Ambient awareness of classroom activities

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Abstract. Ambient information displays are backchannels that are designed to work in the periphery of attention. We present a prototype 'Ambire' that combined features from classroom management systems, screen sharing applications, and ambient information displays. Ambire is an open-source web-based tool for streaming the content of students' 1:1 devices onto a large screen. All screens rotate slowly in Ambire. The rotation may be stopped, paused, forwarded or tracked back. We posit that a solution such as Ambire will provide qualitative benefits to classroom activities in terms of increased peer learning, sharing, collaboration, and community spirit, and be in stark contrast to ordinary teacher-controlled classroom management systems.
Keywords. Ambient information displays, prototype, peer learning, collaboration, sharing, monitoring, classroom management systems

Introduction

As schools strive to integrate new technology to teaching and learning, possibilities for leveraging peer learning and teaching should be explored as evident ways of enhancing classroom activities. Peer learning is frequent in physical education and art and craft studies: students observe, learn from and teach each other. Moving around and viewing the work of other students is part of the learning culture of these subjects. However, in more academic subject areas, this kind of sharing and peer learning is less frequent. Final essays are presented, not work in progress.

Networked digital tools can change that, as they afford easier and effortless sharing of work in. The collaborative writing tool EtherPad is one example of a tool that enables groups of people to observe each other's writing styles and techniques, both synchronously and asynchronously.

Currently, when a class is working in a computer lab, teachers often use a classroom management system (CMS). CMS places the teacher in control of when to share what. Teachers can take control of students' personal computers and can monitor student activities. CMS makes students' work visible to teachers and enables teachers to notice when their help is needed. By design, these tools do not necessarily support peer- and collaborative learning among students.

Figure 1. Photograph of the Harvard School of Design.

Peer learning can be supported by design. For example, the ascending auditorium design of the student workspaces at the Harvard School of Design, Department of Architecture (see Figure 1) allows easy sharing and overseeing of work. Inspired by these workspaces, we developed 'Ambire', a digital prototype of an automated ambient backchannel that could democratize the teacher-owned and teacher-controlled CMS monitoring features through collaboration and shared ownership.

Digital prototype Ambire

Ambire is an open-source web-based tool for streaming the content of students' 1:1 devices onto a large screen. All screens rotate slowly in Ambire. The rotation may be stopped, paused, forwarded or tracked back.

The word 'ambire' is the Latin root for 'ambient', which refers to the immediate surrounding. Ambire was designed using a research-based design approach developed by Teemu Leinonen (2010) and his research group. During a participatory design workshop with four teachers in Finland, one of them expressed the wish for a tool that would display the content of each student's screen to a large screen. We developed this into visual interface prototypes. These

prototypes were discussed with teachers and students of over 5 countries in over 10 Focus Groups. Comments included appreciation of the open sharing of work in progress and the possibility to pause the rotation for peer-assessment.

In adult learning situations, such as conferences, social media tools can present an important additional space for information exchange. According to Focus Group participants, using networked personal 1:1 devices can cause distracting multitasking in classrooms. Students use social media tools while other activities should be focused on. Teachers considered Ambire to address this problem. When a screen with unrelated content would appear on Ambire, teachers considered this to give rise to a pedagogically meaningful discussion. By facilitating students to glance at the wall and to relate other students' works to their own, teachers suggested, Ambire would support introspection.

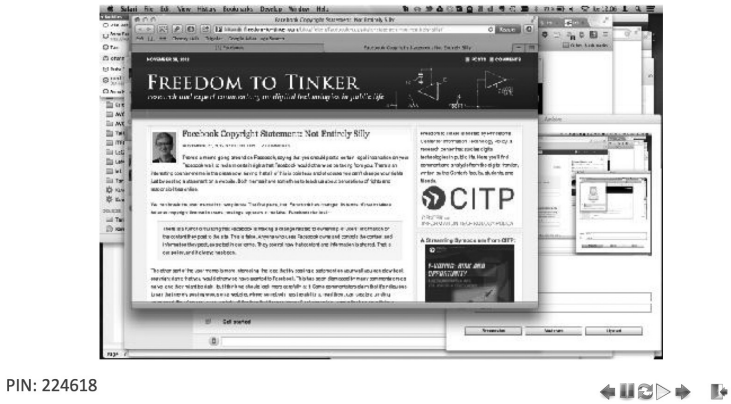

Figure 2. *Ambire prototype during a focus group*.

Based on the comments, we created design instructions for SMART Technologies to develop a beta version of Ambire. Figure 2 shows a screenshot of the implementation of the tool. This prototype was tested and discussed with teachers and students in 3 countries through remote focus group sessions. Two classes in Turkey, two in Italy and one small student group in Austria participated. A video call was initiated and Ambire was presented. Then a shared Ambire space was created. All participants with access to personal computers connected to the shared space using a six-digit pin. The test was followed by a discussion.

Besides a few technical challenges that prevented some participants to join the shared space, participants were concerned that the change between the screens might distract students. They recommended slower transitions to encourage sharing in the classroom to be less distracting.

Ambient information spaces for learning

An early ambient information space is the Dangling String installation by Natalie Jeremijenko. The installation displays the network traffic of an office space through the motions of a dangling rope that is attached to the ceiling. (Weiser & Brown, 1995). Other classic examples of ambient information spaces include information art spaces, in which artworks are transformed to present changing information, such as a Mondrian painting that displays email traffic (Redström, Skog and Hallnäs, 2000). The spaces visualize information so that it can be brought into the center of attention, but merges with the background when it is not needed.

Only in the past few years has slow technology, "technology that promotes moments of concentration and reflection" (Redström, Skog and Hallnäs, 2000; Hallnäs and Redström, 2001), been considered for school learning. DigiQuilt, a large screen ambient tool specifically designed for classrooms, allows students to practice mathematical concepts through the design of digital quilt patterns (Lamberty et al., 2011). As discussed by Lamberty, Adams, Biatek, Froiland and Lapham (2011), classroom ambient displays that present shared artworks and creations support young creators' awareness of an audience. This awareness triggers the development of a second order understanding in children, that is the consideration of how others may interpret a creation, which in turn informs the way in which the creating child represents and understands particular content (Lamberty et al., 2011).

We consider Ambire an ambient information space that can support reflection and peer learning in school. Based on the four characteristics of ambient information systems (Pousman and Stasko, 2006), Ambire matches the Information Monitor Display Archetype, as it ranks high on information capacity, is 'change blind' or 'change aware' (somewhat low to medium) on notification level, indexical (high) on representational fidelity, and medium on aesthetic emphasis.

Potential benefits of transparent monitoring

Tools for monitoring and controlling student devices have not been extensively studied. Notable exceptions are the efficiency measures reported by their manufacturers, which show 60-80% timesaving on tasks such as walking around the classroom, launching applications and logging out. However, the reports do not discuss transformative possibilities of these tools. Questions about how the awareness of being monitored affects student behavior, classroom community building, the culture of trust in a class as well as motivation and attainment, are unanswered and understudied.

By making all screens visible to all, Ambire is an attempt to share what the class is doing across all students equally and openly. We suspect that this can be beneficial for student performance. More often than not, they may try to create work that can be understood by their classmates and help others who are struggling with a task. Additionally, we consider Ambire to support contextual discussion: When something interesting is seen on the screen, the teacher or a student can step up to the screen and use the controls to pause the rotation, discuss the display, switch to the next screen, and finally resume the ambient display.

Discussion

Shared large screen displays have been studied and found in general to be helpful, but most studies rely on explicit sharing by students – students or teachers choose what to share and when. The automatic sharing of screenshots with Ambire removes this curation, which changes the meaning of the shared display. This gives the students a way to focus on their creation and to periodically pay attention to the automatically created background information channel of the activities of the entire class. Comparing this to an explicit sharing scenario would be interesting.

We could not find published studies about changes to student behavior when using teacher-controlled CMSs. A study comparing the practices and learning impacts of teacher-controlled CMSs on students with those of transparent sharing display is needed. We posit that a solution such as Ambire will provide qualitative benefits to classroom activities in terms of increased peer learning, sharing, collaboration, and community spirit, and be in stark contrast to ordinary teacher-controlled classroom management systems.

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