Interactive whiteboards as artefacts to support dialogic learning spaces in primary schools

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Abstract

The interactive whiteboard (IWB) is a technical digital medium for multiple forms of interaction - technical, physical and conceptual. It is a point of departure for this article that the IWB has the potential to support learning, given that the teacher has a dialogic teaching style. Our research is embedded in a social constructive learning philosophy implying that interaction between learners as well as learners and teacher will lead to increased insights for everyone. Dialogue is seen as a characteristic of education, but not all learner talks are dialogic; there are different types of pupil conversations - competitive, cumulative or exploratory. It is in particular the exploratory talk that has the ability to increase learning through interthinking and thus create a dialogic learning space. The article reports findings from a study of 7 primary school teachers and their use of the interactive board. The main findings are that they do not use the full potential that the IWB gives to support collaborative learning. We discuss what teachers need in order to develop their practices to exploit the potential of the IWB for creating a supportive dialogic learning space.

Keywords: Interactive whiteboard, dialogic space, talks, primary school, teacher learning

Introduction

Whole class learning is back on the educational discussion scene in Norway (Klette 2004). It is a reaction to the increasing degree and the kind of individualisation of learning that has been developing over the last few decades. This individualisation of the classroom has been reinforced by the introduction of computers to every learner in many classrooms (Bachmann &

Haug, 2006). Various forms of individual development plans, work plans or other 'self technologies' as practiced in many schools, also go a long way to systematising the individualisation of learning at the cost of the learning community and socialisation (Klette, 2007). Much of the introduction of new technology in the classroom has been technologically rather than educationally driven (Mercer, Warwick, Kershner & Staarman, 2010). A wide range of research findings indicate that both the teachers' role and their pedagogic practice are critical factors for the successful implementation of ICT-supported learning processes. The implementations of such processes should focus on enhancing the understanding of the interaction between teachers, learners and the technology (Wikan, Faugli, Mølster & Hope, 2009).

The question is how a learning community in the classroom is best promoted, and whether and how digital artefacts can be useful in this respect. The challenge is to create an arena for learning by providing today's learners with all learning materials that are currently available, including digital ones. Smith, Hardman & Higgins (2006) find that the use of IWB means that more time is being spent on whole class teaching and less on group work. But it is up to the teacher to take a central role in determining how IWBs are used, and this is mostly in accordance with the teacher's existing practices. Without intervention an IWB in the classroom does not change the teachers' overall pedagogical approaches because it is the teacher and not the tool that has the agency. This applies not only to IWBs, but also holds true for most technologies (Bennet & Lockyer, 2008; Warwick et al., 2011).

In the present study we ask what happens when a digital artefact such as an interactive whiteboard is introduced in the classroom. How are teachers using the interactive potential of IWB? Further, we discuss how this artefact can stimulate learning through dialogic teaching. We also briefly ask how teaching styles may be changed through continuous professional development.

The dialogic space

The dialogic space is not to be understood as a physical space, but as the social entity in which one can think and interact. In education, the dialogue[i] is not just a means but an end in itself, since education involves a shift from monological to dialogic thinking (Wegerif, 2007). Mercer et al. (2010) are studying learners' opportunities for learning in interaction by interacting with others, and they note that certain forms of digital technology can be the instruments for such learning. They use dialogic space (Wegerif, 2007) as a term to describe the arena for the common learning activities. They argue that interactive whiteboards have the potential to support the creation of dialogic space. Mercers own research has shown that with proper guidance learners can learn not only to interact, but to 'interthink' (Mercer, 2000). 'Interthinking' means more than just interacting; it means developing joint understanding of curriculum topics. In order for this to take place pupils need to develop their talking skills. Thus, 'interthinking' is a characteristics of the dialogic classroom.

In dialogic teaching the teacher

1) Gives students opportunities and encouragement to question/ state points of view and comment on ideas and issues which arise in the lessons;

2) Engages in discussions with students, which explore and support the development of their understanding of content;

3) Take students' contributions into account in developing the subject theme of the lesson and in devising activities which enable students to pursue their understanding themselves, through talk and activity;

4) Uses talk to provide a cumulative, contextual frame to enable students' involvement with the new knowledge they are encountering;

5) Encourages the children to recognise that talk is not merely the prosaic chat of everyday life but is a valuable tool for the joint construction of knowledge. (Mercer et al., 2010:369-370)

In the dialogic classroom it is essential to encourage children to talk and discuss, but *how* the learners talk is not irrelevant. Mercer et al. (2010b) distinguishes between three different types of talk; exploratory, disputational and cumulative talk. Exploratory talk is the most effective for collective problem solving. In the exploratory talk learners share all relevant information, and they are critical and constructive. They are active, ask each other questions and listen to other people's answers in calculating in order to arrive at a common result. In science education the way several aspects of exploratory talk influence learning outcomes positively has been documented (Howe et al., 2007). Disputational talk is the second type of talk. According to Mercer et al. a characteristic of this style of talk is that learners do not share relevant information, but rather compete among themselves according to their individual interests.

According to the authors this conversation form is not associated with inclusive or cooperative behaviour or with good learning results. The third talk type of talk is cumulative talk. This includes, for example, 'brainstorming', which can be helpful in introducing a new theme. The aim is to facilitate exploratory conversation in the classroom. This talk is friendly and co-operative, but lacks the critical-constructive perspective inherent in of exploratory conversation. Some researchers find that also cumulative talk is important because it allows a variety of opinions to be expressed, and, in the case of classes with special needs children in particular, this might be the most one can achieve (Warwick, Hennessy & Mercer, 2011). Through their studies in science Mercer et al. (2010) show how, under certain conditions, the use of interactive whiteboards has a potential for creating a dialogic space through the support of exploratory talk. However, in order to achieve a learning community where the IWB supports learning, it is necessary to develop "'talk rules' for conversation and collaborative reasoning" (Kershner, Mercer & Warwick, 2010 p. 381).

How can interactive whiteboards support the dialogic space?

Interactive boards are sold by manufacturers as a technical aid with the capacity to increase interactivity in the classroom situation. The board offers the teacher easy access to sources and a flexibility to support and investigate ideas that come up during lessons. "Its particular affordances offer strong support for cumulative, collaborative and recursive learning. Its effective use by teachers can provide appropriate scaffolding to help create knowledge through opening up dialogic space" (Hennessy et al, 2011:483).

Studies that have looked at the way interactive whiteboards are used by the teacher in the classroom indicate that there is an analytical distinction between three types of interactivity: technical interactivity, physical interactivity and conceptual interactivity (Mildenhall, Marshall and Swan, 2010). Technical interactivity means that it is the teacher who uses the various interactive opportunities of the board. It may help learning by making the lessons more interesting (Kennewell, Tanner & Beauchamp, 2008). Physical interactivity

means that learners are invited forward to touch the board, write on it etc. Conceptual interactivity means that through this technology learners support each other alongside the teacher (scaffolding), interact, share and construct understanding together (Mercer et al., 2010b). Sundberg, Spante & Stenlund (2011) differentiate between technical interactivity and pedagogical interactivity, and conclude that teacher training should include both technical instruction and pedagogical options in order for the teacher to be able to fully exploit the potential of the technology.

Without a conscious focus on using IWBs to promote interactive teaching, research shows that they are only used to support existing pedagogy, and that traditional patterns of classroom interaction persist (Beauchamp, 2004; Blau, 2011; Twiner, Coffin, Littleton &Whitelock , 2010; Wikan & Mølster, 2010). It is easy for most teachers to incorporate them into existing practices, such as in the case of teacher-guided instruction (Digregorio & Sobel- Lojeski, 2009 - 2010; Smith, Hardman & Higgins, 2006). However, even this can improve learning outcomes since it increases motivation. The effect of this is probably only temporary and it is the teacher's responsibility to integrate the use of the board so that it also stimulates intellectual involvement (Jones, Kervin & McIntosh, 2011).The impact of IWB as well as of other types of digital technology and learning material depends on the teacher's ability to utilize the potential to stimulate learning (Kennewell & Beauchamp, 2007). However, it has been observed that the IWB technology is so flexible that it makes it possible for the teacher to create a space for investigation and dialogue more than do other technologies (Mercer et al., 2010). To create such a learning environment teachers must be willing to allow learners to take control of the technology (Gadbois & Haverstock, 2012). In addition to the boards there are also a number of contextual factors that should be borne in mind. It is essential to have a school culture that supports dialogic learning, teacher training is important, and time is important - it turns out that it takes two years before a teacher can fully exploit the interactive potential of the technology (Hennessy, Mercer &Warwick , 2011; Deaney, Chapman & Hennessy, 2009; Warwick & Kershner, 2000).

Methodology

The design of the study was a mixed qualitative methods approach. Classroom observations and teacher interviews were carried out in 6 Norwegian primary schools (cf Thagaard, 2003). Photographs were taken to provide contextualising data (cf Hennessy & al., 2011). We visited 8 classrooms in the 6 schools, which were recruited through an open invitation among schools connected to the teacher education programme in our college. As far as IWB use is concerned, the sample included experienced and less experienced teachers. The majority had undergone some formal training in the use of the technology, but usually very little. 7 teachers were interviewed, one male and 6 female. In the presentation of findings all informants are referred to as female in order to maintain anonymity.

For the classroom observations an instrument based on the "Student Membership Snapshot" (Rivers, Ferguson, Lester & Droege, 1995) was developed. Categories for different types of IWB use and learner talk were included in the instrument: Technical, physical and conceptual interactivity as well as disputational, cumulative and exploratory talk. This allowed easy identification of the frequency of the various forms of interaction. The duration of the each observation was usually of one to three hours, and the data collection took place throughout the autumn term. To supplement the observations the teachers in the observed classrooms were individually interviewed afterwards in a semi-structured interview according to an interview guide. Some of the teachers responded to the questions by e-mail

instead of being interviewed face-to-face. In the analysis all school and personal data have been anonymised. No person is identifiable on pictures shown in public.

Findings

In the following our findings are presented according to the different types of interactivity with the IWB; technical, physical and conceptual.

Technical interactivity

Most of the lessons we observed started with the teacher in front of the class and in charge of the interactive white board. The use the teacher made of the board and the extent to which she/he invited the pupils to talk varied. The following example is typical.

Lesson 1

> The lesson starts with the IWB switched on and it is a whole class setting. On the screen the pupils' names are visible. Each pupil is invited to step forward, find her/his name and drag the name into the "present today" box. Everyone is concentrating on the board. Next phase: the teacher is at the board – date, season, morning song are on the board. She asks questions to which the pupils respond. Today's learning objectives are opened on the screen. The teacher is at the board talking and presenting the lesson. She is checking on the pupils' understanding by asking questions. Sometimes she asks the whole class, sometimes a specific pupil. The pupils are competing to answer;– there is no discussion between them or between teacher–pupils. The teacher is also preparing and explaining the group work which will be coming up. All the pupils are seated and appear to be concentrating the teacher, the board and the topic of the lesson during this sequence, which took about 20 minutes (2nd grade).

The lesson by this experienced teacher was well planned and carried out. Most of the pupils stayed concentrated and were motivated both in the whole-class setting and in the group work. The teacher was largely engaged with white board activities that had been planned for a whole-class setting. Occasionally the pupils were invited to approach the board and touch it to indicate the answer. They were not challenged to discuss or find solutions as a class or as a group. The talk took place between the teacher and the pupils.

Physical interactivity

In most of the lessons we observed physical interactivity was an integral part of the lesson, meaning that pupils were invited to approach the board and touch it. Lesson 2 shows a typical example of this. It is the teacher who is in charge of the activity – she asks questions and those pupils who respond are invited to come and drag or touch the right answer.

Lesson 2

> The lesson starts in a whole-class setting. The pupils are sitting in a semi-circle in front of the teacher and the IWB. The teacher uploads songs and they all sing together a literacy song. Then she loads up a blank lined page on the screen and asks the pupils to come up with words containing the Norwegian letter Ø. The pupils answer individually, while the teacher

writes on the board. Next she uploads up a program from the publisher of the text book –a text about the letter Ø- and, the pupils listen. A new page is uploaded by the teacher,; she asks the pupils to take turns to come up to the board and find the correct answer. They are listening and watching tentatively and sitting very quietly. This was a long sequence that lasted 40 minutes. The whole classes then were setting ends with the teacher demonstrating on the board the tasks to be carried out in the pupils' individual exercise books. The remainder of the lesson consists of individual work. (1st grade).

This lesson was in grade 1 (6 year olds) and it was obviously very motivating for the pupils to have the IWB in the classroom. These young pupils stayed concentrated for almost 40 minutes. The teacher is very much aware of the motivating effect of the board – it is motivating for the pupils to be allowed to come forward and touch the board. There is a great deal of readymade learning material she can use, as demonstrated in the observed lesson 2. Much of this learning material is colourful and lively, and combines figures, sounds, letters and short movies.

Lesson 3

Present in this lesson is a group of 10 pupils considered to be low achievers. The subject is Norwegian, and the exact topic adjectives. The IWB is switched on before the pupils arrive and it immediately catches their attention. The pupils listen to the teacher's questions (right or wrong answers) and raise their hands. All pupils then come up to the board in turn and give examples of adjectives, opposites etc. Next, they write sentences on the board. The teacher saves the text for use the following day. Finally the pupils write the sentences in their exercise books. As a treat towards the end of the lesson a wheel of fortune appeared on the screen, and each pupil chose a task. All the pupils seemed active and concentrated in this 45 minute lesson (5th grade).

Lesson 3 exemplifies how technology can be used in adapting to learners with below average learning capacity. Several of the teachers emphasise the potential of IWB to motivate pupils with a broad range of individual capacities, including learners with a language minority background or special educational needs.

Conceptual interactivity

We have observed much technical and physical interactivity and hardly any conceptual interactivity. Typically, the teacher is in charge of - and much of the time in front of - the interactive white board. In a whole class setting learners are often asked to come forward and touch the board and find and/or drag the right answer into position. We have also observed more active physical interactivity during station work. However, being divided into smaller groups did not help the learners to collaborate better; we did not overhear any spontaneous discussion between the pupils in order to solve a problem. In one situation we did observe that the teacher tried to encourage pupils to cooperate in order to find a solution; however what we observed was closer to competitive rather than collaborative talk.

Lesson 4

The teacher is in front using the IWB to talk the pupils through the stations work that is coming up in groups. She is not trying to elicit a dialogue with the class or individual learners. The stations work starts.

> One of the stations is in front of the IWB; the teacher stays at that station. On the screen there is now an interactive programme and the learners have to find the correct answer to each question. The teacher leads-this by requesting the correct answer; she mostly addresses pupils by name. The pupils are allowed to touch the screen and drag the correct answer into the right position. In the case of one group she asks the group members to discuss and find the correct answer before one of them approaches the board. They do discuss, but it is more of the form of competition than listening to and building on each other's ideas (5th grade).

The teacher in this class tells the pupils that " We can also find out about things that come up in class on Google right/straight away – like what Siamese twins are like" – as they had done the other day. In this case there was a cumulative search for facts, but probably not exploratory talk in Mercer's sense of the notion. Closer to that is the following account from another teacher:

> Whenever I work with the IWB, I ask the children to explain to the class or to their friend how they are thinking about the answer they are about to give, especially in the case of mathematics. Since children think and explain in different ways, listening to others may cause new insight - Eureka! (3rd grade)

But this example is the exception. In our material there is no trace of a longer dialogic sequence of 'interthinking' between learners, prompted by the IWB. One of the teachers explicitly stated that this was not the way she used the board. It should be noted that in our limited inquiry we did not ask how the teachers might attempt to stimulate common exploration in other ways than by use of the IWB.

The teachers' views of the potentials of the IWB

We asked the teachers to evaluate the usefulness of having access to IWB in their classroom. Most teachers said that an IWB in the classroom enhances learning outcomes because it enables the pupils to stay active and obtain instant feedback either from the board or from the teachers. And they said that it is different from PCs. The PC is for individual use, whereas the IWB supports group work or whole class learning. Thus a group or the whole class can work together to find a solution to a problem. One fairly new IWB user also recounted how the children helped her find out about the use of the board.

According to some of the teachers the IWB gives excellent opportunities to support learning in different modalities, both in teacher-centered and learner-centered learning styles. This is another advantage over individual use of PCs. The board lends itself to cooperation, problem solving and encourages pupils as producers of knowledge, not just consumers. "IWBs have the potential to support enhanced learning because I can visualize, I can concretize, I can support pupils in taking active part in the lessons and they can learn to cooperate", says one of the teachers. She continues:

> Another advantage of the board is that it actually helps to keep the focus on the one item that is on the IWB; in that way it helps me to keep the pupils concentrated on the same object. And it supports different learning styles. The board challenges me to plan more for learners to be active and cooperate during the lesson in order to solve problems. Thus, my lessons in classrooms with interactive boards differ from classrooms without them. I find that planning lessons takes longer than it did before. This is especially true when I need to create my own learning material.

We did observe that the learners stayed active and were motivated, though cooperation between learners was limited. But from the comments we acknowledge that some of the teachers see that as a potential.

One of the teachers compares teaching in a classroom with IWB to taking the learners out of the classroom. She argues that with IWB she can show concrete examples, such as pictures, and the learner can "feel" the subject by touching the screen.

Most teachers say that they use IWB in all subjects and all classes. However, some find it especially useful in mathematics, social science and initial literacy teaching. According to our informants these are all subjects that allow teachers to be concrete, give many examples, and showpictures and films that are useful in order to enhance learning. In these subjects there is a great deal of available pre-made learning material for IWB produced by the text books publishers. For instance in counting the children can start with concrete blocks, "then I can open the interactive board and show the same blocks and the learners can touch and drag to find the right answer", one of the teachers explained. We would call this modality semi- concrete. Lastly, the pupils can solve the same problems in their exercise books. By sequencing the lesson in this way, all the pupils' senses are challenged. In the lower grades it is very important to use a variety of modalities and therefore the board is extremely useful in these grades. When working with such young pupils, it is important to be as concrete as possible, : they must feel, see, smell and touch, as one teacher put it. She continued: "And I do think that that is what enhances learning, not the IWB. However, the IWB allows for more varied lessons and it is also an easy means to help angle the lesson differently and motivate the learners to stay focused". "IWB has become indispensable, and I would feel totally helpless without it", as another teacher commented. The most frustrating aspect is when the technology fails, as sometimes happens! Even so, all interviewees – experienced in IWB use or not - were enthusiastic about this artefact in the classroom.

The board works well in all grades but is by our informants seen as especially appropriate for the lower grades as it allows the option of including the learners in the lessons in various ways. However, since it is so flexible it can be used at all grades and thus it is easy to adjust to different individual or group needs, according to the teachers. It also works well in an inclusive perspective to support individual learners' needs. The technology catches the children's attention - for instance using something from You Tube - and because you can adapt it to different needs. And, it is motivating with the physical activity/touching. So "IWB is particularly useful for low achievers. They stay calm if they know that they will have their turn. The reward is a song or something in the end". According to many of the teachers, IWB supports learning because it gives pupils a sense of mastering and it teaches the learners that it is OK to get up in class and that you will have a new chance if you fail. Therefore it is very useful seen from an inclusive perspective.

To sum up, the teachers are happy about having an IWB in their classroom and they find it useful in enhancing learning. They use various sources of learning material, prefabricated for school subjects on the web, from publishers, from the board, from colleagues as well as creating their own learning material. Initially, planning the lessons with IWB was more time-consuming but after a while it really does save because they can use much of the same materials over again and it is easy to transfer learning material to a new setting, new subject or grade/group.

IWB and the dialogic space - a discussion

The question we set out to explore in this article was: Do primary school teachers use interactive white boards as artefacts to support dialogic learning spaces? In this study the typical lesson we saw in Norwegian primary school classrooms involved a great deal of technical interactivity and some physical interactivity – and very attentive children. But we only observed one situation where the teacher tried to stimulate dialogue between the learners. However, from the interviews with the teachers we noticed that some of them had the dialogue as an aim and saw the potential that the IWB had to help to stimulate the dialogue.

We noted above that IWB use tends to continue traditional teaching patterns. Many of our observations seem to fall into the well-known whole-class structure of IRE: *initiation – response – evaluation* (Bellack, Kliebard, Hyman & Smith, 1966). A typical pattern is that of the teacher starting by asking a question, not an open-ended question, but one with a correct answer, leading to an answer from one or more pupils, and then the answers are evaluated or followed up by the teacher. In this way the partners take turns in the classroom talks. However, this didactic model has been heavily criticized for its teacher dominance. A rule of 2/3 was shown by Bellack et al. and also later researchers, implying that the teacher was speaking 2/3 of the time. According to Sahlström (2012) the relevance of this criticism is reduced by the fact that only half of the lessons observed in recent Nordic classroom studies were whole-class teaching. Often combinations of different models were observed in the same lesson – whole-class teaching in combination with individual or group work, just as we found in our inquiry. So, in many lessons the pupils actually talk a lot more than the teacher. In fact, in studies of Norwegian classrooms the role of the teacher has been found to be vague and non-intervening, and voices are raised to call for more whole-class teaching (Klette, 2004).

It should be noted that when an excessive usage of individualization strategies in Norwegian classrooms is challenged, we do not believe that an increased traditional teacher dominated IRE whole class approach is the answer. In order to support a genuine dialogic space we argue that the quality of the conversations in the classroom is the essential issue.

But it is incorrect to maintain that the only effect of interactive boards in the classrooms observed is merely to support traditional teacher-oriented teaching. We saw young pupils who were very motivated; they stayed concentrated on school work for longer period than might have been expected and we did not observe any pupils dropping out. The IWB seems to be helpful in keeping the pupils focused and in keeping the class together. We also observed the same beneficial effect when used in situations with pupils with learning difficulties. According to the teachers, the IWB helps to differentiate the lessons and reach all pupils irrespective of ability, even the young and marginal learners and those from a language minority background.

To sum up, the use of IWB for motivating and activating pupils is frequent and much appreciated in most subjects and at all ages in the primary schools we visited. The inclusive potential of the IWB as a focus for common experiences for very diverse pupils was also emphasized by most of the teachers. This is valued in a country where about 97% of pupils aged 6-16 attend the same mixed ability state school, without any permanent ability grouping or streaming. Instead, the pupils are entitled to adapted education in heterogeneous classes.

However, our classroom observations and the interviews with the teachers reveal that the potential of the IWB to help establishing a dialogic space is not

being exploited. Only to a very limited extent did we note an awareness in the teachers to encourage pupils to ask questions or to contribute in some way by giving their opinions. We did not see teachers actively using conversation to create a framework for pupils' involvement in the acquisition of new knowledge, cf the list of 5 points in Mercer et al. (2010b) cited earlier. In the interviews most teachers did not express recognition of the importance of talk as a tool for the co-construction of knowledge. We noted what most researchers have observed, namely that the IWB does not in itself create dialogic spaces. It is only the teacher who can help to establish this, and this, in turn, would probably require specific teacher training. In order to develop the dialogic space, the teacher must plan, perform and involve the learners in dialogic talk.

However, it is not easy to bring about a change in teaching and learning styles. According to Guskey (2002) in order to succeed one must be aware of the fact that teachers only change their way of teaching when they have experienced that the "new" style is more effective in reaching their objectives. Inviting interested teachers into a participatory action research project might help them to explore, master and develop a new teaching and learning style which exploits the interactive potential of the IWB (Kemmis & Mc Taggart, 2005). Nes and Eriksen (2009) argue that classroom action research is supplemented by input of relevant research-based knowledge as this will support development in the desired direction. A possible point of departure could be to establish a 'dialogic learning space' outside the classroom where teachers and researchers are welcome to share experiences and, hopefully, prompt 'interthinking' and exploratory talk.

To support teachers – and faculty - who wish to develop practice and theory various models exist to be considered for participatory research or co-inquiry between practitioners and researchers. Examples are *network learning* across schools (Veugelers & O'Hair, 2005) or the *workshop model* suggested by Hennessy et al. (2011). Both models have been tried out successfully as digital innovation strategies in schools, cf for instance Lund (2011). In any case, the participants must be aware that this is a long process which should be seen as part of continuous professional development.

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[i] The concept of dialogue is used in many ways and in many traditions - a discussion we will not enter into here, cf for instance Dysthe (2001). By dialogue in our context we refer to the interactions/negotiations between learners and teacher-learners in developing knowledge, acknowledging different voices (cf Bakhtin 1998).