale.
2. A model for involving tutors and student mentors as co-designers, highlighting learnings in scaffolding the collaborations with academics.
3. Empirical insights into student and staff experiences of unplugged activities, including comfort, facilitation challenges, and the role of prior knowledge.

References

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