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Human-centred learning analytics: Four challenges in realising the potential

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The notion of Human-Centred Learning Analytics (HCLA) is gaining traction as educators and learning analytics (LA) researchers recognise the need to align analytics and artificial intelligence (AI) technologies with specific educational contexts. This has led an increasing number of researchers to adopt approaches, such as co-design and participatory design, to include educators and students as active participants in the LA design process. However, some experts contend that HCLA must go beyond stakeholder participation by also focusing on the safety, reliability, and trustworthiness of the analytics, and balancing human control and algorithmic automation. While the adoption of human-centred design (HCD) approaches promises considerable benefits, implementing these practices in data-intensive educational systems may not be straightforward. This paper emphasises the critical need to address specific ethical, technical, and methodological challenges tied to educational and data contexts, in order to effectively apply HCD in the creation of LA systems. We delve into four key challenges in this context: i) ensuring representative participation; ii) considering expertise and lived experiences in LA design; iii) balancing stakeholder input with technological innovation; and iv) navigating power dynamics and decision-making processes.

Keywords: artificial intelligence, design, human-centredness, human-computer interaction

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Introduction

Educational settings are complex and multifaceted, and each presents unique, contextual challenges that require individualised attention (Goodyear & Dimitriadis, 2013). The interplay between subject matter, student characteristics, and instructional design can have a significant impact on the effectiveness of educational technology interventions (McLaren et al., 2022). Due to this, several learning analytics (LA) researchers have acknowledged that '*one-size-fits-all'* LA systems are often ineffective (Gašević et al., 2016; Jivet, 2021; Teasley, 2017) and, therefore, that the characteristics of a particular educational context ultimately shape the impact of data-intensive educational technologies (Ferguson et al., 2014; Knight et al., 2020; Shibani et al., 2019). A solid design stance, which not only considers aspects of instructional design and design for learning but also integrates principles from the wider field of *Design*, is imperative. This can enable a deep understanding of the larger sociotechnical systems in which LA tools are purposed to function and can also aid in effectively addressing the unique contextual challenges prevalent in educational environments. In this paper I refer to these sociotechnical systems as *LA systems*.

Indeed, Gašević et al. (2017) emphasise the importance of prioritising key *design* principles alongside *educational theory* and *data science* to achieve optimal outcomes from

LA systems. Some authors within the LA community (e.g., Dollinger et al., 2019; Knight et al., 2020; Prieto-Alvarez et al., 2018; Wise et al., 2021) and beyond (e.g., see review by Victorelli et al., 2020), have demonstrated the potential of enhancing the effectiveness of communicating data insights in specific social contexts by actively involving stakeholders at various, if not all, stages of the design process, including definition, ideation, prototyping and testing. In particular, *human-centred design* principles are increasingly recognised as essential for developing artificial intelligence (AI) and analytics innovations that prioritise the needs of users and the context where they are used (Shneiderman, 2022).

The interest in human-centredness and placing students and the learning activity at the centre of attention in learning analytics has been growing (Lang & Davis, 2023). The theme of the 2018 Learning Analytics and Knowledge conference (LAK '18), *Towards User-Centred Design,* marked a significant milestone in the formalisation of the LA community's interest in human factors and stakeholder participation, with subsequent workshops (e.g., Dimitriadis et al., 2022; Jivet et al., 2022) and special issues (e.g., Buckingham Shum et al., 2019) focused on human-centred design and cultural values in LA systems. Yet, despite observable progress, there has been scant discussion of the specific challenges encountered when incorporating design methods from other domains into the creation of data-intensive educational tools.

This paper considers the critical need to address specific ethical, technical, and methodological challenges tied to data-intensive educational contexts, in order to realise the potential benefits of applying human-centred design approaches in the development of LA systems. This paper focuses on four key challenges in such contexts: i) ensuring representative participation; ii) considering expertise and *lived experiences* in LA design; iii) balancing stakeholder input with technological innovation; and iv) navigating power dynamics and decision-making processes. This paper intends to serve as a catalyst to enhancing design practices within the field of LA, thereby fostering the creation of effective and user-friendly LA tools that seamlessly integrate into existing sociotechnical educational systems.

What is human-centred learning analytics?

Human-centred learning analytics draws inspiration from human-centred design (HCD) principles. Giacomin (2014) described HCD as an incremental design process that employs various tools to foster communication, interaction, empathy, and stakeholders' participation to gain a deeper understanding of the needs, desires, and experiences of the intended end-users. HCD *not only* focuses on the physical interactions with the technology but also on more abstract aspects like meaning-making, semiotics, and discourse. Unlike other design practices that prioritise the designer's creative process or the innovative aspects enabled by new technologies, HCD prioritises end-users and the people that may be indirectly impacted by the technology (Gall et al., 2021). However, the term "centred" may misleadingly suggest that HCD exclusively focuses on people's needs and requirements rather than the technology (Thomas et al., 2017). Instead, HCD encapsulates how human factors, social elements, and technological aspects intersect and interact within the scope of human activity in a specific context (Winograd & Woods, 1997). This makes HCD relevant for designing the technical, social, and data-related aspects of LA and addressing potential social harms tied to the full range of analytics use, from rule-based and descriptive to AI and machine learning-driven predictive and prescriptive forms (Davenport, 2018). In education, these potential harms could include escalating discrimination, intensifying surveillance, and adding complexity to daily tasks (Buckingham Shum & Luckin, 2020; Selwyn, 2019, 2022).

Buckingham Shum et al. (2019) and Luckin et al. (2006) were pioneers in envisioning the

integration of human-computer interaction (HCI) and HCD methodologies to LA and AI in education, respectively. These authors emphasised the importance of collaborating with educational stakeholders (e.g., learners, teachers, parents, learning designers, and decision makers) to inform interface design and address key issues implicated in the use of data in education, such as the impact on working practices, shifts in learners' and teachers' agency and control, and ways in which values are built into the data models. In turn, there has been an increasing trend (Lang & Davis, 2023) among LA researchers to incorporate approaches like co-design (e.g., Holstein et al., 2019; Martinez-Maldonado et al., 2019; Prieto-Alvarez et al., 2018; Sarmiento et al., 2020) and participatory design (e.g., Liaqat et al., 2018; Ochoa & Wise, 2021; Sarmiento & Wise, 2022) to include educators and students as active participants in the LA design process.

However, some authors argue that the notion of HCLA should go beyond mere stakeholder participation and also prioritise the safety, reliability, and trustworthiness of LA systems (Alfredo et al., 2023). These factors have been identified as critical in emerging Human-Centered AI (HCAI) research (Shneiderman, 2022; Wang et al., 2021), with data-intensive systems that work alongside humans, rather than replacing them. Nevertheless, integrating these characteristics into design processes may exceed the expertise of educational stakeholders. For instance, Shneiderman (2022) advocates for technical practices (such as recording audit trails, conducting bias testing, and creating explainable interfaces) and business management strategies (such as conducting external audits) to ensure that AI and analytics systems are reliable and trustworthy. Envisioning the implementation of these strategies within an educational setting often surpasses the expertise of both students and teachers.

Putting it all together, a balanced working definition of Human-Centred Learning Analytics can be: *a subfield of LA focused on developing trustworthy, reliable systems that augment and support the capabilities of education stakeholders, aligning with their intentions, preferences, interests, and values.*

Challenges and potential strategies

Based on recent research in the field and the author's first-hand experiences in conducting human-centred design and LA research (e.g., Alfredo et al., 2023; Conijn et al., 2022; Dimitriadis et al., 2021; Martinez-Maldonado et al., 2015; Prestigiacomo et al., 2020; Prieto-Alvarez et al., 2020), this section presents some of the challenges and potential opportunities associated with HCLA.

Representative participation

The challenge: The educational stakeholders participating in a HCLA project may be self-selected individuals, such as high-achieving students or innovative teachers. This could result in a skewed representation of participants in the LA design process.

Potential strategies: Fostering robust relationships with underrepresented educational stakeholders, offering compensation for their time, using inclusive design kits and prioritising the design needs of these underrepresented groups can help improve diversity and inclusivity.

An essential objective of educational technology design is to develop systems that can be used efficiently by teachers or students, as they have limited time to teach or learn (Hémard & Cushion, 2001; Mandinach & Abrams, 2022). Because both teachers and students work within time constraints, participating in educational technology design may only attract those

who are highly motivated to contribute (Jahnke et al., 2022). Students who, for whatever reason, are time-poor may be under-represented in the HCLA process, which can be considered an ethical issue (Sanders & Stappers, 2008). Moreover, students are a *transient* group in two ways: first, as students progress through their courses, they are unlikely to become the end-users of the LA tool they co-designed. Second, several LA tools are designed to work as 'fading' instructional scaffolds that are gradually removed as the student develops their self-regulation strategies. As a result, each student will likely view the LA tool differently according to their particular needs at a specific point in time. These issues can pose a threat to representative participation since the participants in the design process may not consider all the potential contexts where the LA tools will ultimately be used.

The HCD and HCI literature offers strategies to maximise participation. Designing solutions for underrepresented users can lead to breakthroughs that benefit everyone (Nielsen, 2013). It is critical for LA researchers to consider inclusion in the design process as a design problem in itself. This may involve creating strategies for building strong relationships with underrepresented educational stakeholders, compensating them for their participation in design activities (McKercher, 2020); and making use of inclusive design toolkits (e.g., the Cambridge Inclusive Design Kit[1]) Brown and Grinter (2016) proposed the notion of *designing for transient use* that can help LA researchers and participants in the design process to view a particular LA system as a transitory means to a more permanent educational end, to be used only for a set period of time.

Understanding expertise and lived experiences in LA design

The challenge: LA researchers and designers may underestimate the extent to which educational stakeholders can contribute to the design process.

Potential strategies: Embracing *lived experience* as a valid and significant form of *expertise*, fostering collaboration during design sessions, and encouraging a diverse range of stakeholders to share their unique insights, can help overcome this challenge.

It is fair to say that students generally lack pedagogical knowledge and may not know what is best for their learning (Kirschner & van Merriënboer, 2013). Also, both teachers and students may find it hard to see all the possibilities that data offers due to limited data literacy (Mandinach & Abrams, 2022; Mandinach & Gummer, 2013; Wasson et al., 2016). For these reasons, some researchers and designers may not be inclined to let educational stakeholders make decisions in the design process, believing that they lack expertise about what constitutes learning (in the case of students) or what is possible with the data (in the case of teachers and other educational stakeholders).

Yet, designers do not always truly understand the needs of teachers and students. HCD acknowledges *lived experience* as a credible form of expertise. Lived experience refers to a person's experiences, decisions, and knowledge gained from these experiences (Jones, 2013). In fact, a key tenet of co-design is that each stakeholder contributes their own expertise, thus increasing the possibility of designing something that addresses authentic needs (McKercher, 2020). Although students may not be experts in learning theory, they *are* experts in what it means to be a contemporary learner. In this way, student experience could inform the design of student representations to be used by others (Pozdniakov et al., 2022) or multi-stakeholder sessions could be organised to conceive or re-design LA tools that align better with the learning design and are technically feasible and ethical (Prieto et al., 2018; Schmitz et al., 2022; Vezzoli et al., 2020).

[1] http://www.inclusivedesigntoolkit.com/tools_guidelines/

Balancing stakeholder input with technological innovation

The challenge: Where educational stakeholders lack expertise in data and analytics they may be unable to envision the full range of possibilities, thus hindering innovation.

Potential strategies: Collaborating with data and human-data interaction experts and using generative tools can foster creativity among educational stakeholders, encouraging the generation of innovative ideas without the burden of technical constraints.

User eXperience (UX) designers and co-design researchers have shown that interacting with end-users and stakeholders can lead to highly beneficial innovation (Sanders & Stappers, 2008). While it may be tempting to argue that involving teachers and students in design sessions for analytics and AI tools is not productive due to their limited data and AI literacies (Mandinach & Abrams, 2022), an HCD perspective emphasises the importance of considering all human factors in addition to technological innovation. This is especially critical given that highly innovative analytics solutions can have unintended impacts on general well-being and decision-making (Ozmen Garibay et al., 2023).

To create highly innovative LA systems, collaboration among experts in AI, HCI, and education is crucial. Collaboration can balance the focus on user needs with the focus on innovation. This is a common practice both in HCD (Flood et al., 2021) and HCAI (Shneiderman, 2022). Furthermore, several generative tools within HCD (Sanders, 2000) can be used to provoke ideation and help participants sketch creative solutions, even if they may initially sound unfeasible.

Power dynamics for decision making

The challenge: Power dynamics among researchers, designers, users, and other stakeholders can significantly influence decision-making in the design process, with those in positions of power making most, if not all, decisions.

Potential strategies: Implementing co-design practices where decisions are made collectively could help mitigate this. These practices may include mapping power influences, compensating co-designers for their time and contribution, building design capacity among stakeholders, and fostering a culture of democratic decision-making.

Human-centred design approaches that emphasise involving people beyond designers and researchers in the design process, such as co-design and participatory design (Steen, 2011), are increasingly being considered in LA (Sarmiento & Wise, 2022). These approaches go beyond initial consultation with users or usability testing by facilitating involvement, participation, and co-production (Stark et al., 2021). Co-design leans more towards empowering the users to design solutions for themselves (McKercher, 2020; Sanders & Stappers, 2008), while Participatory Design stresses the involvement of all relevant stakeholders (Könings et al., 2014). This brings the challenge of determining who makes the ultimate decisions and how the relationships of power among researchers, designers, users and other stakeholders are negotiated.

Addressing power dynamics in the design process of LA systems is crucial as analytics can easily threaten teachers' and students' agency (Prinsloo & Slade, 2016). Therefore, measures should be implemented to equalise power imbalances in the design process. Co-design methods that promote critical reflective practice and inclusion can be adapted to our educational contexts to facilitate more equitable relational processes (Farr, 2018). These methods involve bringing people with lived experiences onto project teams as equal contributors by, for example, visually mapping power influences, compensating co-

designers, building design capability among stakeholders, and making decision-making a democratic process (McKercher, 2020).

Concluding remarks

This paper contributes to the discourse on HCLA by presenting a critical stance on unsolved emerging challenges and offering potential directions for future research and development efforts. Adopting HCLA can promote inclusive and equitable education while mitigating potential social harms associated with the use of analytics in education. This paper also stresses the importance of enabling stakeholders' participation and using their expertise and experiences to inform the design process-in order to meet the needs of end-users. This means moving away from creating data-driven applications that may not align with authentic pedagogical intentions, towards creating human-centred systems that address specific learning challenges and provide accessible data insights to end-users. However, this requires more emphasis on design as a key pillar in learning analytics research and practice.

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Lift Learning

Engage further with the author and the challenges faced when adopting human-centered approaches in learning analytics at the companion LIFT Learning site. The author will be hosting a live webinar on Tuesday 12 September 2023 at 6-7pm AEST (8-9am UTC). Visit the LIFT Learning site at https://apps.lift.c3l.ai/learning/course/course-v1:LEARNINGLETTERS+0106+2023 to sign up for your free ticket to this event. If you are unable to attend the webinar live, then the recording will be made available on this same site shortly afterwards.

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