Learner-Computer Interaction

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Abstract

Learner-Computer Interaction (LCI) research addresses the design, development and use of interactive technologies to support and amplify human learning. LCI is based on the rationale that learning while interacting with technology is a complex, multi-layered phenomenon, thus, designing the conditions for engaging in meaningful learning is vital in the 21st century, yet, it remains a challenging process. LCI developments are expected to contribute towards a coherent new, high-impact way of understanding and building learner-centered interaction concepts to support the design of future learning environments. LCI provides an interdisciplinary playground for researchers and professionals across all areas of learning technologies, psychology, learning science and human-computer interaction (HCI), with an ultimate objective of providing a forum at the intersection of these topical areas. LCI aims to develop a critical discussion, debate and co-development of ideas and approaches about the next generation of learning environments and their interaction design capacities, the form of these capacities and the way they can be identified, utilized and enhanced to help us improve the contemporary learning technologies and users' learning experience.

Author Keywords
Learner computer interaction; learning technologies; learning analytics; interaction design

ACM Classification Keywords
CCS → Human-centered computing → Human computer interaction (HCI) → Interaction paradigms

CCS → Applied computing → Education → Interactive learning environments

Introduction

Learner-Computer Interaction (LCI) is *an area of scientific investigation that concerns the phenomena surrounding the interaction between learners and computational and communication technologies*. LCI concerns the study of the design, evaluation, and implementation of learning systems, and the wider impact of technology in humans' learning capacities. It combines inputs and perspectives from multiple scientific disciplines (e.g., HCI, learning technologies, learning science, data science, psychology) informing and supporting an area of research and industrial practice that concerns the design of systems to support human learning.

Background

The systematic use of learning technologies has become widely employed in the past years, diverse technologies have been applied in a variety of teaching and learning practices; for instance, learning tools which allow you to flip the classroom; monitor and enhance learning and teaching practices, or support informal learning scenarios.

Designing the conditions for engaging in meaningful learning is vital in the 21st century, yet, it remains a challenging process. Designing the technology to enhance human learning is a complex, multi-layered task. Most of the contemporary learning systems remain oblivious of users' current needs and capacities, as the available multi-faceted learner-generated data are not adequately utilized to advance current interfaces and communication modalities. To amplify learning capacities of users, learning environments need to seamlessly enhance their different functionalities and modalities, to account for and adapt to users' changing needs in the best viable way [1].

Users need both easy to use and powerful interfaces and communication modalities, offering fine-grained control of time and progress during their learning experience. To do so, contemporary user experience (UX) and learning designs are informed by various user-generated data coming from different sources [2, 3]. For example, data coming from traditional computer activity logging (e.g. video lectures, clickers, learning management systems), traditional educational research activities (e.g., questionnaires, interviews) and physiological-data (e.g., brain-activity, eye-activity, facial gesture), can play a key role in a new generation of technology to support human learning. Since, utilizing representative, objective, diverse and accurate data allows us to better understand users' learning capacities and design meaningful experiences for them [4, 5].

LCI research addresses the design, development and use of interactive technologies to support and amplify human learning and cognition, thus learners' experience and engagement are central to LCI. As a

step toward improving learners' experience and engagement with learning systems, learner-generated data might be converted via analytics into useful information and benefit environments efficiency and ultimately learners experience and performance. Capturing, sharing and analyzing learners' interactions can clearly provide scholars and educators with valuable information [2].

Whilst LCI is multidisciplinary, (incorporating psychology, learning sciences, interaction design, computer science, media studies etc.), and with having authors publishing in different venues and taking a range of research approaches, LCI takes most of its inspiration from Human–Computer Interaction (HCI).

Therefore, to explore the future of technologies for teaching and learning, we aim to build a research community around this topical area, to brainstorm about what the next generation of learning environments might look like, novel LCI concepts, what kind of learner-generated data can be collected, and how these data can help us to better understand and improve learning experience.

LCI Areas and Themes

The advents in digitalization of education and ubiquitous learning, indicate an increased use of technologies to facilitate teaching and learning. From the current research, it is difficult to tell which aspects of the design and development of learning systems can have a positive impact. In order to employ technology that serve as a powerful pedagogical tool, care should be taken to examine its impact on the overall learner experience. As such, the purpose of this endeavor is to explore how LCI research can help us to improve the learning potential and experience.

In particular, we seek to address the following overreaching research question:

> **RQ.** How insights generated during learner-computer interaction can help us to design future learning environments and improve users' learning experience?

Guiding themes to investigate the aforementioned overreaching research question include:

- Collect rich and multifaceted user-generated data (UGD) from people' interaction with the learning environments and other people.
- Advance data analysis techniques (e.g., machine learning) as well as data visualizations that can help us to provide reflection and insights to various stakeholders like, learner, teacher, manager, researcher, etc.
- Conceive future interaction modalities and affordances of learning environments that can help us to amplify learning experience.
- Seamlessly integrate interaction modalities and affordances of learning environments to provide low cognitive load.
- Envision the next generation of learning ecosystems and analytics enhanced learning tools.
- Ethical issues and guidelines when conducting studies with learners and teachers.

The Way Ahead

In the near future, learning technologies and therefore users of these technologies (i.e. learners), will be very different than they are now.

Today's young learners were born and grew up with digital technologies, K-12 students and the generations that follow, have not known a world without social media, mobile, wearable and ubiquitous technologies. These developments mean that future learners will have different capabilities and consider the, and interact with, technology differently.

Emerging areas of research like robots, intuitive / multimodal integrations, smart and adaptive technologies are widely available commercially though they have not yet received broad adoption as well as integration to traditional learning ecosystem.

The landscape for learners continuously changes as a result of the readily available and yet growing technologies and digital services that are used to support learning. Learning and knowledge acquisition occur in multiple spaces, sometimes facilitated by networked applications and instructors and learners communicate, using a various technologies—these technological ecosystems change the way humans learn.

In the near future, we will have learning technologies and learning spaces that cannot yet be imagined. Thus, one of the key challenges for LCI is to provide a body of research to support the design, evaluation, and implementation of learning systems, and the wider impact of technology in humans' learning capacities.

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