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The use of the interactive whiteboard for creative teaching and learning in literacy and mathematics: a case study

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Abstract
This paper considers the ways in which the interactive whiteboard may support and enhance pedagogic practice through whole-class teaching within literacy and numeracy. Data collected from observations of whole-class lessons, alongside individual interviews and focus group discussions with class teachers and Initial Teacher Education students, has provided opportunities to consider the potential of such technology to facilitate a more creative approach to whole-class teaching. The data suggests that, in the first instance, the special features of information and communications technology such as interactivity, 'provisionality,' speed, capacity and range enhance the delivery and pace of the session. This research seems to indicate that it is the skill and the professional knowledge of the teacher who mediates the interaction, and facilitates the development of pupils' creative responses at the interface of technology, which is critical to the enhancement of the whole-class teaching and learning processes.

Introduction

The globalising phenomenon of information and communication technologies (ICT) is a distinct characteristic of modern times. The speed and immediacy of ICT, coupled with opportunities for increased information flow through multiple routes of communication, suggest that we are living in a time of unprecedented change, with ICT affecting the way we live and function as individuals and as a society (Castells, 2004).

Within the context of education there are some technologies that appear to have attracted more interest than others; however, the degree to which they have been

successfully integrated into the classroom environment has been varied. In recent years, there has been a growing level of interest in the electronic or interactive whiteboard (IWB), well documented by the educational press. Such technology is generally comprised of a triangulation between data projector, computer and an electronic screen. This allows an individual to interact with software at the front of a class rather than from the computer. Effectively, the computer screen is projected onto the electronic whiteboard and presented to the class with the teacher, or perhaps student, selecting, activating and interacting with the programs.

At a time in England when the government has promoted whole-class interactive teaching, particularly within Literacy and Numeracy, access to IWB technology through targeted government funding is also increasing, and the IWB is steadily becoming a feature of most numeracy and literacy lessons. In January 2004, Charles Clarke, the Secretary of State for Education in England, announced that, in addition to the £25 million previously made available to schools in September 2003; a further £25 million would be released for the purchase of IWBs. This technology is therefore likely to become a key resource in most schools. Introduction of new technologies such as this within the classroom context raises questions regarding the ways in which pedagogic practice may be supported and enhanced; this being the focus of this study, specifically, the links between three areas; whole-class direct teaching, creativity and the integration of technology.

As IWBs are becoming more familiar within the educational market, additional challenges, which imply new priorities, have arisen from recent demands for 'a much stronger emphasis on creative and cultural education and a new balance in teaching and in the curriculum.' (The National Advisory Committee on Creative and Cultural Education [NACCCE], 1999) The teacher educator is therefore faced with a complex set of demands that require resolution in terms of pedagogic practice. The aim of this study is to investigate how IWBs can provide opportunities for creativity in teaching and learning, particularly within whole-class lessons, by drawing upon observations of, and discussions with, classroom practitioners and ITE students. In so doing, the study will contribute to debates within educational fields (Bleakley, 2004; Craft, 2005; NACCCE, 1999) regarding the notion of creativity in primary teaching and learning.

Current developments in creativity, interactivity and whole-class direct teaching

The current focus on direct whole-class teaching, particularly in mathematics, developed in response to concerns in England about the level of children's performance in English and mathematics compared to those in other countries. In particular, in the Third International Mathematics and Science Study of 1999 (Mullis *et al*, 2000) England was placed low in basic number skills although as Muijs and Reynolds (2001) note, faring better in geometry and problem solving. Research conducted by Professor David Reynolds, chair of the newly established Numeracy Task Force, singled out a substantial amount of direct whole-class teaching as a key feature of mathematics sessions in the top-attaining countries (Reynolds & Farrell, 1996), these findings

echoing those of previous studies, (Galton & Croll, 1980; Rosenshine, 1979), and more recently, Bierhoff (1996), Bierhoff and Prais (1995) and Burghes (1995).

In response to these concerns about attainment and the related research findings, the National Literacy Strategy (NLS; DfEE, 1998) and National Numeracy Strategy (NNS) were introduced into most state-funded primary schools; the NLS in 1998 and the NNS in 1999, both providing a clear framework for the content of the curriculum and recommended teaching approaches. In both Literacy and Numeracy, sessions were expected to consist of a substantial amount of direct, whole-class teaching. A whole-class approach, it was claimed, enables the teacher to interact more with each pupil; adapt activities quickly in response to pupils' responses; use errors and misconceptions as a teaching point for the whole class and keep pupils on task for longer periods of time (Muijs & Reynolds, 2001). However, Muijs and Reynolds also noted that this approach was not necessarily the best to use in all circumstances. Brophy and Good (1986) are cited as finding this method more suited for teaching rules, procedures and basic skills, especially to younger pupils. Less structured and teacher-directed approaches, Muijs and Reynolds (2001) suggest, would be more appropriate when the aims of the lesson are more complex or open-ended (eg, developing students' thinking skills) With the IWB featuring widely in whole-class teaching, there is a concern that its full interactive potential may not be explored through this structured, teacher-directed approach as the teaching and modelling of rules, procedures and basic skills is likely to take precedence over more complex and cognitively demanding activities.

Where whole-class interactive teaching in mathematics lessons is concerned, the Numeracy Task Force stressed that 'it is the quality of the whole class teaching which determines its success' (Department for Education and Employment [DfEE], 1999) rather than the whole-class approach per se. They note that whole-class teaching should not be viewed as a purely transmission-based approach, with children given instruction regarding knowledge and understanding in a product-driven mode of teaching. Rather, it should be seen as an interactive, process-oriented approach to learning with the quality of the interaction within the classroom being of prime importance, maximised effectively and efficiently through good whole-class teaching. The NNS goes on to state that 'interaction is a two-way process in which pupils are expected to play an active part' and that 'high quality interactive teaching is oral, interactive and lively', which is fundamental to a social constructivist view of learning (Vygotsky, 1978). This may be a laudable claim, however; Muijs and Reynolds (2001) caution that with direct whole-class teaching, pupils may find it easy to adopt a more passive role, becoming too dependent on the teacher and failing to develop independent learning skills. Nevertheless, it may be within a more social, interactive and lively learning environment that the IWB could be seen to make a valuable contribution. At present, there is a limited amount of research available that focuses specifically upon the IWB and associated pedagogy, however, Smith, Hardman and Higgins (2006) have undertaken a substantial study involving observations made in primary schools of 184 lessons in literacy and numeracy conducted over a 2-year period. The study suggests that, although the use of IWBs engages the pupils and sessions are generally faster in

their pace of delivery, the underlying pedagogy of whole-class teaching appears to remain unaffected, with teacher-led recitation and emphasis upon recall dominating proceedings. Previous research has highlighted the motivational impact of IWBs upon pupils, with the large screen, the multimedia capability and the element of fun enhancing the presentational aspects of a lesson (Glover & Miller, 2001; Levy, 2002). Essentially, there appears to be the potential for enhancements in whole-class teaching and learning through the use of IWBs if pedagogic practice were to adapt and change through creative and innovative use of the particular features of this new technology.

Creativity

Creativity has been described as 'the word of the moment' (Bruce, 2004, p. vi) and 'an important element of the zeitgeist in the early twenty-first century' (Craft, 2005, p. ix). In what is seen as a fast-changing and relatively uncertain future strongly influenced by the speed and connectivity of multidirectional digital communications networks and the global market economy, the British government, within their document *Excellence in Schools*, have highlighted the necessity of preparing individuals 'successfully for the twenty-first century' (DfEE, 1997). The document stressed the importance of recognising the different talents that children possess and called for a 'broad, flexible and motivating education' that would help to develop creative, innovative and adaptable students.

The increased focus on numeracy, literacy and testing standardised assessment tests (SATs) in primary schools has led to a tendency to focus upon the product of learning rather than the process. This is at a time when the business community has expressed a need for young people's creative abilities to be developed in order to prepare them for what has become a fast-moving and ever-changing world. To be able to operate within such a dynamic, microelectronically driven world, individuals would need to recognise the provisionality of knowledge and, through divergent rather than convergent methods of thinking, (Guilford, 1975) recognise and solve problems that may be presented to them in creative and innovative ways. Rules, procedures and basic skills therefore, rather than being the main learning goal, could be seen as tools to be used creatively in solving problems and developing new ideas.

The suggestion seems to be that schools were focusing more on knowledge and skills, particularly related to literacy and numeracy, and giving less attention to developing young people's capacity for original thinking and action; key aspects of creative problem solving. In response to such concerns, NACCCE (1999), established in 1998, drew up a series of recommendations for the creative and cultural development of young people through both formal and informal education, some of these finding their way into the Department for Education and Skills (2003) document *Excellence and Enjoyment*, which brought together the NLS and NNS, with a focus upon creative teaching and learning, to become the Primary National Strategy.

NACCCE (1999) was keen to dispel what they viewed as misconceptions about creativity, that it was associated with lack of discipline, was related only to the 'arts' or was the

domain of a gifted few. Rather, they saw it as possible in all areas of the curriculum, enhancing literacy and numeracy and involving a 'balance between teaching skills and understanding, and promoting the freedom to innovate, and take risks' (p. 10).

This report also recognised both the opportunities, and the challenges provided by new technologies, enabling young people to '*broaden their horizons; to find new modes of creativity and to deepen their understanding of the world around them*'. (NACCCE, 1999, p. 21) When considering the educational implications of the IWB, teachers may therefore need to consider two aspects with regards to creativity. First, how such technology may provide teachers with opportunities to teach creatively, and second how this may encourage and support pupils to develop 'modes of creativity' ie, teaching *for* creativity (Jeffrey & Craft, 2004). Teaching creatively, for example, may include the teacher's use of a wide range of media such as video, animation, graphics and text, with hyperlinks to documents, websites and associated content. Although this may result in an exciting and creative presentation, it does not necessarily follow that the children within the class are actively engaged in developing their own creative thought processes, rather they may adopt the more passive role noted by Muijs and Reynolds (2001). Teaching *for* creativity would therefore demand the teacher's use of the IWB to enhance the process, rather than the product, of learning. As pointed out by Jeffrey and Craft (2004, p. 84), the relationship between *teaching creatively* and *teaching for creativity* may be viewed as integral with the former leading to, and inherent within, the latter. By referring to four features of creative pedagogic practice, as developed by Woods (1990), Jeffrey and Craft (2004) argued that by making content relevant to children and by allowing them to have ownership and control over the learning experience, it is possible to encourage innovation, with children becoming active participants in the process. It is this possible engagement in creative teaching and learning that this study sought to explore.

Interactions between teacher, pupils and technology necessitate more than the transmission of knowledge from either teacher or technology to pupil. Instead it requires a considered approach to the integration of ICT during whole-class teaching in order to optimise opportunities to engage with the creative processes related to learning. Such processes, according to Fisher (1990) include higher order thinking skills such as analysis and evaluation, problem solving and originality of thought. Although it may be important to consider these two aspects of creative teaching, it is equally important to recognise that there is a strong link between them. The NACCCE report states that 'teaching for creativity' involves 'teaching creatively' (NACCCE, 1999, p. 90) and, as Woods (1995) reminds us, 'creative teaching promotes creative learning' (p. 2). Encouraging learners to 'pose questions, identify problems and issues, together with the opportunity to debate and discuss their "thinking" rather than focus on learning rules, procedures and basic skills, brings the learner into the heart of both the teaching and learning process as a co-participant (Emilia, 1996)' (in Jeffrey & Craft, 2004, p. 82), so experiencing ownership and control of their learning. By using the IWB as the focus and hub of interaction, documenting, presenting and rapidly processing information, it is possible that such learning opportunities may be supported and enhanced in a meaningful and purposeful manner.

Cardellichio and Field (1997) for example, suggest a range of strategies that include hypothetical thinking, web analysis, reversal, analysis of point of view and the application of symbol systems, all of which may encourage metacognitive activity. Hypothetical thinking requires the teacher to challenge what may be viewed as standard responses from pupils by encouraging them to explain their reasons for giving such answers, in effect probing their underlying thoughts and ideas in order to reflect, reconsider and analyse any given response. Web analysis focuses upon the creation of linkages between events in an attempt to reveal complex relationships and connections that are not necessarily obvious at the onset, or over-simplified by the individual in order to understand such issues more easily. Such connections may be visually represented and reorganised using appropriate software designed for mind mapping activities in order to assist analysis. Reversal encourages individuals to develop hypothetical thinking by bringing into question detail or elements that may be less noticeable; for example exchanging the position of the numbers constituting an addition sum, or reversing the placement of numbers within a sequence. Where point of view analysis is concerned, alternative perspectives and their underlying rationale may be introduced while the changing of symbol system requires the presentation of ideas in different formats, for example verbal to diagrammatic.

One of the differences between using an IWB as opposed to a conventional whiteboard, overhead projector and flipchart would be the ability to draw upon a wide range of digital resources to support such representations and navigate through such material quickly therefore avoiding any loss of pace in learning and teaching. The potential to save, edit and retrieve stored data for continued development and future learning opportunities can also be easily accomplished with the use of IWB technologies. Effectively, data presented on the face of an IWB may be recalled and revised to include annotations resulting from discussion within the classroom.

Methodology

A case study was considered to be the most appropriate approach, as this study responds to 'how' and 'why' research questions (Yin, 2003), and aims to give a portrayal of a specific situation, identifying the unique features of interaction within it and providing an example of 'real people in real situations' (Cohen, Manion & Morrison, 2000, p. 181). A grounded theory approach, attributed to Glaser and Strauss (1967) was used in this study. As such, an analytical induction process is applied, as opposed to a hypthetico-deductive system, in order to develop theory from collected data. During the course of the research there were 10 observations of whole-class lessons, five in literacy and five in numeracy, in five primary schools. In addition to this, interviews with the respective class teachers and focus group discussions with students attending an Initial Teacher Education programme provided qualitative data regarding perceptions towards, and use of, IWB technology within the classroom.

While lessons were observed and field notes were kept, individual and focus group discussions were recorded on audio tape and later transcribed for analysis by the researchers. In order to provide opportunities for observer triangulation (Robson,

2002), both researchers recorded field notes independently of one another. At the time of the research, 75 students out of a cohort of 137 students had opportunities to use IWBs during school placement. From the 75, two groups of four were randomly selected to undertake focus group discussions (Bailey, 1996, p. 78), which aimed to provide opportunity for them to share their perceptions and experience of the IWB with regard to teaching and learning. Open-ended questions were asked by the researcher, with additional, probing questions to gain clarification from the answers given.

The selected software used alongside the associated hardware was identified and, in addition to this, notes were made regarding the nature of the software; for example whether it included interactive features such as sound and animation, whether it was specific to the IWB concerned and whether it had been commercially produced or teacher generated as a teaching resource. Use of the IWB in terms of teacher and pupil operation was also noted alongside the questions and interaction between teacher and pupils. For example, the IWB may be used to demonstrate, model or highlight specific processes, ideas and concepts. While the lesson is in progress, the teacher may be the only individual operating the software, with teacher-directed questioning providing opportunities for children to engage with the subject matter. In some instances, children may be encouraged to interact with the software at the face of the IWB or through the use of peripheral devices such as slates or tablets; demonstrating their understanding by selecting specific responses or exploring possibilities within the context of a more open-ended task.

Subsequent discussions with class teachers and focus groups centred upon the ways in which the IWB had been utilised by teachers and pupils and the perception teachers and student teachers held with regard to the potential of the IWB to support and enhance teaching and learning.

Observations

The data gathered was tentatively placed under four broad headings. Those aspects referred to most frequently by respondents included an increase in concentration, motivation, attention and focus of pupils, and these were drawn together under 'Maintaining Attention'.

'Enhanced Learning Experience' provided by the IWB described the multisensory nature of the resources; ease of replay and retrieval of data, entertainment value and the variety of available resources, while the 'Nature of Interaction' included questioning, discussion and the incorporation of the IWB to complement the substance of the lesson. These were identified as integral to the nature of the interaction. Questioning could be considered to be either open or closed, involving either higher or lower order thinking.

Respondents made particular references to specific features of the IWB and, in addition to field notes taken during observation; it was possible to construct another heading that related to 'The Distinct Characteristics of the Technology'. Features identified

included the potential to save, retrieve and edit digital material, and the speed at which a vast library of materials could be accessed and utilised.

Elements within these headings were, in many instances, interconnected. For example, the 'Distinct Characteristics of the Technology' eg, visual imagery, was also related to both 'Enhanced Learning Experience' and 'Maintaining Attention'.

The following reflections relate to the aforementioned headings and highlight the substance of specific events discussed with respondents and observed during the course of a lesson.

Such features as clip art images and photos, sound, animations, video and hyperlinks were all commented on by the teachers interviewed as elements that served to enhance their teaching. They felt that the use of these features helped to capture the children's attention, maintain their concentration and motivate them to learn.

As one year 3 teacher noted, 'It's fun and motivating for the children… . They seem to focus more.' A student teacher also stated that, 'They [the children] just concentrate for longer because there is something to look at which is colourful and bright—they really seem to like this, especially if it moves and makes a sound'.

Some teachers and student teachers highlighted the fact that good visual resources supported the 'visual learners' within the class, and that those images displayed on the IWB were often of better quality than alternative resources such as overhead transparencies, posters and photocopied worksheets. In their view, this improved the quality of pupils' learning. Both teachers and students felt that the IWB and associated software enabled them to create '*lively and exciting lessons*', drawing on video clips, photographs, animations and text from a variety of sources.

All of the individuals interviewed highlighted the vast range of software and digital resource material available to them. This included materials accessed via the Web and from inbuilt resource banks located within proprietary software. In addition to this, some software companies are designing and creating software that is specifically designed for use on the IWB. As one respondent noted:

> There are so many resources you can use from the resource bank as well as the massive amount on the World Wide Web. (Year 6 teacher)

It could be argued that these teachers are 'teaching creatively' by being imaginative in selecting and using resources to make their lessons more interesting, exciting and motivating for the pupils. However, the question arises as to the nature of learning that is taking place; to what degree are pupils' simply passive recipients or actively engaged in their own learning? As pointed out by Jeffrey and Craft (2004) when referring to the work of Woods (1990), providing children with the opportunity to gain ownership and control of their learning may encourage innovation. Indeed, in one literacy lesson,

which encouraged children to explore their own imagination and experience with regard to visual images of settings, the teacher facilitated a productive and lively discussion among the class. In this instance, pupils actively sought to extend their vocabulary and exchange ideas which were woven into descriptive phrases and sentences. In comparison, a lesson with a similar focus involved a paragraph with adjectives removed. The adjectives were displayed at the side of the paragraph and the 'correct' word moved into position. There was limited interaction and the pupils appeared to be far less engaged in their own learning. Similarly, in a mathematical context, pupils were presented with a commercially created activity that required the individual operating the software at the IWB to select the correct answer to a number sentence. Upon selection, the appropriate answer triggered animation and sound as a reward, which amused the class. Such activities were often favoured by teachers because of their motivational impact, and were generally regarded by interviewees as useful for consolidation purposes. One teacher highlighted that such material had a 'more professional look to it' than anything they could produce, and was therefore of 'better quality'.

Aspects of direct teaching such as modelling and demonstrating were supported by carefully selected multimedia resources including commercially created software. However, unless resource material and software is selected and used with a view to enhance and support teaching and learning through pupils being actively engaged in their own thinking and learning, and not to simply acquire knowledge and skills, then the full potential of the technology and the teacher's expertise is not exploited to the extent that it perhaps could be, and the children's learning is not maximised. Observations indicated that where teachers did not seek to engage children in higher level thinking through process-oriented discussion, the children generally took a somewhat passive role as learners. They seemed to be engaged by the colourful graphics and the movement of visual elements, but opportunities to develop a more interactive approach, stimulating discussion through open and probing questioning, were not fully exploited by the teacher. In effect, where multimedia resources and materials were used to replace the teacher through the display and transmission of information, learning appeared to be a matter of routine, with opportunities for interaction and discussion limited. For example, a multimedia program designed to support children in telling the time posed the questions and provided feedback if children selected correct or incorrect answers to closed questions. The software had effectively become the teacher, with the class teacher acting as intermediary between class and program. In this instance, the software controlled the direction of the lesson. Similarly, where a commercially created literacy game was used, the teacher was merely the conduit through which children provided answers to closed questions posed by the program. By way of contrast, one teacher had created their own set of resources by using proprietary software. The teacher concerned indicated that this allowed them to control the shape and the direction of the lesson. Here, highlighting tools and reveal options were used to focus attention while the teacher directed a variety of questions that encouraged children to explore and create their own ideas and points of view (Cardellichio & Field, 1997). In this instance, opportunities were given for children to discuss in pairs and groups, with some individuals modelling their ideas during whole-class discussions at the IWB itself.

The key focus in this session was the children's active and creative engagement with their own learning, with the teacher maintaining, encouraging and developing a dynamic learning environment, hence, creativity found expression in complementary ways with the teaching approach and the technology together providing a suitable and effective learning opportunity.

Alongside the range and the variety of resources, teachers were particularly positive about the way in which the IWB enabled the pace of the lesson to increase. A year 5 teacher commented that 'It's so easy to move from one thing to another and this keeps the pace going.' The speed at which resources could be selected, modified and navigated increased the pace of the lesson, however this did not always seem to lead to the facilitation of higher order thinking skills. This was either because the speed did not equate to the time required for children to reflect upon the material presented or because teachers felt that they needed to maintain pace and effectively generated a set of 'quick fire' closed questions. For example, during one maths lesson, the activities designed to support children's understanding of number were presented in a relatively short space of time. This appeared to leave the children somewhat bewildered and unable to complete the associated work that followed. Again, the role of the teacher is instrumental in maintaining an appropriate pace to ensure children are challenged and yet not confused by the speed of delivery. Particular features that allow teachers to maintain and increase the pace of a session may be seen as being specific to ICT as a whole. For example, the ability to save, edit and retrieve work allowed resources created to be used and reused with any editing and annotations stored separately as and when required. This particular feature was identified by all participants during discussions, and recognised as a time-saving facility. For example one teacher noted that 'once it's made it is there and you don't have to do it again.' While a student teacher suggested that 'It doesn't matter if you make a mistake you can just undo it!'

One of the more revealing statements came from a year 6 teacher with many years experience, who remarked that they liked the IWB because they did not have to change the way they taught. Observations of this teacher's lessons indicated that the preferred mode of teaching involved a whole-class, direct transmission-based method, with a preponderance of closed questions, which appeared to test children's ability to recall facts and information previously presented to the class by the teacher.

The question arises as to whether the IWB is presenting teachers with new opportunities to engage children in the process of learning or whether it merely replaces pre-existing presentation devices such as the conventional whiteboard or, prior to that, the chalkboard or blackboard, and reinforces teachers' established modes of teaching. The issue of the IWB's role therefore does not lie within the technology itself, which can complement and support the teacher's preferred mode of teaching, but brings into question the style and approach adopted by the individual and therefore the pedagogic philosophy that underpins a teacher's course of action and interaction.

Conclusion

This study appeared to highlight the way in which the IWB could support a teacher's preferred style of whole-class interactive teaching. In general, all of the individuals

interviewed and observed felt that the IWB had enhanced whole-class teaching and learning. Indeed, features of the IWB and the associated software do support this teaching approach. Speed of operation and the quality of media accessed, with the teacher positioned at the face of the board, are all aspects that were specifically identified by the participants. In many ways the functionality of the IWB could be viewed as a modern technological version of the traditional blackboard. Aspects of direct teaching such as explaining, modelling, directing and instructing are all facilitated by the IWB, or more specifically, by the software, which is accessed via a large screen presentation device. However, with regard to creative teaching for creative learning, a more fundamental question seems to have arisen, which relates to pedagogic practice. While initially this study intended to focus upon the way in which the IWB could support whole-class interactive teaching, it became increasingly apparent that the teacher's interpretation of whole-class interactive teaching itself was the primary factor in developing materials and opportunities for children to engage with their own learning. In terms of creative teaching, it is essentially the teacher who determines what resource to use and how it will be utilised. The quality and clarity of multimedia resources may offer enhanced visual material for presenting to a large audience, and the teacher is able to move between varieties of electronic resources, with greater speed in comparison to nonelectronic resources, with opportunities to edit, record and retrieve data represented. In this way, technologies such as the IWB, which utilise the power of ICT, may be transformational to pedagogic practice. However, as with any resource, it is perhaps the context and the purpose that remain the most influential factors with regard to developing children's learning.

Creative teaching for creative learning is not merely a question of presentation, whether by teacher or child, rather it is the teaching and learning strategies that determine the potential for creative learning. Furthermore, creative teaching, which aims to develop pupils' own creative thinking processes, could be said to move the focus away from the teachers' delivery and towards the pupils' learning. The range of constructivist strategies suggested by Cardellichio and Field (1997) may encourage metacognitive activity, and highlight the way in which creative teaching and creative learning are interrelated insomuch as the strategies a teacher selects will ultimately determine the opportunities children have to become creative learners.

Presentation technologies such as the IWB may be used to support teaching *for* creativity. The immediacy and adaptability of ICT encourages the testing of ideas through a process of hypothesis, analysis and reflection. Similarly, teachers are offered opportunities to design, create and employ digital resources that demand creativity in teaching with a constant and mindful eye upon the learning experience. In this respect, the view expressed by NACCCE that '…education must enable young people to engage positively with information technologies: to know how to use them, and to explore their potential in creative thinking and action' (NACCCE, 1999, p. 54) would apply equally as well to both pupil and teacher alike.

With a growing number of 'ready-made' electronic teaching resources created for the large screen, it is possible that a teacher may be controlled by the design of the software

rather than the reverse. This was evidenced during observations where the teacher appeared to take on the role of software operator; acting as a human conduit between class and software. Certainly, the development of resources designed for the IWB screen and based upon social constructivist theory would greatly enhance learning and teaching opportunities. Creating their own multimedia teaching resources provides the teacher with the greatest control in the design and use of electronic material. However, the design of the software alone does not automatically lead to opportunities for creative learning. There are clear implications for teacher educators and school leaders when introducing technology such as this to the repertoire of teacher resources. These include fusing technology with pedagogy to ensure that teachers are not merely equipped with the resources and technical capability, but also have a clear understanding of children's learning and how this may be facilitated within whole-class lessons. Furthermore, teachers may also need to engage with ICT, not only at the level of consumer, but also at the point of design and development. Creative teaching is not solely the evaluation and use of existing electronic resources within the confines of the classroom. To be truly transformative in terms of pedagogic practice, professionals in education need to consider the potential and evolution of ICT and engage in debate at the point at which ideas for educational technology are generated.

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