Computers & Education 63 (2013) 337–357

Contents lists available at SciVerse ScienceDirect

Computers & Education

journal homepage: www.elsevier.com/locate/compedu

Re-mediating classroom activity with a non-linear, multi-display presentation tool

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ARTICLE INFO

Article history:
Received 20 May 2012
Received in revised form
29 December 2012
Accepted 2 January 2013

Keywords:
Cooperative/collaborative learning
Evaluation of CAL systems
Human-computer interface
Improving classroom teaching
Media in education

ABSTRACT

This paper uses an Activity Theory framework to evaluate the use of a novel, multi-screen, non-linear presentation tool. The Thunder tool allows presenters to manipulate and annotate multiple digital slides and to concurrently display a selection of juxtaposed resources across a wall-sized projection area. Conventional, single screen presentation systems have been frequently criticised in the literature. Yet very little work has investigated the use of multi-screen alternatives, particularly within authentic activity systems. We placed the Thunder tool into an established activity system of student presentations in University-level Architecture education and examined how that system was re-mediated by participants' use of the tool. Our instruments included in-room and video-based observations, questionnaire responses and transcribed interviews.

We analyse how using Thunder in this setting re-mediated conventional activity structures in terms of interactivity, efficiency, cost, failure and serendipity. Drawing actions became prominently used to support design arguments, resulting in the 'easel' screen becoming a site for struggle between students and tutors. Slide manipulation was not well managed by students and yet the disorganised wall projection area nonetheless supported a directness of communication between participants that was novel for the activity. Students' historical learning costs, in terms of time and money, were removed, serving as the basis for the more fluid, contingent interactions, while participants' perception of tool failure was heavily influenced by prior expectations and historical activity forms. Novel forms of serendipitous discovery were enabled by the juxtaposition and annotation of materials, but such discovery was possible for both student-presenters and their audience and could be used to challenge presenters' narrative. We conclude by discussing how the re-mediation we document is pertinent to the contradictions in the activity system and suggest that, for the particular activity system we studied, a new leading form of the activity system would need to emerge if tools such as Thunder are to better mediate student presentation activity.

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1. Introduction

This paper contributes to understanding how presentation tools mediate teaching and learning activities. It has long been understood that the impact of technology on learning is greatly dependent on contextual factors, such as how the technology is integrated into particular teaching and learning practices (e.g., Wood, Underwood, & Avis, 1999). We study how introducing a novel presentation tool *re-mediated* an existing, established form of activity. Re-mediation of activity systems means people replacing an old mediation with a new one; this involves reflecting on the activity, generating new actions individually and thereby contributing collectively to generating a new form of activity, perhaps in unexpected or unintended ways (Lektorsky, 2009). New technology tools frequently allow activities to be re-mediated. For example, Lektorsky discusses how 18th Century French physicist Coulomb's work on elasticity led to the invention of the *turning balance* tool which, in turn, unexpectedly enabled him to re-mediate investigative activity into electrical charges (by examining how different electrical fields interact). We investigated the re-mediation that was associated with introducing a non-linear, multi-display presentation tool into a well-established classroom activity system of assessed presentations in University-level Architecture education.

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0360-1315/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.compedu.2013.01.001

Digital presentation systems such as Microsoft PowerPoint and LibreOffice Impress are common across many teaching and learning settings and are viewed positively by students (Susskind, 2008). Yet typical usage of this "slideware" is frequently criticised — due to presenters' linear and sequential presentation style, frequent separation of data from analysis, overuse of bullet points in unnecessary hierarchies, and the constraining effects of slide templates — and it is suggested that audience comprehension is affected as a result (Fagerjord, 2005; Tufte, 2006).

Slideware has been compared unfavourably to traditional, pre-digital alternatives. Lanir, Booth, and Findlater (2008) compared PowerPoint presentations to the use of multiple sliding blackboards in Mathematics lectures, and concluded that the blackboards allowed for more dynamic and spontaneous activity, provided more space for information (and enabled more comparisons), were associated with more embodied gesturing, and allowed rich data to be built up over time. Bligh and Lorenz (2010) described historic, 19th and early 20th Century use of dual lantern-slide projectors in Art History lectures. They argued that the use of dual projectors allowed presenters to better construct verbal arguments about pictures than using PowerPoint — in particular by structuring these arguments using pairs of images in a sequence, and comparing these pairs using a particular methodology called *comparative viewing*.

While some authors (e.g., Kjeldsen, 2006) have focussed on the need for better media rhetoracy, i.e., educating presenters so that they can create and communicate appropriate media statements and overcome the limitations of their tools, other work has investigated the development of novel classroom presentation technologies (e.g., Coyle, 2005). The *Virtual MultiBoard* and *MultiPresenter* tools both utilise a very large projected display area and allow lecturers to position visual artefacts using pen or mouse controls (Lanir, Booth, & Hawkey, 2010; Rößling, Trompler, Mühlhäuser, Köbler, & Wolf, 2004), while the *Multi-Slides* tool has been used to cascade PowerPoint slides around multiple walls of a seminar room (Bligh and Lorenz, 2010). In different ways, these tools aim to help users overcome the problems associated with slideware usage, reclaiming some of the benefits of pre-digital alternatives while remaining popular with students. In addition, empirical investigation of such tools has suggested benefits for audiences. For example, the *MultiPresenter* tool (Lanir et al., 2010) was used in an empirical study comparing 'two-stream' and 'one-stream' lecture presentations, which found significantly better student information retention from two-stream presentations under two conditions: when one information stream provided long-term context for the other, or when the two streams contained information for direct comparison.

Within the literature, evaluations of novel presentation tools can be categorised as technical descriptions (Rößling et al., 2004), case studies of enthusiasts' use with their own students (Bligh and Lorenz, 2010), or quasi-experimental studies where the behaviour of tool users is narrowly specified by the terms of the experiment (Lanir et al., 2010). What is absent is any detailed evaluation of the ways these novel tools interact with authentic users' established presentation activity in naturalistic teaching and learning settings, or more specifically how novel presentation tools re-mediate existing activity systems. This is clearly unacceptable, since any emergent presentation tools that seek to replace PowerPoint-like slideware within teaching and learning settings will need to contend with established activity systems that will influence how they are used. For this reason, we document in detail how a novel presentation tool enabled the re-mediation of real presentation activity, providing a detailed worked example that draws attention to the integration of a tool into a particular teaching and learning context rather than a comparative study under quasi-experimental conditions. Our methodology is based on Scanlon and Issroff's (2005) framework for evaluating technology in Higher Education settings, which focusses attention on five factors (pp. 434–436):

- **Interactivity**: how the tool responds to characteristics of users or queries, and how this relates to the expectations of scenario participants;
- **Efficiency**: how information is accessed, without wasting time or effort, to achieve the goals of scenario participants (which may be contradictory);
- **Cost**: how the holistic cost of tool adoption affects scenario participants and changes the rules of practice;
- **Failure**: consequences of technology malfunction upon students, expectations, the course or the community;
- **Serendipity**: occurrence of accidental discovery using the tool and its implications for the dynamics of control between scenario participants.

Scanlon and Issroff (2005) developed this framework to guide the evaluation of technology in Higher Education settings as a result of their own evaluation work. Scanlon and Issroff had previously evaluated several cases of computer-supported collaborative learning in University science education, a distance learning course for science postgraduates and an undergraduate history website used to support a conventional module. They concluded that their approach was useful to describe educational development, to express key features of learners' experiences, and to consider relationships between changing professional practices and changes in teaching and learning approaches. A possible limitation was seen in how to develop "insights into the fine grained aspects of interactions" (p. 432). Our own fine grained observational methods (see Methodology) were chosen so as to transcend this latter limitation.

Importantly, the framework is derived from Activity Theory, which has been widely used to inform evaluation and design of computer technologies, workplace environments and educational interventions (Kaptelinin & Nardi, 2006). Activities are characterised by specific divisions of labour, tools and rules which together constitute an *activity system* (Engeström, 1987); activities are regulated by motives and can be understood to be composed, hierarchically, of individual actions and low-level operations, regulated respectively by goals and current conditions (Kaptelinin & Nardi, 2006, p.64). Meaning is derived from the hierarchical structure, so for example an action derives meaning from its place *within* activity. Activity forms change: actions *develop* to become activities or operations, goals become higher-order motives, and so on (Lektorsky, 2009, p. 77). This development of activity forms is driven by the presence of contradictions within and between activity systems (Engeström, 1987). The term *contradiction* is drawn from dialectics, where systems are understood as relationships between elements that are both dependent and developing. Elements develop in ways that block or undermine the development of other elements, or act to transform other elements. Contradiction is the interaction of these opposing tendencies within a system (Ollman, 2003).

Our research question was as follows: how can a collaborative, multi-display presentation tool (Thunder) re-mediate a culturally entrenched Activity System (Studio Crits in Architecture education)? Such a question is justified, important, and possible to address: *justified*, because prior research has shown that the manner of integration into concrete learning and teaching practices strongly influences the impact of tools upon learning (see the reference to Wood et al., 1999; above); *important*, because the overview of prior work provided in this section demonstrates that novel presentation tools can have a measurable impact on audience memory retention, particularly those that

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