# Tools for Transformation: The Impact of Interactive Whiteboards in a range of contexts

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**Abstract:** The use of Interactive Whiteboards (IWBs) has had a marked impact on both teacher and learner behaviour and expectations (Cuthell, 2005). To date, much of the literature has reflected small-scale studies, with much of the evidence being ethnographic in nature (Glover et al, 2005; Smith et al, 2005). This paper looks at evidence drawn from the first phase of a three-year international longitudinal study of schools in China, Mexico, South Africa and the United Kingdom. Evidence is drawn from teams involving six universities, pupils, teachers, teacher-educators, curriculum advisers, policy makers and educational journalists to evaluate the impact of the technology and its affordances on a range of factors: attainment; concept formation, behaviour, attendance, motivation, collaborative learning, pedagogical styles, materials development and change management.

## Project background

This paper describes a number of projects undertaken by the MirandaNet Fellowship (www.mirandanet.ac.uk). The Fellowship, founded in 1992, strives to span national, cultural, commercial and political divides to provide an innovative and inclusive forum for professionals in education. Partnership with industry and Government is at the heart of the research, development and evaluation processes that underpin and support good practice. Individual learning patterns are celebrated through action research strategies and peer e-mentoring. Dissemination and publication are central to the Fellowship process. Fellows who share their experience and expertise are building a professional knowledge base about the use of advanced technologies in transforming teaching and learning.
One such partnership is with Promethean, Ltd, who have been working with MirandaNet Scholars and Fellows since 2002 with the aim of making teaching and learning a more effective – and enjoyable – process. Teachers across all key stages and curriculum areas in the United Kingdom and across the world have collaborated in workshops, presentations and case studies to develop strategies to inspire and involve pupils and colleagues.

### MirandaNet research into interactive whiteboards (IWB)

The first evaluation of the impact of interactive whiteboards was published by MirandaNet in 2000. It was written by Anna Smith, of Boston Spa Comprehensive School (mentored by Dr. John Cuthell) who submitted the evaluation for her Fellowship. Her research reported findings from teachers and students aged 11-18 across a range of curriculum areas. Subsequent research evaluated classroom praxis in a variety of contexts (MirandaNorth, 2002). Action research projects across the UK then examined the impact of the technology on teaching, learning and classroom interactions (Virtual Learning, 2004). The current programme investigates the impact of IWB technology in an international context (MirandaNet: Promethean Ambassadors Programme, 2005 – 7).

### Recent UK research

Two recent papers (Glover, Miller, Averis & Door, 2005) and Smith, Higgins, Wall & Miller (2005) have surveyed the literature on interactive whiteboards. The small-scale studies focused on the impact on schools, on classroom management and on pedagogy. Other research looked at issues concerned with managing change and with the impact of IWBs on learning styles. A number of respondents raised concerns that IWB use was 'just another presentational tool', although teachers who consistently used the boards did not voice these concerns. The existential reality of classroom practitioners suggests that IWB use changed the dynamic of the classroom, and the teaching and learning experience. These changing pupil/teacher participation patterns occasioned by IWB use are examined by Davison & Pratt (2003).

The MirandaNet approach to collecting research evidence is that MirandaNet scholars conduct practice-based research. Their findings are discussed with mentors and colleagues in an e-journal and form a knowledge base. Case studies are published on the MirandaNet site, which has facilities for peer review. The feedback is therefore continuous and formative, reinforcing the iterative research cycle. Teachers in the United Kingdom can choose to have their work accredited at pos-graduate level through the MirandaNet Academy at Bath Spa University.

The evidence base collected by MirandaNet suggests a number of specific impacts of IWBs on educational praxis.

**Transforming teaching**

The visual element transforms Mathematics, Geography, Science, ICT and Design Technology. Students are able to move through the stages of a process and visualise each one. Concept acquisition is enhanced.

Interactive language games involve the whole class: there is far less classroom passivity: boys in particular become much more engaged with the lesson.

Teacher enjoyment: lesson resources involve their creativity, which extends to the classes they teach.

Resource banks and lessons can be re-used and distributed through school networks for colleagues and students.

This is a tool, then, that empowers teachers in the process of teaching, and as such transforms classroom interactions.

**Transforming learning?**

V-A-K models (Visual, Aural, Kinaesthetic) are powerfully supported by the boards. Teachers and pupils report enhanced learning experiences, with a wider range of learning styles being supported than previously. In addition, ICT skills are seen in context to support learning. This is particularly true with any learning involving data – charts, graphs, diagrams and so on – proving more effective, as the visual element reinforces the process of data handling. Investigative learning is facilitated through the ability to focus on changes in the process whilst they are happening, and then to replay them.

**Interactive Whiteboards: new tools, new pedagogies, new learning?**

The next phase of the research took place in 2002, during which time IWBs were appearing in more classrooms across the UK. Promethean and MirandaNet collaborated to examine the impact that interactive whiteboards were making on teaching and learning in schools. The first phase of the project was completed at the end of 2002 and published for the BETT exhibition (the educational technology show) at Olympia, London. The evidence collected by MirandaNet researchers was arranged thematically. Case Studies from this first phase explored the ways in which interactive whiteboards were being used at this time, and the ways in which they contributed to student learning and teacher pedagogies. They were in no way definitive: what they provided was a snapshot of shared experience and the beginning of a Community of Practice.

As more schools were fitted with interactive whiteboards there was a real need for teachers to play an active role in specifying the ways in which this extremely powerful tool was installed and used. The technology can effect a profound change in the ways in which our students learn, the ways in which we teach and, more fundamentally, the ways in which we organise the curriculum and our schools. When teachers are expected to respond to so many conflicting demands – social regulation vs. radical change; transforming teaching vs. raising standards: and when the audience for learning has expanded beyond the teacher – student relationship, these case studies were seen as providing some ideas for hard-pressed colleagues.

During 2003 the work was extended, and seven teachers from schools across the country participated in action research projects that covered all Key stages, funded by Promethean and directed by MirandaNet. The in-depth case studies looked at the impact of ACTIVboards on teaching and learning. The case studies can be downloaded from the MirandaNet site.
Three distinct threads emerged from the research:
the need for a planned approach to the infrastructure and ICT skills that were needed when interactive whiteboards were introduced;
the identification of all of the curriculum concepts involved in the teaching;
affective changes in staff and students engendered by effective use of interactive whiteboards.

**Promethean Ambassadors (2005 - 7)**

The latest research project has been extended to include four countries over a three-year period. MirandaNet Fellowship Researchers are investigating the achievements of a core ACTIV teaching community who are building an online knowledge base for other users. These practitioners, advisers and researchers are working with UK colleagues as teacher researchers by investigating specific links between classroom technology and achievement in their local context in China, Mexico and South Africa. They reflect on their ongoing practice and publish their work for others. This mode of sharing experience provides an innovative Action Research or Practice Based Research model for Continuing Professional Development in ICT. The practitioners are being encouraged in these methods of learning: research indicates that this is the most effective way to ensure that teachers become confident users of ICT and take ownership of the effective deployment technology to enrich the learning process (Preston, 2000; Cuthell, 2002; Preston & Cuthell, 2005).

**Widening the research**

The Promethean Ambassadors project is collecting data in China, Mexico, South Africa and the UK. The project involves 6 universities, at least 1,500 pupils, 60 teachers, 6 teacher educators, company trainers and curriculum advisers, national policy makers and educational journalists. Key ethnographic research questions for this phase are how interactive the classroom is for the learner, the degree to which the classroom is transformed and whether the traditional role of the teacher is reinforced. What are the degrees of classroom interactivity?
The presence of the IWB in itself should enhance the learning experience: the degree to which is does is the focus of one of the research strands. Whether teacher praxis is modified is another area of investigation.
Quantitative aspects of the research are examining the learning gains and raised standards occasioned by IWBs, increase in pupil participation in the lessons, the increase in resources to support a range of learning styles, collaborative working by teachers, resource provision and faster curriculum coverage.
The first phase of the research was completed by December 2005.

**Evidence**

A data collection exercise was undertaken in all three countries from October to December 2005. The collection focused on perceptions of the impact of ACTIVboards from a range of stakeholders: pupils; teachers; head teachers; government policymakers, journalists and others in all three countries. The research used both face-to-face and online data collection. In-depth interviews were conducted in China, Mexico and South Africa. Some 60 educationalists and almost 150 pupils contributed information. Online data collection remains an ongoing process. Fourteen case studies on the impact of ACTIVboards on teaching and learning by teachers involved in the project were completed during 2005 and have been disseminated through the MirandaNet website. Two seminars during BETT 06 focused on the project, impacts and achievements.

**Emerging trends**

The first phase of this study identified a number of commonalities between the three countries. These were the contexts for change, emerging themes from the research, transforming teaching and learning, empowering pupils, improving outcomes and promoting elearning.

## The contexts for change

### *Large classes*

Both China and Mexico have large numbers of students in classes. In China there are on average 50 students per class in Secondary schools and in excess of 100 in some university classes. One consequence of this is that those seated towards the back of classes and lecture theatres often struggle to follow the lesson and read what is written on a conventional blackboard. Large classes also inhibit pupil participation in the lesson.

### *Didactic pedagogy*

In both China and Mexico large class sizes have reinforced traditional didactic pedagogies, which result in both passive learning and passive teaching, with neither teacher nor learner engages in the learning process, but rather concerned with information transmission of curriculum content. In South Africa a new curriculum (OBE) has been introduced to transform a rigid education system shaped by the old National Party. This Outcomes Based Education curriculum (OBE) demands active learning and a much more engaged and proactive teaching style. All three countries, therefore, see the use of ACTIVboards, ACTIVstudio and their affordances as critical to the process of changing the balance of the classroom: making teachers more proactive and creative, and learners more active and engaged.

### *Restricted learning opportunities*

Large classes and didactic teaching styles necessarily restrict the learning opportunities for both learners and teachers. The project has made it possible for a wide range of learning styles to be supported, making opportunities available to learners whose preferred learning style was not accommodated by traditional pedagogies. Teachers are able to work with colleagues in a range of development projects that provide a wealth of learning opportunities. This opportunity for self-directed professional development leads the teachers to a greater understanding of the learning process that ultimately changes classroom praxis and benefits all learners.

### *The need to integrate ICT into the curriculum in a cost-effective way*

In 1995 the Mexican government announced the intention to equip every primary school with a computer lab. By 2005 only 10% of schools had been so equipped, with many schools wondering whether they would be provided with equipment before the end of the 21st Century. Fortunately, by 2005 educationalists had realised the limitations of ICT being restricted to a computer lab. ICT implementation in both South Africa and China was initially seen in similar terms: the creation of computer labs. Head teachers and government leaders, however, have seen the impact of interactive whiteboards on classes and determined that they provide an immediate and cost-effective solution to ICT integration. Comments from head teachers in South Africa have suggested that the combination of staff laptop computers and the use of ACTIVboards and ACTIVstudio provides the swiftest and most cost-effective route for embedding ICT in the curriculum.

### *The imperative to change teaching and learning cultures*

China's economic transformation requires innovative creative thinkers to lead the workforce, and government policy makers have articulated a transformed education process as key to that. Active learning is seen as a critical

component of the knowledge economy: early results from the project suggest that, in classrooms in which ACTIVboards are in use, the teaching and learning culture is changed. Mexico and South Africa also see education as the key to the knowledge economy, but these countries also focus on social transformation, the empowerment of marginalised communities and the bridging of the digital divide. The use of interactive whiteboards, software, digital resources such as Enciclomedia and digital tools offers a way of providing all children with the same educational entitlement.
These, then, are the contexts in which the project is set: the application of interactive technology and digital tools offers a way in which the educational need of each society can be addressed.

**Emerging Themes**

Interviews and data collected from each of the countries in the project have yielded information that is common to all of the countries. A number of themes have emerged from findings from this first year of the study. They focus on the ways in which the Ambassadors project have impacted on teachers, pupils and schools by transforming teaching and learning; rekindling enthusiasm; promoting creativity; empowering pupils; improving outcomes and promoting elearning.

**Transforming teaching and learning**

Government policy-makers, head teachers and journalists in China, Mexico and South Africa say that:
*ACTIVboards are an ideal vehicle for implementing elearning;*
*transforming teaching;*
*promoting active learning in the classroom.*
*Re-kindling enthusiasm; promoting creativity*
*Teachers feel empowered by the boards and the software;*
*ACTIVstudio gives them back creativity;*
*banks of materials at their fingertips mean they can respond to their pupils every learning need;*
*teaching is made more individual.*

**Empowering pupils**

Pupils say there has been a significant change:
*in the way they are taught;*
*In the ways that they learn.*
*They are empowered and more involved in the process of learning.*
*Many pupils say that they can now understand Mathematics, and that it's fun.*
*They can visualise the stages of the lesson, and of their own learning.*
*ACTIVboards have changed the way in which they learn.*

**Improving outcomes**

Teachers have seen a significant impact on pupil work and attainment.
Motivation has increased, and punctuality and attendance have improved.
Time on task is significantly better: pupils complete more work each lesson.
Pupils regard ACTIVboards as essential to their learning.

**Promoting elearning**

Head teachers say that ACTIVboards are catalysts for implementing elearning and improving staff ICT skills.
They are crucial tools for Continuous Professional Development and promoting school improvement.
ACTIVboards are a more cost-effective way of putting ICT at the heart of the curriculum than ICT labs.

When linked with teacher laptops ACTIVboards create a multimedia platform for ICT literacy.

**Emerging findings**

Participant schools have been working with ACTIVboards for less than nine months.
All have seen increases in motivation of staff and students.
Understanding and implementation of elearning have been increased.
Pupil attendance, motivation and work have shown improvement.
ACTIVboards offer a cost-effective solution for implementing elearning.

## Classroom realities: evidence from teachers

***Changes occasioned by IWB use***

Feedback from project partners with schools teaching Citizenship in Nuevo Leon, Mexico shows that, prior to ACTIVboards being installed "the subject was not of great interest to the students, even though it was about learning their rights and responsibilities as Mexican children. The aim was for them to acquire and practice each and every one of the universal values.
The explanations that were given were like words that the wind took, useless."

***With the use of the IWB***

"Nonetheless, the situation made a 360-degree turn and the classes will never be the same. Our classroom started using the ACTIVboard on April 5th and each time the students are showing more interest for this and other subjects. During this time, in our city a misfortune occurred that went against the universal values. A woman of vengeance burned alive her friend's son. The child survived and they are going give the woman a jail sentence. This news caused great shock among the students and they could not stop talking about it. Thus, I decided to do some research using the local newspaper's website. Once I found the information, I presented it to the students by using the IWB. The children requested the opportunity to give the pyromaniac woman a jail sentence. That day many of the students did not take their recess time with the purpose of staying and continuing investigating more in depth the news so that they could place it in view the next day. The students showed so much enthusiasm like never before, they did all that was needed for the completion of the work."
Further studies in Nuevo Leon have found a marked increase in focus and motivation, particularly with students who formerly had learning and discipline problems. "During the time I have used the ACTIVboard with my students, I have seen lots of changes. Usually students working with regular blackboards are not focused on class, this could be for many reasons: boring, not motivated, etc.; speaking of students with learning and discipline problems. Now we have seen that good technology like ACTIVboards increases motivation in students to participate in class, not only participating just to use the board, but doing activities right. Our school is located in a difficult community. Many students are involved in gangs, and also have to deal with their parents because some are divorced, alcoholic, aggressive or simply they do not care about them. So they do not teach them any kind of values, and we are seeing the results in the classroom with bad discipline, fighting with partners, disrespecting teachers, etc. Because of this I planned activities where students can see real situations and try to solve them according the right thing to do, debating in class the reasons that support their ideas, and not even knowing that they are using a value and also applying it. At the end they understand the meaning of the value without an explanation from the teacher. They have seen that they form part of the world, and the acts they do for a bad or a good reason will affect everyone in this world. They created a strip cartoon using the ACTIVboard. This strip cartoon was about a story where they had to decide to do something wrong for a good reason, or do the right thing.

## The way forward

Previous MirandaNet studies (2002; 2003; 2005) have identified the impact of IWB technology on teacher praxis and the existential reality of teaching. The introduction of any project runs the risk of the Hawthorne Factor in producing results difficult to replicate across an organisation or period of time. There is a natural scepticism in education over any new initiative or technology that promises to transform the classroom. What is significant about the studies undertaken to date is that those teachers who have embraced the new technology now work in classrooms that are very different from those in which teachers operate in a conventional didactic manner with chalkboards or marker boards. Interactive whiteboard technology brings elearning into the classroom and provides a cost-effective alternative to computer labs. The next two years of the study will chart the progress of pupils, teachers and institutions, in which, to quote a participant from Mexico, we can see the transformation of teaching, learning and lives.

**Appendix**

***Pupil perceptions***

99% agreed or strongly agreed that they found lessons in which the IWB is used more enjoyable.
84% said that they would like to use the IWB in their assignment presentations.
80% said that, in lessons using the IWB, their concentration was better or much better.
80% said that their understanding and retention of material presented using the IWB was better or much better.
73% said that, compared with other lessons, they talked to their friends (unrelated to work) less or much less in IWB lessons.
54% said that their participation in IWB lessons was better or much better.

***Teacher perceptions***

All pupils were more engaged and focused.
Topics are covered in more depth: teachers and pupils are able to move from one section of the materials to another with ease.
Revision materials are always available to pupils.
Lessons were more enjoyable and fun.
Initial findings suggest higher attainment with lower/middle pupil band pupils. Teachers report that there is a faster coverage of syllabus and curriculum materials, which means that more time is available for pre-examination revision.

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