Using Cultural Historical Activity Theory to investigate IWBs

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Abstract

This paper reports on the progress of a research project that uses Cultural Historical Activity Theory [CHAT] as a framework to investigate the use of Interactive Whiteboards [IWBs] in the primary classroom. It will be of interest to researchers and research students considering theoretical approaches and methodologies to ICT in education research. Much of the early research on IWBs is considered superficial; however a new research paradigm, based on the notion of “interactivity”, is gaining momentum. The purpose of this project is to begin to move beyond replicating earlier findings on the educational use of IWBs by building on the work of Kennewell and others, in order to further examine the application of IWBs and their potential in education. This is to be done by using CHAT as a framework for data collection and analysis and conducting case studies of a number of IWB equipped primary classrooms to investigate and compare “interactivity”. Updates of the case studies will be presented and discussed at the conference as well as the value of CHAT as an ICT research tool.

Introduction

Interactive Whiteboards (IWBs) have attracted considerable attention in the education sector. Initially intended for business purposes, IWBs contain many features that make them amendable to use in classroom settings including, for example, the ability to use and integrate web-based resources in whole-class teaching; show video-clips to illustrate concepts; develop digital flip-charts; save written notes for future use and present student work to the rest of the class (Hall & Higgins, 2005). Internationally, much of the research associated with the use of IWBs in educational settings has emerged from the UK (see for example Higgins, Beauchamp & Miller, 2007; Moss, Jewitt, Levaaic, Armstrong, Cardini & Castle, 2007; Glover, Miller, Averis, & Door, 2005; Smith, Higgins, Wall, & Miller, 2005; BECTA, 2003). These findings can be extrapolated to the Australian context, however, much of the available research literature on the use of IWBs in education has been described as ‘limited’ and critiqued as largely small-scale, involving predominately informal interviews and surveys (Smith et al., 2005). Further research focussing on the unique features of IWBs and how these are best exploited for educational use is needed to determine the impact of the technology on student learning and teacher approaches to pedagogy.

Much of the early research on IWBs describes the ‘wow’ effect of the large display and the touch sensitive board. It also reports the enthusiasm of the teachers and students for the technology and its novelty factor. ‘Touch’ and the large display are acclaimed advantages and, often argued, the key components that will transform teaching and learning. However, the ‘presentation’ and ‘touch’ aspects of an IWB, per se, do not necessarily ensure interaction between the technology, the teacher and the learner, in achieving learning goals.

Research by Kennewell (2004) and others suggests the possibility of much deeper interactive opportunities for learning with IWBs than just the notion of a large display and physical manipulation. These deeper interactive opportunities are derived from further features of the IWB environment that Kennewell (2004) has identified and are likely to augment a higher level of interactivity in teaching and learning depending on the choice teachers make. These features have the potential to influence learning (affordances) but are also characterised by constraints. The orchestration of these affordances
and constraints by the teacher needs to be more fully explored and is fertile ground for research.

**Interactivity**

Kennewell (2004) and Kennewell, Tanner, Jones, & Beauchamp (2008) and others (Higgins et al., 2007; Tanner, Jones, Kennewell & Beauchamp, 2005) use the term interactivity to describe this process of orchestration. The term is becoming ubiquitous in literature related to ICT in education particularly in the UK (e.g. Higgins et al., 2007: 216). It is used to describe the interactions between teachers, learners and technology in the classroom to enhance learning. It is derived from the term *interactive teaching* (see Kennewell, 2004).

In this study, Interactivity, is defined as the exchange of information, and communication, in the process of teaching and learning, among the teacher and learners via the IWB and other mediums in order to achieve educational goals. The literature suggests that further research on interactivity in teaching and learning is needed.

Tanner et al., (2005) and Kennewell et al. (2008) suggest that technology has brought changes to classroom dynamics and interaction patterns which potentially enhance interactivity and contribute to a high level of ‘active participation by learners who contribute to the development of collective understanding’. According to Higgins et al. (2007) there are two dimensions of interactivity: *technical interactivity* (TI) - the interplay of digital information as elements in the learning process and *pedagogical interactivity* (PI) - the interaction between the learner and teacher, learner and learner, and teacher and teachers. This coincides with previous assertion made by Smith et al. (2005) who make a clear distinction between technical interactivity and pedagogical interactivity in describing the learners’ interaction with IWBs. Kennewell et al. (2008) also refers to technical interactivity and pedagogical interactivity.

Higgins et al., (2007) explored literature on technical and pedagogical interactivity and argued that the interrelationship between IWB technology and pedagogy has led to further exploration of technical interactivity and pedagogical interactivity and the ways in which, both combine as interactivity to assist learning (Higgins et al., 2007: 219). However, it is not clear how the technical interactive potential of IWBs intersects the pedagogical interactive opportunities to create interactivity to foster learning. While the literature points out the challenge in developing a pedagogy based on IWB technical interactivity, there is no indication of what level of technical interactivity and/or pedagogical interactivity or what combination of these interactive potentials enhance learning and how they impact on practice, professional learning, curriculum and policy.

Overall the research on the notion of interactivity associated with IWBs is minimal but growing (Glover & Miller, 2007). The literature suggests that teachers need to adapt pedagogy to take advantage of the interactive potential of the IWBs. Since much of the early research (Levy, 2002) concentrated on the technical affordance of IWB, more recent research (Kennewel et al., 2008) is moving towards employing this technical interactive potential to enhance pedagogical interactivity.

Now the concept of interactivity seems to be the key to sustaining interest and promoting effective use of IWBs in schools. However, in order to fully exploit interactivity, teachers not only need to be confident with the technology, but also need to prepare and implement advanced instructional designs.
The authors put forward the notion that effective teaching and learning with IWBs will be based on a combination of technical interactivity and pedagogical interactivity; thus, the shape of interactivity. Therefore, the key hypothesis in this project is that the appropriate shape of interactivity: meaning the appropriate combination of TI and PI, orchestrated with the appropriate Instructional Design (ID) is likely to empower teachers towards carrying out an Effective Learning Episode (ELE) with IWBs. Therefore, the purpose of this research is to compare and contrast the shape of interactivity in a number of IWB equipped classrooms to determine the implications for curriculum development, professional learning and further research.

Cultural Historical Activity Theory (CHAT)

The authors are of the view that a richer exploration of interactivity can be achieved with the use of cultural historical activity theory (CHAT). From a CHAT perspective the use of IWBs is examined and understood within the context of an activity. One of the reasons for proposing the use of CHAT is that much of the existing research is limited to revealing the attitudes of the user, views and beliefs on technology use by teachers, and classroom factors to determine effective use of technology in teaching and learning (Koszalka and Wu, 2004). In doing so, factors that may influence the cognitive construction of knowledge and the development of skills, such as the role of the individual and the collective in a socio-cultural and socio-historical context, may be overlooked.

CHAT is conceived from soviet-originated cultural-historical psychology (Vygotsky, 1978 & Leont’ev, 1981). ‘Cultural-historical activity theory is a school of thought concerning itself with the relation and interaction between humans and their material and social environment’ (Engestrom and Kuutti, 2006: 44). From a CHAT perspective consciousness arises from an externally practical activity and the principle lies in the unity of the consciousness and the activity. As Kaptelinin (1996: 107) describes, consciousness, is the human mind as a whole, and activity is human interaction with the objective reality. Therefore, a person alone should not be the unit of analysis in isolation to these actions and the context in which they occur. The fundamental concept of CHAT is that the human mind is socially mediated and relies on tools and labour activities.

As Kuutti & Engestrom (2006) suggest, a better description of this theory would be to refer it as a framework. It is anticipated the use of a CHAT theoretical framework would allow richer and deeper analysis of teaching and learning in an IWB classroom (Kaptelinin 1996: 107) and take into account the cultural - historical factors that impact the participants (Bodker, 1991; Leont’ev, 1978; 1981).

In this study CHAT will be employed to investigate the shape of interactivity in classrooms that use IWBs in teaching and learning. The study seeks to illuminate how participants interact with each other and the IWB to share thinking. Second generation CHAT, which is the most commonly used in research (Jonassen & Rohrer-Murphy 1999), will be used to analyse interactivity and a six-step model adapted from Jonassen and Rhorer-Murphy (1999) and Mwanza (2001) is proposed as the framework for data collection and analysis (see Table 1).
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### Table 1 – Framework for data collection and analysis

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<th>Step one</th>
<th>Understanding the activity and the setting</th>
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<td>Analyse actors of the activity system</td>
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### The Research Design

The study seeks to investigate the interactivity surrounding the use of IWBs in primary classrooms. The purpose is to compare and contrast the shape of interactivity in four IWB equipped classrooms to determine the implications for curriculum development, professional learning and further research. The research questions driving the investigation are:

- What shape of interactivity exists in each of these classrooms?
  - a. How are the affordances and constraints of the IWB orchestrated in each of these classrooms?
  - b. How does the shape of interactivity influence learning in each of these classrooms?
  - c. How does the classroom culture, setting and prior knowledge of the participants influence and limit the shape of interactivity?

A case study methodology will be adopted employing a CHAT theoretical framework. In CHAT, the minimum unit of analysis is the activity system; therefore, research on interactivity around IWBs needs to analyse the activity system elements - subject, object, tools, community, rules and division of labour and the relationship between each element.

### Data collection

Data collection will be carried out using classroom video, observations, interviews, documents, multimedia research journals with photographs and surveys. More than one source of information strengthens the study, ‘a major strength of case study data collection is the opportunity to use many different sources of evidence’ (Burns 2000:469, Yin 2003 p:97)
<table>
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<tr>
<th>Step two</th>
<th>Analyse actors of the activity system</th>
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| Define subject and the community. Who is involved in this activity (technical staff, curriculum coordinator, principal)? What are their roles? What are their expectations as actors? What are the contradictions? | - Observation  
- Video  
- Survey  
- Interview |
| What shape of interactivity exists in each of these classrooms? | - How are the affordances and constraints of the IWB orchestrated in each of these classrooms? |
| How does classroom culture, setting and prior knowledge influence learning? |

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<tr>
<th>Step three</th>
<th>Analyse the mediators of the activity system</th>
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| Describe the tools, rules and division of labour in the activity. By what means are the subjects and community carrying out this activity? Are there any cultural norms, rules or regulations governing the performance of the activity? Who is responsible for what, when carrying out this activity and how are the roles organised? What tools do the subject and the community use to achieve their objectives and how? What rules affect the way the subjects and community achieve their objective and how? How does the division of labour influence the way the subjects and community satisfy their objective? What are the contradictions? | - Documents - Policy, Rules and Regulations & IWB instruction manual  
- Observation  
- Video  
- Planning Documents Interviews |
| What shape of interactivity exists in each of these classrooms? | - How are the affordances and constraints of the IWB orchestrated in each of these classrooms? |
| How does classroom culture, setting and prior knowledge influence learning? |

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<tr>
<th>Step four</th>
<th>Analyse the structure of the activity system</th>
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| What are the activities, actions and operation that IWB support? What activity level support has IWB provided? What action level support has IWB provided? What operation level support has IWB provided? How do the actions and operations evolved over time and what are the historical changes? What are the contradictions? | - Observation  
- Video  
- Interviews  
- Multimedia research journals |
| What shape of interactivity exists in each of these classrooms? | - How are the affordances and constraints of the IWB orchestrated in each of these classrooms? |
| How does classroom culture, setting and prior knowledge influence learning? |

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<th>Step five</th>
<th>The context</th>
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| What are the beliefs of the learners and teachers have towards IWB and the interactivity that surround it? What were the facilities available to carry out activities? What are the tools, rules and division of labour required according to the participants? What are the expectations and expected of other staffs that influence the activity? What is the prior learning of the students, how experienced with technology, what are their backgrounds? What is the condition under which teachers do their work (staff development, previous experience with IWB, available resources)? What are the contradictions? | - Survey  
- Interview  
- Video  
- Observations |
| What does this comparative study on shape of interactivity imply for curriculum development, professional learning and further research relating IWBs in education? |
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**Step six**

Analyse the outcome and activity system dynamics

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<th>What has been achieved? What is the outcome? To what extent was the IWB utilised in achieving the result? What are the dynamics among the components of the activity? What are the primary, secondary, tertiary and quaternary contradictions? How do the participants perceive the accomplishment of the activity? How did the activity unfold compare to the plan and predicted at the beginning? What are the suggestions for the future in helping in designing and carrying out future learning activities using IWB and in general?</th>
<th></th>
<th>How does the shape of interactivity influence learning?</th>
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<tbody>
<tr>
<td>Lesson plan</td>
<td>Video</td>
<td>Interview</td>
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<tr>
<td>Data analysis</td>
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The data set will consist of digital video recordings, audio recordings, text and digital photos. The story of each case will be constructed from these varied sources of data. Content analysis of each document, interview, multimedia research journal, observation and video comparing themes that emerge will be carried out and with the aid of the CHAT framework a detailed description of the activity system will be captured systematically. The data analysis will be an ongoing process with initial findings taken back to the field for further investigation. Afterwards, a set of categories will be developed from the research questions that are aimed at describing the level, or shape, of interactivity that fosters learning.

**Conclusion**

This project is adopting a cultural and historical approach towards use of IWBs in classrooms because CHAT rejects the view that ICT can be investigated in separation to its setting and broader context of use. By adopting a CHAT framework, along with its the limitations, we believe it is possible to conduct a more holistic investigation of ‘interactivity’ around the IWB and in classroom. Therefore, the cultural and historical setting in which IWB use is situated, will be examined and documented. The shape of interactivity in each of the classrooms will be compared and contrasted to determine the implications for curriculum development, professional learning and further research. It is anticipated that data collection will commence in March 2010 and an update of the project will be part of the conference presentation.

**References**


