Digital Ecosystems for Collaborative Learning: Embedding Personal and Collaborative Devices to Support Classrooms of the Future[†]

Roberto Martinez[1], James Slotta[3], Pierre Dillenbourg[4], Andrew Clayphan[1],
Mike Tissenbaum[3], Beat Schwendimann[2] and Chirstopher Ackad[1]
[1]School of Information Technologies, [2]Faculty of Education and Social Work
University of Sydney, Sydney, NSW 2006, Australia
[3]Ontario Institute for Studies in Education, University of Toronto, Ontario, Canada
[4]CRAFT, Ecole Polytechnique Fédérale de Lausanne (EPFL)
roberto@it.usyd.edu.au, jslotta@oise.utoronto.ca, pierre.dillenbourg@epfl.ch,
andrew.clayphan@sydney.edu.au, mike.tissenbaum@utoronto.ca, beat.schwendimann@sydney.edu.au,
christopher.ackad@sydney.edu.au

Abstract: Multi-touch tables, interactive whiteboards, motion sensitive interfaces, physical and tangible computers, all present enticing new functional affordances for learning. However, this constitutes a problem space for design, rather than any specific solution. What forms of learning can now be supported by a multi-user touch screen? How can such learning be incorporated into K-12, university, or informal learning designs? As new commercial offerings become available, it is timely for learning scientists and educators to explore how to best make use of these tools at the classroom. This workshop will offer a venue to discuss how to develop novel technology into supportive tools and intelligent mediators between peers' activity to build the classroom of the future. We will discuss the role of technology and its limitations along with the roles of teachers and students. This workshop gives participants the opportunity to experience such a classroom, share their work, discuss practical challenges and define an agenda for future work.

Motivation and Themes

The expanded abilities to connect students with peers, support collaborative work, and aggregate user contributions holds great promise for the design of materials, assessments, activities, and interactions. Yet, designing curriculum that deeply integrates such media is challenging, particularly if done comprehensively so that the entire course is organised according to the social and collaborative products or exchanges that typify collaborative environments.

Face-to-face collaboration offers unique advantages compared with other ways of learning by affording continuous communication, dynamic transition between individual and group work, and productivity in completing tasks (Olson, Teasley, Covi, & Olson, 2002). However, groups of students often do not just spontaneously collaborate. Students require teacher support and attention at different times to make collaboration effective. One of the main challenges for teachers in *managing* collaborative learning at traditional classrooms is that teachers attend specific groups at a time and often only see the final product (Race, 2001).

There are a number of emerging and well grounded technologies that are promising to improve face-to-face collaborative learning, and there is growing interest on how they can enhance classroom activities. These include: multi-display groupware; interactive surfaces, such as multi-touch tabletops, electronic whiteboards, tablets, smart phones; motion sensitive interfaces; and physical and tangible computing. They all provide novel interaction spaces that can enrich collaborative work by providing access to digital content and also by capturing the learners' digital footprints. Such spaces can offer teachers and researchers new opportunities to orchestrate the class (Dillenbourg et al., 2011), offer an ecological learning environment (Moher, Gnioli, Jaeger, Wiley, & Lopez Silva, 2011) and inspect the collaborative process through real-time tools that help improve teacher's awareness in the classroom (Martinez, Yacef, Kay, & Schwendimann, 2012).

The nature of learning and instruction may be transformed by such new technologies, but we must consider how to re-organise our instruction around social, cooperative principles, including user-contributed content, shared experiences and emergent learning goals. It is not straightforward to design instruction that integrates students' use of shared displays or technologically augmented learning environments.

As a field, we require exemplars of coherent designs in order to inform our theoretical models of learning in such a "community-oriented" approach. These new forms of learning and instruction provide unique

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[†] Website: https://sites.google.com/site/iclsdecl/

opportunities to connect individual students, small groups, and the entire class in complex and increasingly interconnected configurations that could not be achieved without the technological scaffolds that support them.

Purpose and Contribution

Interactive surface devices (for example, multi-touch tabletops, interactive whiteboards, tablets and personal devices) promise to improve collaborative learning. There is growing interest on how to enhance classroom activities through interactive surface devices. Tabletops and whiteboards have been habitually used as "spaces", where people interact face-to-face to discuss ideas and build artefacts together. Tablets and other mobile devices create personal and private spaces that can connect people anywhere and at anytime. The promise of new technology is that they offer a tangible shared space that can enhance collaborative work by providing access to rich digital content or carrying this content in the pocket or the backpack.

The purpose of this workshop is to explore how new tangible, ubiquitous and collaborative learning technologies can transform the traditional classroom, allowing for new forms of, collaborative learning, and inquiry-oriented instruction.. This workshop aims to engage the research community in discussions about the best practices for adaptation of advanced technologies to educational contexts, and integrating technology within a pedagogical or theoretical perspective. In this workshop, participants will collaboratively develop an understanding of the current state of interactive surfaces, mobile and *ecological* technology integration: first, through the demonstration of several successful implementations in authentic classroom settings; and second, through a panel discussion with experts in the field sharing their personal experiences in enacting these complex pedagogical and technical designs; and finally, through hands-on interactions with collaborative and distributed surface technologies, turning the workshop itself into an advanced technology augmented classroom.

The goal of this workshop is to address several key issues within this emerging field including: What forms of collaborative inquiry can be empowered by collaborative and distributed surface technologies? What theoretical models and frameworks form the basis of learning from these technologies? What kinds of learning outcomes/measures can be obtained? What technology innovations are exciting? What are recent innovations in classroom technologies? What problems or obstacles might be present? What are the "defining issues" for this area of research? How can research collaborations make a difference? What is the role of open source and online communities in these classrooms?

Conclusion

The workshop will focus on the discussion of two main questions: 1) What are the Challenges for collaboration in real classrooms that technology has the potential to address?; and 2) What are some possible "solutions" and the agenda for the next steps in research to bring these to practice?

This workshop recognises that the use of technology in the classroom needs to respond to the needs of educators and learners, and must be guided by a strong pedagogical/collaborative perspective about learning. The only way to design and implement truly enhanced collaborative learning for classrooms of the future is through the integration of the experience of researchers, educators, designers, ethnographers and computer scientists who explore, build, or work with educational technology that provides support to students and teachers in the classroom (Slotta, 2010). Our multidisciplinary vision is that Educators will leverage these tools to effectively deliver next-generation learning experiences.

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