
Build Bridges or Burn Them? The Unsolved Challenge of Student Skill Gaps in Ongoing HCI Education

Alexandra Thompson

IDEA Lab, Griffith University
Nathan, QLD, Australia
a.thompson@griffith.edu.au

Leigh Ellen Potter

IDEA Lab, Griffith University
Nathan, QLD, Australia
l.potter@griffith.edu.au

Abstract

This paper presents the key challenges identified by a group of educators participating in a design session to improve the delivery of an advanced HCI course, Interaction Design (ID) within an Australian tertiary education program. Despite showing some promise or interest in HCI studies, students coming through this course seemed to lack the knowledge and skills needed to form a foundation for more advanced concepts. While discussion in the design session highlighted a

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number of concerns, this paper focuses on two main challenges: minimal-to-no retention of foundational knowledge from previous courses, and a missing desire to engage with course content.

Author Keywords

HCI Education; Education Challenges; Knowledge Gaps.

CSS Concepts

- Human-centered computing~Human computer interaction (HCI)~HCI theory, concepts and models
- Social and professional topics~Professional topics~Computing education~Computing education programs

Introduction

Human-Computer Interaction is an integral concept in the field of Information Technology, but many students seem to struggle to engage with the concept or recognise its importance in information technology development [3]. This leads to issues within the classroom as students fail to take the material seriously, or discount its relevance. Many IT students tend to focus on technical skills rather than the “easy” or “common sense” skills taught in HCI [3].

IT professionals need an adaptive skill set in order to build a successful career [17], and IT students should consider their tertiary studies as the first step in developing this skill set. Technical skills are often more valued than interpersonal and design skills [7], however it is these skills that are often described as more important for an IT professional [15], and a mix of technical and professional skills is seen as imperative [5].

If the development of a diverse and adaptive skill set is required by IT students in order to develop into successful IT professionals, then exposure to and mastery of a combination of skills and content areas is required. However, the experience of many academics is that IT student engagement with and retention of HCI topics is low [3]. Even students that choose to pursue more advanced HCI topics during their undergraduate studies have difficulty recalling or drawing on past HCI experiences when engaging with more advanced concepts, and it impacts on their knowledge retention and success in these more advanced courses.

In this paper, we will explore the issues surrounding the student experience as discussed during a participatory design workshop reviewing an advanced HCI course. We will identify the key challenges for HCI educators discussed within this workshop as they relate to student skill development and retention, while exploring the issue of responsibility: where does the responsibility for skills retention lie?

Background

Prior Knowledge, Gaps, and Catered Learning

It has been shown that in other STEM fields, the level of foundational knowledge a student takes into a course directly impacts on their knowledge retention through the course, which then translates to their success within the course as a whole [10]. In courses where prior knowledge has been “assumed” rather than required or assessed, perceptions of what is actually expected by “assumed knowledge” varied across both educators and students. This variance has shown to have detrimental impacts on both student success and educator capability [9,13], which might be avoided with more rigorous description of the concepts required as “assumed knowledge”. This knowledge gap has primarily been investigated in the context of the secondary to tertiary transition [9,10,13,18], but more recently similar challenges have been seen between foundational and advanced courses on the same subject [12]. While there is no research that specifically explores this phenomenon within the context of HCI courses, it is reasonable to expect similar outcomes to other STEM subjects.

However, there is a potential for this gap in foundational knowledge to persist beyond any integrated bridging attempts. The Knowledge Gap Hypothesis (KGH) suggests that the introduction of new knowledge to a group of less- and more-educated people can potentially increase rather than decrease the gap between the two groups [4,16]. Heron and Sligo [8] found that some of the components of KGH applied to tertiary Information Systems education, as the knowledge gap widened, but differed in that the accuracy of knowledge required was consistent across less- and more-educated groups. That being said, some

research suggests that implementing mechanisms to support specific learning styles can improve overall student performance [14].

HCI Education

HCI is a concept core to a number of degree programs within the Australian tertiary education system, whether it be in the form of a major, individual course, or even a consistent theme or motivation that guides a larger program [2]. As such a result, HCI educational experiences attract a diverse range of students with different needs and interests [12]. This presents a number of challenges for course design, such as determining which concepts are included and/or excluded, how the content is delivered to maximise engagement [11], and how topics are assessed fairly without leaning too heavily on any particular discipline's skillset.

Design Session

Session Context

As part of a larger research project, a participatory design session was run to identify opportunities for an emerging technology intervention for an undergraduate course in the tertiary education context. The course selected for the session was the Interaction Design (ID) course, an advanced final year subject within an Information Technology school at an Australian University. The course is available to students from the Information Technology and Intelligent Digital Technology degrees, and as an elective to students from other disciplines. It has a prerequisite of the first year Human Computer Interaction course and completion of 120 credit points of course work, the equivalent of three full-time semesters work.

The ID course was a new unit in 2019 and was scheduled in such a way that students could enrol in it either 12 or 24 months after they completed the foundational HCI course prerequisite, with no similar design or HCI topics covered within that time. The course ran with a small cohort for this initial offering: thirty students across two campuses. The teaching style was based on a flipped classroom (where students are provided with resources online, there is no class lecture, and material is approached using active learning strategies including exercises in an in-class setting) [1] : students accessed theoretical material through an online course site, and met in an on-campus tutor-guided workshop for two hours each week to discuss the material and complete practical activities applying the theory to project based situations.

Session Focus

This design session was focused on identifying opportunities within the ID course for additional tools to support students' learning and engagement. After the first offering of ID, the convening academics had identified a need to review components of the course based on student feedback and their own observations, and a noted lack of retained concept understanding from the foundational HCI course. Their goal was to develop a course that will showcase its own content, delivering ID concepts in an innovative and engaging manner supported by online material and tools.

Session Participants and Structure

The two convening academics were joined by a team of four learning and teaching consultants from the Sciences Group of the University, as well as a student consultant who had taken the foundational HCI course

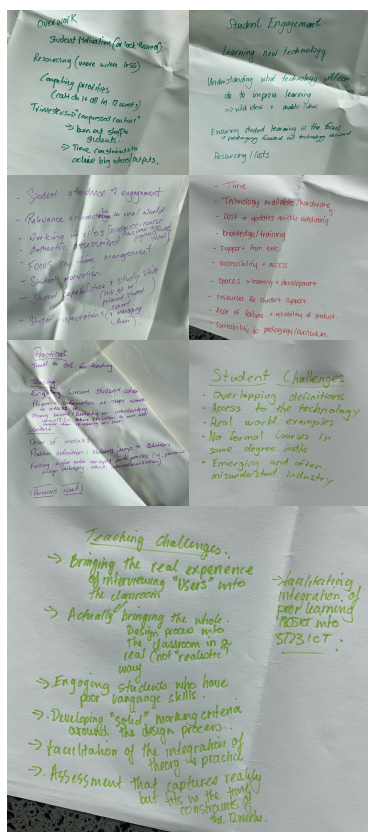


Figure 1: Outcomes of individual brainstorming about challenges faced with the Interaction Design course

but not the ID course. The session was structured with a pre-session questionnaire completed as participants arrived, followed by an icebreaker activity once everyone was present. An overview of the ID course was given, followed by an individual brainstorm where participants noted their own ideas and observations that then fed into a group discussion around the current problems faced in the ID course. The key themes of this discussion were isolated and then prioritized through a sticker vote. Participants were asked to consider possible technological solutions to the higher priority problems individually in a 6-8-5 or Crazy 8's activity (brainstorming 6-8 ideas in 5 minutes on one sheet of paper) [6], before breaking into two small groups to each describe and prototype a solution.

This paper is focused on the challenges that were identified from session and will present the outcomes of the initial discussions as unsolved challenges. This paper will not present the design activities themselves, or work resultant from the prototyping component of the session.

Outcomes

The group spent time initially discussing the structure of both the course and the overarching program, and how that influenced the student experience (or lack thereof) of the content. During this discussion, the group identified the skill of problem-solving as a particular challenge, asking how it would be possible to improve the students' problem-solving abilities. Participants described situations where students struggled to resolve issues or to explore beyond the surface of a problem. One participant described a course that had been part of an earlier iteration of the degree that specifically targeted problem solving,

however this course had been removed. Issues relating to program design pressures and the practicalities involved in sourcing sufficient staff for teaching, covering the required content in courses, and delivering on program outcomes were described; particularly focussing on the way these issues made it difficult to include every desired topic.

Participants then completed an individual brainstorm and presented their ideas and observations. This process generated active discussion highlighting a number of challenges experienced during the delivery of the course, including student attendance and engagement, and structural difficulties around module outlines, order, and assessment.

Course attendance was generally good, with 53% of the cohort attending at least 80% of classes. A quarter of the students attended between 50 and 80% of classes, and the minority attended less than half the classes. Given that several of the in-class activities were assessed, class attendance was vital and the convenors were concerned about the students who opted not to attend. Student engagement with the course material was described as mixed, again with a small number of students appearing very engaged with both content and exercises, and a larger number appearing to be "just going through the motions". A secondary engagement issue was identified as related to language, with specific issues identified for a group of students with English as a second language.

As individuals shared their notes, seen in Figure 1, the rest of the group discussed how those challenges were similar to or differed from their own experience. The learning and teaching consultants tended to provide

more general feedback focused on the student experience and overarching program structure, where the course convenors reflected specifically on the challenges of the ID course.

With help from the facilitator, the group then identified the key themes of their challenges: content delivery and preferences, student engagement and motivation, issues with time and time pressures (for both students and academics), students characteristics themselves, and the student approach to course concepts. Participants then suggested key questions or problems that came out of the conversation and related them to these key themes. This process was documented by the facilitator for the group to see, as in **Figure 2**.

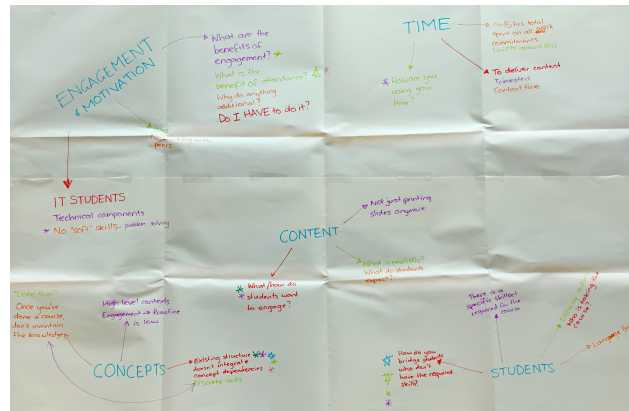


Figure 2: Summary of the emergent themes of the challenge brainstorm

Once the key challenges were mapped out, participants were asked to indicate the components they considered to be the two most important concerns facing the ID

course by marking their selected components with a star.

The final outcome is a set of themes, components and challenges representing educator captured concerns: provided in Table 1.

Theme	Components	Specific challenges	Votes
Engagement and Motivation	Student Attitude	What are the benefits of engagement?	1
		What is the benefit of attendance?	2
		Why do anything additional?	-
		Do I HAVE to do it?	-
	Fragmentation	Staff working in silos	-
		Students don't want to work with peers	-
IT Student Characteristics	Focus on technical components	-	
	No soft skills such as problem solving	1	
Concepts	Program Structure	"Already done that" attitude	-
		Once a student completes a course, they don't retain the knowledge	-
		Existing structure doesn't integrate concept dependencies	5
		Each unit is treated as discrete	-
	Context	Contexts are kept at a high level	-
		Engagement to practice conversion is low	-
Students	Skills	There is a specific skillset required for the course	-
		How do you bridge students who don't have the required skills?	4
	Diversity	Who (which students) are taking the course?	-
		Students have differing skillsets	-
		Language barriers	-

Time	Student Work-Life Balance	~15 hours a week spent on other work commitments	-
		Uni is expected to fit around work	-
	Pressures	Trimester system	-
		Contact time	-
		To deliver content	-
Optimisation	How are you using your time?	1	
Content	Change in Engagement	What/how do students want to engage with content?	2
		Not just printing slides anymore	-
	Delivery of content	What is realistic?	-
		What do students expect?	-

Table 1: Interaction Design Course Challenges

The Unsolved Challenges

Table 1 illustrates a majority of the group voted on two key concerns: the integration of dependencies between concepts within the existing program structure, and how it would be possible to provide bridging for students who don't have the required skillset assumed to have been mastered in previous courses to complete the course. Through both the mapping of the concepts and group discussion, it was highlighted that both these challenges relate back to a larger concern of student knowledge retention. Several participants related observed student behaviour indicating that course knowledge was 'disposed of' once a course was completed: "they finish a course, and just go "I don't need that anymore" and throw it out." One participant reported a student commenting "I didn't need to remember that did I?" when asked about content from a previous course. Some discussion emerged regarding potential causes for this behaviour, with a participant suggesting it was "potentially to make room for future course knowledge" and another suggesting that some

students look at their progress as a 'getting through' process, and not as a learning journey.

Participants highlighted that the program structure enabled this attitude, as a majority of courses aren't directly dependent on each other through enforced prerequisites and carefully structured course development around increasingly complex core concepts. This sets a behavioural expectation for students that is a disadvantage in cases such as ID where the course has been designed around a set prerequisite and content design that adds complexity to assumed existing knowledge. The course structure relies heavily on existing knowledge and skills that were established in the HCI course prerequisite.

Participants discussed whether an individual convenor was obligated to incorporate some sort of foundational knowledge module into the structure of an advanced course such as ID, and what such a module should look like; or if students were responsible for maintaining their own prior knowledge of the topic and should seek out their own catch-up activities as necessary. Teaching staff described the time pressures already in place within a teaching period as they endeavour to cover the required course content, and the difficulty of losing more teaching time to "retracing their steps" from prerequisite courses. In the case of ID, the convenors stated that they did include a high level revision of the HCI concepts as module material within their first week's teaching, including specific recommended reading for targeted concepts, however it was apparent from student work during the course that this material had either not been revised or had not been retained.

While the HCI and ID courses have the same course convenors who were therefore able to design concept progression through the two courses, it was also discussed that this approach is not enforced within the School as a whole and is out of the control of any individual course convenor in the program more generally. Course convenors “are left to their own devices” in relation to course design and linkage between courses.

A less prominent but persistent concern the group identified was engagement with both the content and class activities. Participants noted a recent change in the attitude of students: preferring on-demand content in smaller doses through different mediums; minimizing in-person contact hours wherever possible; and placing higher emphasis on the direct and perceived benefit of the learning experience. It was suggested by many participants that current social media outlets and social communication patterns encouraged by these outlets may also be influencing the preferences of students, particularly the younger members of the cohort. The group questioned whether it was the university’s responsibility to update course approaches to appeal to these learners, or if part of the tertiary education experience was adapting individual learning techniques to suit the style of content delivery provided by the university.

Conclusions and Key Questions

This paper has presented the key challenges identified by a group of educators during a course-review focussed participatory design session. Challenges were identified, both specific to the HCI field and more generally related to STEM education, within the context of Australian tertiary education. They fell within the

themes of engagement and motivation, time, content, concepts, and students. The key questions that came out of the session were:

1. How do educators encourage student knowledge building and retention in an increasingly ‘disposable’ environment?
2. Are educators responsible for building bridging components into their course structures, and if so, what should these components look like?
3. To what extent are educators responsible for diversifying content delivery in response to emerging trends from more social outlets?

These questions represent a larger challenge around the balance between traditional tertiary education approaches and the dynamism of current and future student cohorts that is of particular relevance to HCI educators. As HCI concepts are integral to a number of diverse specialisations, it is important to determine whether we should invest time in building bridges to support students who fall behind, or burning bridges and leaving responsibility for learning in the students’ hands.

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