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HCI expertise needed! Personalisation and feedback optimisation in online education

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Two key challenges in education relate to how traditional educational providers can personalise online provisions to the students' skill level, optimise the use of tools and increase both the generation and utilisation of feedback (in terms of timing, content, and subsequent use by students). The application of traditional programmes in the online setting is often complicated by the legacy of traditional universities infrastructures, knowledge bases (or lack thereof in the human-computer-interaction/HCI realm), and pedagogical priorities. It is here that HCI experts (designers and researchers) can have real-world impact in line with macro-HCI, while also being able to test new innovations in collaboration with educators (e.g., the practitioners in such education settings). In this note, we make a case that the HCI community is in a situation where it can make a significant contribution to traditional providers in two prospective areas: personalisation, feedback generation and increased feedback utilisation.

Online education. Design of online learning. Customisation. Personalisation. Automated feedback.

1. INTRODUCTION

As the number of online learners rises from one year to the next (with 35 million online learners in 2015 as reported by Sunar, White, Abdullah, and Davis, 2016), attrition and dropout are a major concern among virtual universities and/or MOOC providers (e.g., Kim et al., 2017; Kizilcec and Halawa, 2015). This problem also continues to plague more traditional education providers that now offer their programmes online as well (as an extension of traditional classroom education). Such traditional online education programmes are usually based on classroom modules and programmes, which are then moved online (rather than starting off first as programmes offered virtually). This often shifts the focus to extending the existing forms of pedagogy and responding to the needs of educators.

At the same time, such online programmes may not utilise novel or innovative HCI tools, nor do such programmes typically benefit from HCI expertise and work in the area of usability and user-centred design. A good case in point is the reliance on communication media such as email and chat to interact, particularly when geographic distance means different time zones. Many educators invest a significant amount of work and time to support their students online (often facilitated by purchased online platforms). Research on self-regulation, instructional design, online environments and e-learning has proliferated. However, most of the work in this area has been and continues to be published in education-oriented outlets, rather than HCI-specific domains. This has diminished the knowledge exchange and practitioner-oriented input of HCI in online education.

As a result, online programmes led by educators may not be aware of and thus not employ flexible, multi-purpose and novel HCI tools and features to personalise student support and support feedback mechanisms (e.g., system-generated feedback to students based on educators' accounts or previous student input). Yet, as many HCI researchers know, a number of such options already exist and have been implemented by researchers in the field (e.g., McKay and Izard, 2016; Ovaska, 2013).

In this paper, we focus on two areas where HCI could have an impact. These two areas shape student and educator interactions with the content and each other in an online space:

(1) Personalisation and tailoring environments to support student learning (based on profiles and skills); and the

(2) Generation and utilisation of automated feedback options to support learning.

These two points are each considered in the next two sections.

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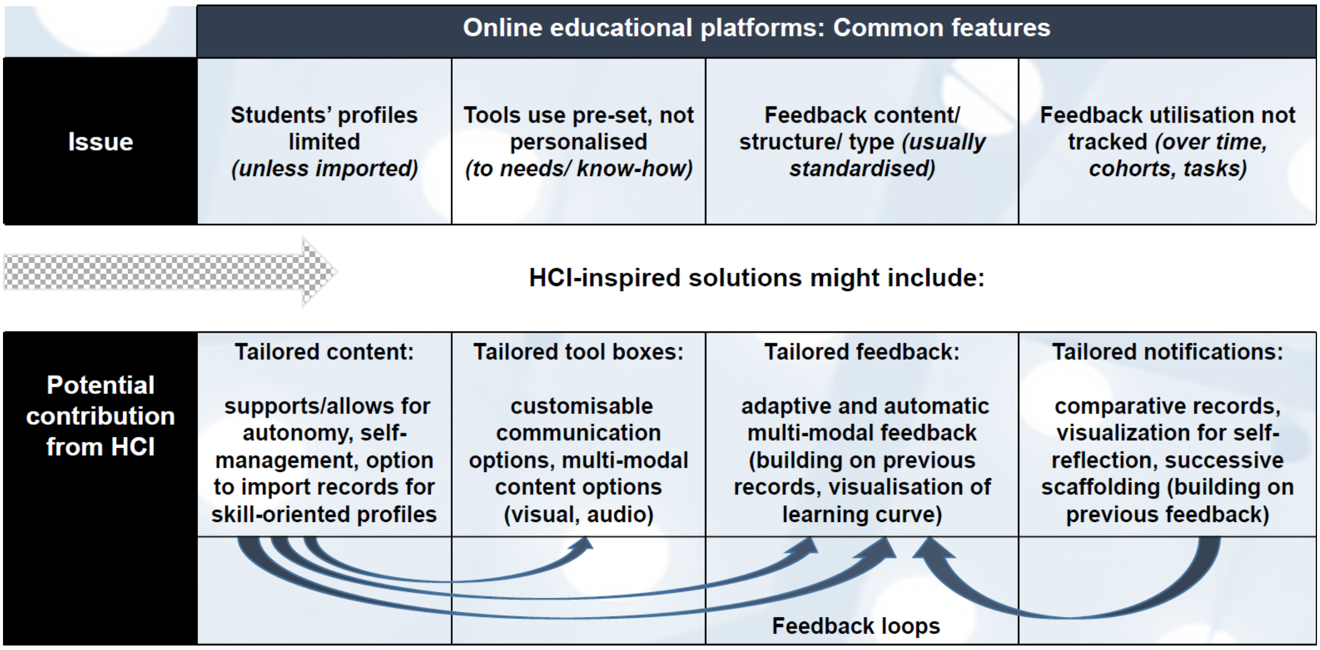

Figure 1. Diagram of issues and potential HCI-generated benefits in the case of platforms used to support online education

Figure 1 provides an overview of the issues we discuss, and links these to the potential benefits that HCI expertise may bring to online education programmes that are heavily reliant on platforms and emerging traditional face-to-face.

1.1 Student profiles: Skills and tool use

The first aspect concerns the use of various HCI options to create personalised learning paths (e.g., Mullen et al., 2017). This can be achieved by customising or tailoring the online content and experience of materials to the type of student enrolled on the programme. This could include customisation to personal characteristics (e.g., gender and goal striving, see Kizilcec and Halawa, 2015) or prior information and learning experience (Pardo, Han, and Ellis, 2016), when these are known to facilitate programme performance. Such an approach would be able to build on existing projects (such as the "Domain of one's own") that provide students with autonomy to manage their own environment.

For example, an assessment of which tools are used by users may enable profiling of student traces and dispositions (see also Tempelaar, Rienties, and Nguyen, 2017). In addition, a personality profile of online users (e.g., to get a sense of their reported time keeping skills – which may be verified using actual time records; their analytical, social and verbal skills) could enable the educator to compile a profile of the student body. This may then also give them a means to determine how and when, in what form, communication such as feedback is compiled, shared, and elaborated on.

Such assessment may also benefit from a consideration of the needs for support and preferences for chat, virtual assistants, avatars, peer support/interactions (see Ngoon et al. 2016; Kotturi et al., 2015; Kulkarni et al., 2016), visualised or graphical versus written feedback (the last option already exist, Lewkow et al., 2016). Such preliminary evaluation of tool use is not currently standard for online platforms and represents an excellent opportunity for HCI experts to contribute their knowledge.

1.2 Feedback: From generation to utilisation

The second issue pertains to the tools that exist to support automated feedback generation and utilisation. Let's tackle the topic of *feedback* generation first. At the moment, more tools could be utilised to support potentially adaptive feedback generation, both for students and educators (e.g., Kosba, Dimitrova, and Boyle, 2007).

Some work may generate starting points. Czaplewski (2009) introduced computer-assisted grading rubrics to help automate comment generation as part of student feedback. He argued that such approaches can increase the amount of feedback, and hence student satisfaction and improvement. D'Antoni et al. (2015) presented an approach to automate feedback as part of an intelligent tutoring system that provides students with alternative conceptual hints when students are making mistakes. Exploratory work by Orlando (2016) also introduced text, voice, and screen casting feedback. Yoon et al. (2016) trialled a collaborative multi-modal annotation system for instructor feedback as well as peer discussion, which presents more feedback options than most standard online platforms; options that could be implemented, trialled and monitored by HCI experts.

The second topic is *feedback utilisation*. Using prompts and student-specific log files, the system can prompt both students and educators to identify insufficient (delayed or no) engagement with materials ahead of deadlines – providing metrics on what is expected from the student (which requires exchange and dialogue, see work by Foong et al., 2017). Platforms such as Blackboard can generate time records on which materials are used. But these tools are usually available to instructors, but these notification/record keeping tools are not usually combined with feedback notification mechanisms to generate student-specific (or instructor-specific) instruction.

If students are not accessing the feedback between assignments, notifications could independently remind them to utilise this information more strategically. This means we essentially scaffold their learning (see also Demetriadis et al., 2008), requiring no human input. Visualisation tools added to automated (see Lewkow et al., 2016) and individualised feedback (e.g., Schaffer et al., 2017) could also enable students to reflect and assess their progress (see also Govaerts et al., 2010), compared to other users in the system (their cohort). This could be achieved by employing employ social group comparison and norms (e.g., comparing performance to other groups completing modules one level below or one level above). Visual tools (e.g., emoticons, colour, visual imagery and similar, see Dixson et al., 2016) may support self-reflection, and also engagement with, feedback on activities (see also Govaerts et al., 2010). HCI experts may be able to implement notifications (e.g., D'Antoni et al., 2015) and actual real-time detection methods to track attempts at manipulation (e.g., in online tests; see also Alexandron et al., 2017). Sharing such information with online students may increase their utilisation of feedback and foster actual learning, while reducing attempts to game the online system.

2. CONCLUSIONS

Our two examples demonstrate how HCI experts can make a substantial contribution to improve the quality of online programmes offered by more traditional education providers. Such activities carry three benefits. First, such work presents an excellent testing ground for the application and trial of newer HCI concepts. Second, it could open up new funding opportunities from various sources outside HCI (e.g., quality assurance). And third, it creates a role for HCI researchers in other domains (e.g., as members of instructional design groups, student IT support, and instructors in charge of online programmes).

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