QUALITY TEACHING AND INTERACTIVE WHITEBOARDS: USING ACTIVITY THEORY TO IMPROVE PRACTICE

Trudy Sweeney
Flinders University, South Australia

This research project investigated the use of interactive whiteboards (IWBs) in one primary school (R-7). The NSW Quality Teaching Framework was used as a part of professional development activities with teachers to improve their practice. Using activity theory and drawing upon observations and interview data, tensions are identified and described about the uptake and effective use of IWBs across the curriculum.

There is limited research into the use of interactive whiteboards in Australian schools (Schuck & Kearney, 2007). International research suggests that IWBs can have positive effects on both teaching and learning (Smith, Higgins, Wall & Miller, 2005). They are an excellent means for teachers to enliven formal expositions, including demonstrations of practical procedures and explanations of complex concepts (Somekh, 2007).

The development of teachers’ skill and knowledge in using IWBs is critical to their effective use (Higgins, Beauchamp & Miller, 2007). Researchers maintain that teachers require a significant amount of sustained experience to become technically and pedagogically accomplished in using IWBs (Beauchamp, 2004); (Sweeney, 2008). Teachers need guidance and support to make choices about how and when to use IWBs based on the pedagogical content knowledge, combined with the process of pedagogical reasoning (Kennewell, Parkinson & Tanner, 2005).

Some studies suggest that teachers’ use of technology progresses along predictable patterns of development. They begin by applying technology to old industrial tasks (Naisbitt, 1984) as they are learning to manage concerns related to efficiency, organisation, managing, scheduling and time demands. Most teachers’ efforts are focused on short-term use of the innovation with little time for reflection (Hall & Hord, 2006). Once they are competent and reliant upon the new technology, they become receptive to changing their techniques and modifying its use as a pedagogical tool to improve student learning (Glover, Miller, Averis, & Door, 2007); (Hall & Hord, 2006). Thus, the research literature points to a progression from technology to pedagogy (Glover et al., 2007).

According to Glover et al (2007), there is limited and, as yet, unproven evidence about the rate at which teachers progress towards more effective use of interactive whiteboards. Somekh et al (2006) claim that it takes approximately two years for IWBs to become embedded in teachers’ pedagogy. After this time, teachers are able to change their teaching practices to make best use of its facilities (Somekh et al., 2006).

This paper reports on a study that investigated the impact of IWBs on seven teachers’ pedagogy in one Australian primary school over an eighteen-month period. The paper draws on activity theory, to investigate the dialectical process by which teachers’ consciousness, professional learning and development simultaneously shape and are shaped by the use of IWBs (Gay, Rieger & Bennington, 2001).

Activity Theory

Activity theory provides a versatile tool to inquire into various aspects of educational technology (Murphy & Rodriguez-Manzanares, 2008). It focuses attention on the processes by which activities shape and are shaped by their context (Lim & Chai, 2003). To date, there is limited use of this
research methodology in relation to the use of IWBs.

The main unit of analysis in activity theory is the activity system. A model of the second-generation activity system was formulated by Cole and Engeström (1993) and is represented in Figure 1. The subject node refers to the individual or group whose agency or point of view is taken in the analysis of the activity. The activity of the subject is directed towards the object node or goal and is transformed into outcomes with the help of physical and symbolic external and internal tools that mediate the object into an outcome (Engeström, 1993). Thus, the object embodies the meaning, motive and purpose of the system. The base of the triangle represents the contextual characteristics of the activity system. The community node refers to the participants who share the same general object with the subject. The division of labour node refers to how tasks are divided between community members (horizontally as well the vertical division of power and status). Rules are explicit or implicit regulations, norms and conventions that constrain actions and interactions within the activity system (Centre for Activity Theory and Developmental Work Research, 2003).

![Second generation activity system](image)

Figure 1: Second generation activity system (Cole & Engeström, 1993)

According to (Il'enkov, 1977) and (Engeström, Miettinen & Punamaki, 1999), change systems (like the implementation of new technologies) are internally contradictory and identifying these contradictions is of crucial importance to understand the efforts of changing the system. Contradictions are developmentally significant within activity systems and exist in the form of resistance to achieving the object of the activity and as emerging dilemmas, tensions and disturbances (Engeström, 1999). Engeström et al. (1999), point out that the adoption of a new technology often leads to an aggravated secondary contradiction where some old element of the activity system (for example, the division of labour) collides with the new one leading to disturbances and conflicts that may give rise to innovative attempts to change the activity.

**Data Collection**

The seven participants in this study volunteered to use an IWB. Four participants were new users. The other three volunteers had been using an IWB for twelve months before the commencement of the study. The project proceeded in four stages. The first stage was an individual interview to capture teachers’ existing beliefs and practices related to use of IWBs prior to any intervention. The second stage involved a video taped lesson observation and second individual interview to reflect on the use of the IWB in the classroom. Participants then participated in a one-day professional development workshop using the NSW Quality Teaching Framework (NSW, 2006) and applied this knowledge by independently rating a video of their own lessons and moderating the results with a peer and the researcher. The third stage of the project involved a second video taped lesson and rating. There was also a final individual interview focused on identifying the tensions in the activity system and exploring ways to address these.
Table 1: The Elements of the NSW Quality Teaching Framework (NSW, 2003).

<table>
<thead>
<tr>
<th>Dimension of Intellectual Quality</th>
<th>Element</th>
<th>What does it look like in classrooms?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep knowledge</td>
<td>Deep knowledge</td>
<td>The knowledge being addressed is focused on a small number of key concepts and ideas within topics, subjects or KLAs, and on the relationships between and among these concepts.</td>
</tr>
<tr>
<td>Deep understanding</td>
<td>Deep understanding</td>
<td>Students demonstrate a profound and meaningful understanding of central ideas and the relationships between and among those central ideas.</td>
</tr>
<tr>
<td>Problematic knowledge</td>
<td>Problematic knowledge</td>
<td>Students are encouraged to address multiple perspectives an/or solutions and to recognise that knowledge has been constructed and is therefore open to question.</td>
</tr>
<tr>
<td>Higher Order Thinking</td>
<td>Higher Order Thinking</td>
<td>Students are regularly engaged in thinking that requires them to organise, reorganise, apply, analyse, synthesise and evaluate knowledge and information.</td>
</tr>
<tr>
<td>Metalanguage</td>
<td>Metalanguage</td>
<td>Lessons explicitly name and analyse knowledge as a specialist language (metalanguage), and provide frequent commentary on language use and the various contexts of differing language uses.</td>
</tr>
<tr>
<td>Substantive communication</td>
<td>Substantive communication</td>
<td>Students are regularly engaged in sustained conversations about the concepts and ideas they are encountering. These conversations can be manifest in oral, written or artistic forms.</td>
</tr>
<tr>
<td>Dimension of Quality Learning Environment</td>
<td>Explicit quality criteria</td>
<td>Students are provided with explicit criteria for the quality of the work they are to produce and those criteria are a regular reference point for the development and assessment of student work.</td>
</tr>
<tr>
<td></td>
<td>Engagement</td>
<td>Most students, most of the time, are seriously engaged in the lesson or assessment activity, rather than going through the motions. Students display sustained interest and attention.</td>
</tr>
<tr>
<td></td>
<td>High expectations</td>
<td>High expectations of all students are communicated, and conceptual risk taking is encouraged and rewarded.</td>
</tr>
<tr>
<td></td>
<td>Social support</td>
<td>There is strong positive support for learning and mutual respect among teachers and students and others assisting students’ learning. The classroom is free of negative personal comment or put-downs.</td>
</tr>
<tr>
<td></td>
<td>Students’ self-regulation</td>
<td>Students demonstrate autonomy and initiative so that minimal attention to the disciplining and regulation of student behaviour is required.</td>
</tr>
<tr>
<td></td>
<td>Student direction</td>
<td>Students exercise some direction over the selection of activities related to their learning and the means and manner by which these activities will be done.</td>
</tr>
<tr>
<td>Dimension of Significance</td>
<td>Background knowledge</td>
<td>Lessons regularly and explicitly build from students’ background knowledge, in terms of prior school knowledge as well as other aspects of their personal lives.</td>
</tr>
<tr>
<td></td>
<td>Cultural knowledge</td>
<td>Lessons regularly incorporate the cultural knowledge of diverse social groupings (such as economic class, gender, ethnicity, race, sexuality, disability, language and religion).</td>
</tr>
<tr>
<td></td>
<td>Knowledge integration</td>
<td>Lessons regularly demonstrate links between and within subjects and key learning areas.</td>
</tr>
<tr>
<td></td>
<td>Inclusivity</td>
<td>Lessons include and publicly value the participation of all students across the social and cultural backgrounds represented in the classroom.</td>
</tr>
<tr>
<td></td>
<td>Connectedness</td>
<td>Lesson activities rely on the application of school knowledge in real-life contexts or problems, and provide opportunities for students to share their work with audiences beyond the classroom and school.</td>
</tr>
<tr>
<td></td>
<td>Narrative</td>
<td>Lessons employ narrative accounts as either (or both) a process or content of lessons to enrich student understanding.</td>
</tr>
</tbody>
</table>
Understanding the use of IWBs

Rather than explain the outcomes in a deficit framing, activity theory allows the tensions in the activity system to be understood more holistically. This section focuses on examining the tensions that emerged as participants used the NSW Quality Teaching Framework as a tool to improve their pedagogy using IWBs. The framework comprises eighteen elements divided equally into three dimensions: Intellectual Quality, Quality Learning Environment and Significance. These dimensions and elements are outlined in Table 1.

The rationale for adopting IWBs at the school was that they would be an effective strategy for supporting teachers to easily integrate ICT across the curriculum without the need for radical pedagogical change. Participants identified that the potential benefits of IWBs were to use the devices as an organisational tool to integrate digital resources and engage students using quality presentations and physical interactivity. Participants attended regular professional development sessions organised by the IWB retailer and these focused on the technical features of the native IWB software.

New users began using IWBs in their classrooms by exploring the affordances of the technology and ways to manage it with students. They described clear links between use of the native IWB software and the elements of Deep Knowledge, Substantive Communication and Metalanguage from the NSW Quality Teaching Framework. Participants felt that the IWB enhanced these elements because lesson content could easily be presented and discussed. As a result of using the IWB, participants described tensions that emerged in their practice.

Teacher A provides an example of a tension that was resolved between the Subject, Tool, Object and the Division of Labour. After viewing her first video taped lesson observation, Teacher A commented that her use of the IWB native software was similar to using ‘digital worksheets’ where students were asked to demonstrate their understanding of concepts in limited ways by simply ‘dragging and dropping’ missing answers. Ironically, Teacher A explained that she had agreed to use an IWB because she thought it would improve her practice by increasing interactivity in her classroom. However, when she reviewed her IWB lesson, she felt that her intensive use of the IWB software meant that she was doing all of the work. Furthermore, the element of Higher Order Thinking was coded low using the NSW Quality Teaching Framework because students had limited opportunities for demonstrating their understanding and developing their higher order thinking skills. Having made this realisation, Teacher A felt that a resolution to this tension was to spend less time preparing teacher-directed lessons and access alternative sources of lesson resources from the Internet. She explained that using online resources meant that lessons could be more responsive to students’ needs and interests and that she could focus less on the technology and more on student learning. Teacher A commented:

I am so over flip-charts! I’ve moved on from how I was using it. … It was time consuming in putting it all together, almost like a digital worksheet. I now like the spontaneity of having [the IWB] there … you can quickly get on to the Internet and it’s instant.

Furthermore, Teacher A emphasised that the native IWB software was an appropriate starting point for all new IWB users because “if you start searching on the Internet for resources you can get lost in cyberspace [because] there’s heaps out there but it takes a lot of time to filter it”.

Teacher B (the teacher-librarian) provides an example of a resolved tension between the Community, Tool, Object and Division of Labour. Reflecting on both of her videotaped lessons, she commented how at the commencement of the study, her lessons in the resource centre used to be disconnected from learning in classrooms because it was difficult for class teachers to continue these activities. She also found it challenging to recall where all classes were up to in their weekly lessons. This disconnection was evident in the elements of Knowledge Integration and Background Knowledge using the NSW Quality Teaching Framework. However, since receiving an IWB and improvements to the school infrastructure, Teacher B was now able to easily save work for students to access and
continue in their classrooms after lessons. She could also quickly create multiple copies of files as a starting point for use with each class and review progress. In addition, Teacher B had been encouraged by the principal to take a lead role in collaborative curriculum planning and applied her recently gained knowledge from professional development activities to clearly identify how her lessons complemented those of class teachers.

At the commencement of the study, the three experienced users relied on the native IWB software to develop students’ conceptual knowledge through whole class teaching. After reflecting on their first video taped lesson observation and rating their practice using the NSW Quality Teaching Framework, participants explored ways to improve the elements where they received relatively low ratings and most of these related to the dimension of Significance. Participants were enthusiastic to coordinate with others to explore ways to make learning more meaningful and important to students. This change involved using IWBs in ways that were more responsive to students and this required participants to draw on technical skills using a variety of ICT tools and pedagogical skills related to curriculum planning.

Teacher C provides an example of a tension that was resolved between the Rules, Subject, Tool, Object and Division of Labour. After reviewing his first video taped lesson observation, Teacher C lamented: “I felt like I was giving a keynote to my class! It sort of sounds like I was giving a workshop not talking to kids”. At this point, Teacher C questioned whether using the IWB primarily to support explicit-teaching as a major part of stand-alone lessons was the most effective way to use the technology. During the first individual interview, Teacher D also commented:

“That’s the thing that’s ironic, you use a digital tool out the front and then you sit students down and ask them to go back to pen and paper. That’s the part that I’ve really struggled with. There is only so much money and you can’t buy everything but in an ideal world, you’d have laptops to use. We might be moving towards that next year.

Subsequently, for the second lesson observation, Teacher C focused on exploring ways to focus on students’ learning and increase the significance of lessons by building on students’ prior knowledge, making connections beyond the classroom and focusing learning on cultural knowledge. Teacher C had recently participated in extended professional development activities focused on collaborative curriculum planning and using an inquiry learning approach and was eager to apply this knowledge to make changes to his practice. He did this by initiating a cross-cultural collaborative wiki project with a teacher in Alaska.

The IWB was used in the project primarily as a whole class to discuss ways to develop the wiki and demonstrate new skills. The project valued the questions that each class asked of each other to compare what it was like to be a student at each school. Students were encouraged to show initiative and influence the pace and direction of the project based on their experiences and interests. Accessing the computers in the computer room enabled students to put into practice the aspects discussed as a class using the IWB. These changes to the use of the IWB enabled Teacher C to improve the Significance of his second lesson observation and address some of the tensions related to sharing the division of labour with students however there were still ‘Rules’ restricting the use of computers to regular allocated times in the computer lab. These tensions were subsequently resolved the following year with the implementation of laptops.

Teacher D provides an example of a tension within the objective. During the first lesson observation, Teacher D encouraged many young students in the class to physically interact with the IWB to demonstrate their understandings of the conventions of punctuation. This resulted in a slow pace to the lesson as students waited for a turn to complete similar tasks. Consequently, a major portion of the lesson was teacher directed and some students became disengaged and disruptive. This was reflected in the low ratings for the elements of Student Direction and Student Self-Regulation. Teacher D planned the second lesson observation with the teacher-librarian as part of a recent collaborative planning initiative in the school. The lesson plan focused on clearly defined learning objectives related
to an inquiry-learning unit of work about the emergency services. The lesson consisted of several parts involving the IWB and follow-up activities at students’ desks.

The IWB was used in the second lesson observation to draw on students’ background knowledge, connect with experiences beyond the classroom and use narratives to present scenarios for students to respond to. A few students were selected to interact with the IWB during the various parts of the lesson including choosing different scenarios and using the audio recording tool to rehearse making phone calls for emergency assistance. Thus, Teacher D had made a deliberate shift from the object in the activity system from a focus on the technology, to working collaboratively with others to improve pedagogy and students’ learning. She commented:

*It was a better lesson because the focus had shifted. The first lesson it was all about the board, whereas now it was more about the actual lesson and outcomes and what I wanted the children to learn from the experience.*

During the final individual interview, Teacher D described that she had resolved tensions related to the use of the IWB by realising that although explicit teaching is an important part of Early Years pedagogy, it is important to balance this with a range of stimulating practical activities that don’t need to involve all students physically interacting with the IWB.

**Conclusion**

The development of teachers’ technical and pedagogical skills and knowledge using IWBs is critical to their effective use. The NSW Quality Teaching Framework provides a valuable measure to empower teachers to evaluate and target appropriate improvements to their pedagogy, especially when this is used in conjunction with video taped lesson observations and opportunities for shared reflection.

The results of this study indicate that for new IWB users, participation in ongoing professional development focused on technical skills, can lead to improvements to the dimension of Intellectual Quality. This appears to be because elements such as Deep Knowledge, Substantive Communication and Metalanguage concern how curriculum content is presented and discussed. Furthermore, these elements do not require radical pedagogical change.

The results of this study also suggest that for experienced IWB users, participation in professional development focused on pedagogy and collaborative curriculum planning can lead to improvements to the dimension of Significance. These findings support previous research, which suggest that it takes approximately two years for IWBs to become embedded into teachers’ practice. This is because once teachers are technically competent and reliant on the technology, they become more receptive to changing their pedagogical techniques and make deliberate efforts to coordinate with others to improve student learning.

This paper used activity theory to focus attention on the processes by which the use of IWBs shape and are shaped by their context. As teachers make changes to improve their pedagogy, tensions often emerge as some old elements of the activity system collide with the new one. This study described how these tensions were unique to individuals and the school context, and influenced by teachers experiences, pedagogical beliefs, their participation in professional development activities, level of technical and pedagogical competence, teaching role and willingness to reflect on and improve their practice. Understanding these tensions supports teachers to change the activity and improve student learning.

**References**

Beauchamp, G. (2004). Teacher use of the interactive whiteboard in primary schools: Towards an


