

Text Competencies and Interaction in Technology-Enhanced Classrooms

Enriching and Developing Subject-Didactics with Interactive Whiteboard in Focus



October 2011

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Final Report Nordic SMART – Sweden

Preface

Nordic SMART School Project was initiated in August 2010 in Sweden on the initiative of Roskilde municipality in Denmark as a development of the project "IT - a school for everyone" at Absalon school in Roskilde, researchers at Roskilde University and University College Sjælland during the school year 2009-2010. Schools and researchers in Sweden and Norway were invited to the project during the school year 2010-2011 for a development of a broader and Nordic experience. In Sweden attended two schools in the municipality of Uddevalla and researchers from the University West, and in Norway a school in Drammen municipality, Vestfold University College and the Centre for IT in Education. SMART Technologies in Canada, producer of the interactive whiteboard "*SMART Board*", in cooperation with local suppliers *Solutors* (Denmark) and *NetSMART* (Sweden) co-funded the project in the form of hardware, i.e. SMART Board and introductory courses.

The overall aim of the project was to study how students learn by using new digital tools such as an interactive whiteboard in the classroom and to develop, test and implement new teaching methods in the subject of Swedish and mathematics. There was also an interest to study inclusion and how a digital learning environment affects students' motivation.

Special thanks to the teachers at Herrestad and Forshälla schools in Uddevalla for their effort and commitment to the project and giving us the opportunity to observe their classrooms and time for discussion and development in the project. Many thanks also to the participating students and the school management.

Many thanks to the project organizers at Roskilde municipality and Absalon school in Denmark and SMART Technologies in Canada. Many thanks also to the University West, Uddevalla municipality and NetSMART, who have made the project possible in Sweden. Special thanks to all the teachers and researchers involved in this Nordic cooperation from Absalon school and Roskilde municipality, Roskilde University and University College Sjælland in Denmark; Gulskogen school and Drammen municipality, Vestfold University College and the Centre for IT in Education in Norway.

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October 26, 2011

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Introduction

Investments in technology implemented today in schools in Sweden to support and develop learning are aiming at increase in computer density and involvement of various forms of artifacts such as interactive whiteboards, e-readers, learning management systems, etc. Several studies and reports show that innovative pedagogical approaches with active and experience-based learning with Information and Communication Technologies (ICTs) provide opportunities for more varied and individualized instruction and increase students' motivation to learn (see EACEA/Eurydice, 2011; Hylén, 2010; Condi et al, 2007; Passey et al, 2003). At the same time reports from TIMSS (2007)¹ and PISA (2009)² reveal, that while most students have access to computers at school, the application is limited in many school subjects, both in terms of use and teaching content. Above all, it is unusual to use computers in mathematics, science and language teaching.³ The school subjects where technology is most used in Swedish schools is Swedish and civics. The most common use is, according to students, collecting facts and information, and text production (Skolverket, 2010c). The results show that introduction of new technology creates no new teaching in itself in the classroom and that there is a lack of pedagogical principles to support teaching and content of subjects.

The use and integration of ICT in educational settings is influenced by several factors at various levels, where the teacher's attitude to and skills in ICT, the objectives and strategies established, and the availability and functioning technology has proven to be crucial (see Kozma, 1991; Riis, 2000; Cuban, 2001; Alexandersson et al, 2006). Similar results also apply to the introduction of interactive whiteboards in the teaching process, where for instance a Swedish study shows clearly that the teacher's attitude and skills strongly influence whether and how the interactive whiteboard is used in teaching (see Sundberg et al, forthcoming).⁴ The implementation process is according to several studies time consuming and complex in that a new tool is introduced in education and requires the school to support the teacher's professional development and technical support (Sundberg et al, forthcoming; DiGregorio & Sobel-Lojeski, 2010; Holmes, 2009; Higgins et al, 2005). The special thing about using interactive whiteboard in teaching is connected primarily to the board's interactive and immediate opportunities that promote authentic, dialogic teaching and collaborative learning. Students are motivated by the active and participatory approach and the teachers appreciate the flexibility of the tool that provides them a support in planning and the opportunity for creating own lesson materials (Smith et al., 2005). The disadvantages or negative effects reported are the costs for installation of the boards and classroom practice where teachers return to

¹ TIMSS (Trends in International Mathematics and Science Study): an international review conducted since 1995 under the auspices of the International Association for the Evaluation of Educational Achievement (IEA) for the Evaluation of Educational Achievement.

² PISA (Programme for International Student Assessment): an international investigation led by the OECD in 65 countries around the world to measure the performance of pupils aged 15 in reading, mathematics and science.

³ More than 90 percent of students in elementary and secondary schools in Sweden say that they never use computers during lessons in mathematics (Skolverket, 2010c).

⁴ Investments and research on the use of interactive whiteboard has mainly been carried on in the UK (e.g. Higgins et al, 2005; Wall et al, 2005) and later also in Australia, South Africa and Turkey (Slay et al, 2007; Zevenbergen & Lerman, 2008; Somyürek et al, 2009). In Sweden, we find reports on the introduction and implementation of interactive whiteboard in Swedish schools (Gustafsson, 2009; Christiansen et al, 2010; Sundberg et al, forthcoming).

addressing the whole class in front of the board (Becta, 2003; Zevenbergen & Lerman, 2008).

This report summarizes the experiences and results of the Swedish part in the *Nordic SMART School Project* on the integration and use of *interactive whiteboards* in grade six in two schools in Uddevalla during the school year 2010-2011. The overall aim of the project was to study ICT-enriched teaching and develop, test and implement new teaching methods in the subjects of Swedish and mathematics. The aim was to study and develop *didactics in the subjects* along with the introduction of interactive whiteboard with focus on *inclusion and differentiation in teaching, collaborative learning and communication* in the classroom, whereof the following research questions were identified:

- What learning strategies, organization of teaching and didactic approaches are involved with introduction of interactive whiteboard in the classrooms?
- What variation and opportunities for inclusion and differentiation are offered?
- What are the characteristics of communication and collaboration in the classrooms?

The methodological base of the Swedish part of the project rests on an action-oriented approach based on the variation theory (see Ottersten Nylund & Sofkova Hashemi, 2010). Work in the project has been carried out in close collaboration between researchers and teachers at the two schools with regular workshops and meetings, and classroom observations. This report gathers the concrete data collected through observational studies and interviews with teachers, a series of workshops and experience meetings, and questionnaires to students. The report begins by presenting the results in the subject of Swedish and then discusses general didactic results in the organization of teaching, inclusion and differentiation in teaching approaches, communication and collaboration.

Text competencies in the subject of Swedish

Digital technology in reading and writing

As digital technologies evolve, also the ways in which we write, form and read texts change (Holsanova, 2010; Lorenzen & Smidt, 2010). Students encounter a new type of writing and communication culture where new technology replaces, simplifies and changes reading and writing. Electronic mind maps, speech synthesis applications, writing arenas as blog and wiki with tools for commentary, Google Docs and other environments for collaborative writing are examples of artifacts that are accessible through computer and support and develop reading and writing practices in school (see Davis & MacGrail, 2009; Sofkova Hashemi, 2008; forthcoming; Warschauer, 2008; 2010). Here the text production becomes more “real” with an immediate and in principle unlimited audience (see Penrod, 2007; Davis & MacGrail, 2009; Warschauer, 2008). These authentic text landscapes support writing practices on both content and formal levels. Students find such assignments motivating, their texts become longer and they develop greater confidence in their writing (see Kovacic, Bubas, & Zlatovic, 2007; Mak & Coniam, 2008).

The characteristics of reading and writing practices in digital environments is that they are more *user-centered* and *collaborative*, through their transparency in both the

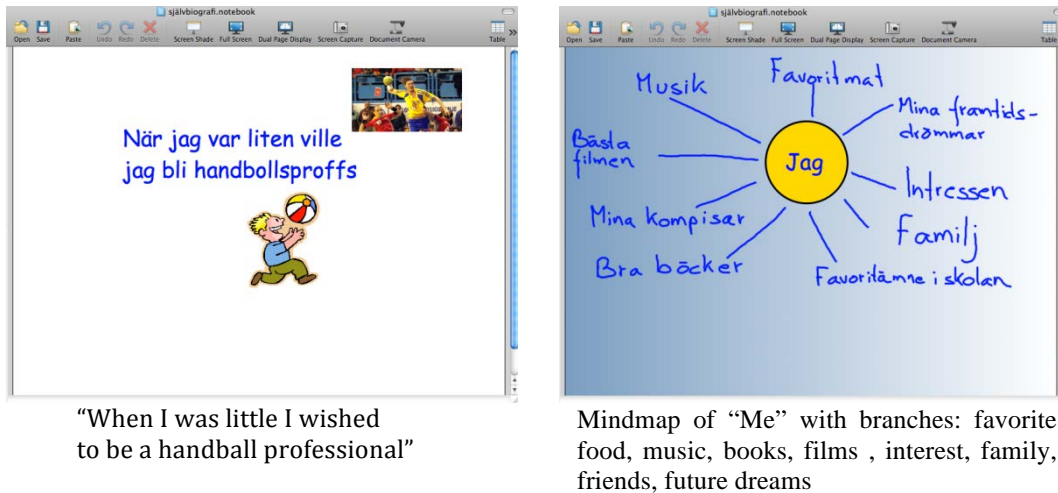
creation and sharing of information (e.g. in blogs, wikis). Furthermore, they offer a text design that is more *open and floating*, where the writer can always add, edit and change information. Another component is the *multimodal nature of texts*, where text, sound and image are unified in the same format (Lankshear & Knobel, 2007). The selection of texts in school is usually limited to a relatively narrow range of text types, often with an emphasis on narrative texts (see Folkeryd, 2006; Brorsson, 2007). Digital environments invite to more varied and extended work with several types of texts.

The students in grade 6 in the participating classes were considered as weak writers with little motivation to write and difficulties to express themselves in a more nuanced and advanced language. To develop their *textual competencies* and *linguistic awareness* in a broader perspective on text felt then as a natural goal in a project on ICT-enriched teaching. To motivate and support the students' different learning styles and ways of expression using digital technology, was also one of the goals. Students would meet texts of varied content and genre, be introduced to digital writing arenas with authentic publishing and work actively with multimodal texts. Support was also found in the new curriculum in Sweden, with the general learning objectives that state for example: "*can use modern technology as a tool for searching for knowledge, communication, creativity and learning*" (Skolverket, 2010a:11). For the subject of Swedish in grades 4 – 6, the curriculum particularly expresses the objectives such as developing "*reading strategies to understand and interpret texts from various media ...*", "*Creating texts in which words, images and sound interact.*", learn to use "*support words, graphics and digital media as a tool to plan and conduct an oral presentation.*", having access to "*texts that combine words, images and sounds, such as web content, interactive games and television programs.*", and regarding language use to be familiar with "*Differences in language use, depending on who you write to and for what purpose, such as the difference between writing a personal sms and to write a factual text.*", etc. (Skolverket, 2010b:91-92).

Text, recipient and digital ways of expression

The work on developing the students' text and language competencies and meet texts in different formats with the support of ICT was the subject of discussion at the joint workshops between the teachers and the researcher. A school newspaper in digital format with presentations of the students and work on texts that describe and report on news from the region was the initial goal. Students would produce texts in different formats and publish to an authentic recipient: "*Parents and others can read your text.*" An arena in the collaborative tool wiki⁵ was initiated for publication of the students' products for the planned school newspaper: smartuddevalla.wikispaces.com All students created a personal presentation of themselves using the Notebook-program, which they then published on the schools' common wiki site. This was also the first time they used the Notebook software, where they showed clear evidence of how they learn the digital along with the assignment. The instructions were fairly simple; the students would present themselves, their interests and hobbies on a page using the Notebook-program. Figure 1 shows examples of the teachers' use of the interactive whiteboard for the introduction of the task. The board's opportunities to use handwriting, illustration and graphics were applied early on by the teachers in the project, here in the form of a mind map, photo, image and colors:

⁵ A wiki is a website that can be shared by several users, where pages can be edited quickly and easily by the members themselves in a web interface and are published immediately. Wikipedia is an example of a wiki.



“When I was little I wished to be a handball professional”

Mindmap of “Me” with branches: favorite food, music, books, films , interest, family, friends, future dreams

Figure 1: Introduction to the task of personal presentation

The students worked individually on their presentations and expressed themselves in both plain text and other modalities, and experimented with color, appearance and design. They enclosed animations and sound effects, images on artists and sports idols that they downloaded from the Internet and their own photos. The teachers gave only a brief introduction to the students in the Notebook software and they noticed that the students learned on their own and by peers. In Figure 2., we present four examples of student presentations that clearly show the different strategies of the students to approach the task:



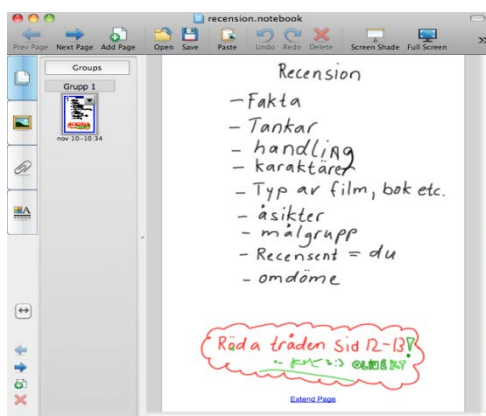
Figure 2: Four examples of students' presentations

During fall 2010 the classes also worked with comics from a Nordic perspective. Students in groups scanned a page from the Donald Duck comic series and created a PowerPoint presentation in which they read the comics in Swedish. The goal was to share the comics with schools in Norway and Denmark, and learn more about the Nordic languages. The teachers created the instructions in a Notebook file with step-by-step instructions and screenshots for certain features, such as how to add narration to a PowerPoint presentation, and links to other pages in the document.

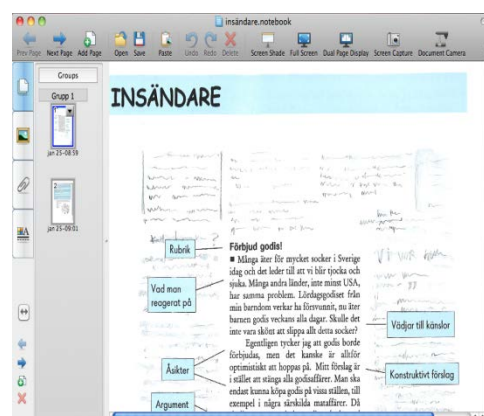


Figure 3: Example of work with comics

Further work with text competencies and linguistics awareness has resulted in both interactive language exercises of various kinds adapted to current work in the classrooms (parts of speech, spelling rules, etc.), simple presentations and reviews of texts and writing assignments to students, as well as concrete production of texts on the computer or with pen and paper. Teachers learned the digital in connection to their teaching and they made use of the board's functionalities in combination with other school material available to them. Figure 4 shows examples where a teacher uses the board's functionality as a whiteboard and lists features of a book review directly on the board, and then refers further to assignments in textbook. The second picture shows how a teacher uses existing school material and scans a textbook description of a letter to the editor. The teacher has then the opportunity to enter notes and comments on the board during the lesson and catches attention of the whole class at the board.



Book review: facts, thoughts, characters, story, etc.



Letter to the editor

Figure 4: Examples of lecture assignments

Developing text competencies in other subjects

Text competencies were also developed outside the subject of Swedish in these classes. During this school year the classes were working with diverse thematic assignments such as the world's religions or facts about different countries. The practices involved collecting and processing facts and information in the form of mind maps, information search and presentations. Students read and searched for facts and images in textbooks and on the Internet, mainly on Wikipedia and in Google Search. They created mind maps

and presented facts they gathered in Notebook or PowerPoint. They worked in pairs or individually and in addition to work with text and images, the students wrote scripts for their presentations and recorded their narrations or read the facts they had gathered. The final work was presented in front of the whole class on the interactive whiteboard. Figure 5 shows an example with students collaborating on the script for their presentation.



Figure 5: Working with script to presentation

Additional assignments, as complement to the class tasks, made also use of information processing. One such assignment concerned crossword puzzles like the one in Figure 6, where students had to test and develop their literary skills by answering questions such as: *Sherlock Holmes profession*. The students applied different strategies to solve the crossword and searched for individual words and exact phrases, like "The boy Holgersson" and got hits that were not as fruitful, as in this case when a picture of a newborn baby with the surname Holgersson came up.

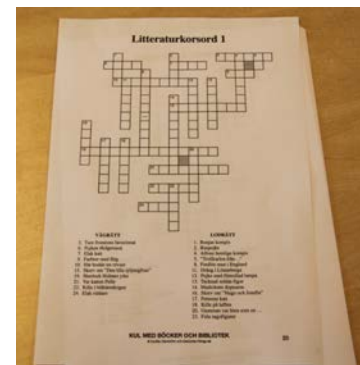


Figure 6: Literature crossword

Organization and didactic approach in the classroom

Computer density and organization

The classroom environments and conditions for teaching and organization differed significantly between the two participating schools, especially in the number of students per class, computer density and the technical quality of the equipment. Forshälla school had a class with 11 students in grade 6 who participated in the project. The class was equipped with both laptops and some desktop computers in adjacent group rooms.

The two parallel classes of Herrestad school had an average of 25 students each and a set of laptops that the classes shared. There were also a couple of desktop computers placed both in the classrooms and a group room next to the classrooms. The computers here were of varying quality and often caused problems during lessons. The students have to change computers because of malfunctions of various types.

Initial work with interactive whiteboard

The interactive whiteboard was introduced in the 6th grade in fall 2010 in all three classes with introductory courses for teachers in October. In the initial phase the teachers worked all together as a team in the construction of assignments on the interactive whiteboard, testing the various functionalities (e.g. flashing text, drop down, sound effects). They have developed lesson materials together and worked with the same assignments in all three classes. Further on, they shared examples of their own work at the board they developed in their classes and gave each other tips and advice. At this initial stage the board was used mostly as a writing tool and a screen. Past lessons

were reused and simple elements in the planned assignments were prepared in advance, for example new words in English:

"What I did is that I prepared the Notebook before, such as now, when we had English because then I have written all the words, so they are just on the board when I press the button instead of that I will be writing them".

(Initial interview, teacher Herrestad School)

Existing lectures were collected from *lektion.se* and Liberg Publisher's learning resource *Espresso* and adapted to the planned lesson. The teachers' focus was at this initial stage on development of their own skills in the use of the interactive whiteboard and they all had high expectation on their own competence. Especially in the production of lesson materials they were not comfortable with downloading lesson materials produced by other teachers: *"What I think what I did, I have borrowed from others then..."*. The students showed signs of motivation and desire to learn how to work with the interactive whiteboard. The general opinion among the teachers was that the students are in general better at dealing with technology and do not need much training in the use of various programs.

Before the introduction of interactive whiteboard in the classrooms, the students viewed the subject of Swedish as primarily focusing on *reading and writing* with recurring activities in the form of silent reading, writing stories and work with writing exercises of various kinds. The majority of students expressed that they wanted to work more with computers in the subject of Swedish, develop their writing and read books more and many were also satisfied as it was.

Development of didactic design with interactive whiteboard

The implementation of interactive whiteboard resulted in a use of varied nature during the school year that relates both to the subject as well as the competence of the teachers in handling the interactive whiteboard and their teaching skills. All the teachers expressed at the end of this project that they use the interactive whiteboard on every day basis in their classes and in different subjects for instruction and briefings, streaming audio and video, games and competitions in mathematics. They prepare majority of their lecture material in advance. The picture given by the teachers fits well with the students' beliefs that account for that the interactive whiteboard is used primarily for instruction and briefings, problem solving in mathematics and viewing films in different subjects.

During the lesson observations the interactive whiteboard was used to introduce or in different ways go through a subject matter and for instructions to subsequent assignments, more elaborated and interactive lessons with the students active at the board, it was shown film clips and news reports and tests and evaluations of various kinds were carried out using the mentometers. In overall, the teachers combined activities on the interactive whiteboard with other assignments in the classroom, that involved both work on computers, with pen and paper and in textbooks. Essentially there are two scenarios in teaching design in which the interactive whiteboard had a central role in the classes:

1. dialogic, student-centered and activity-oriented design
2. teacher-controlled and activity-oriented design

In the more **dialogical approach**, the lessons are organized **with** the interactive whiteboard in focus. Such a teaching design strives for a dialogue in the classroom and feedback to students, involving the students and capturing their attention. Students work with the board most in **whole class** and take turns on the touch screen on the board, solve problems and learn the board's interactive features at the same time. Lessons are planned with extra assignments and materials for those who finish with the lecture assignments (e.g. crossword puzzles as in Figure 6). Students are paired in different constellations between lessons and assignments, often depending on when they are finished with the lecture assignment.

The classroom observations clearly show that the class briefings in this context are most challenging with regard to capturing and maintaining the attention of students on the lesson content. With interactive and collaborative elements, when students themselves actively participate and use the interactive whiteboard, it is more natural that the level of concentration rises in the class. Such sessions result in questions and discussions about the subject matter and also the technical aspects concerning the functionalities of the board. Mutual and collaborative learning occurs when different approaches to solving problems on the board are discussed. Some activities, such as using the mentometers, engage and capture more the attention of students. Students with difficulties to concentrate found, during the observed lessons, more peace and quiet in the collaborative work in pairs in computer assignments. In front of the interactive whiteboard, they could still disturb others by shouting out the answers out loud or the like.

The more **teacher-led approach** is characterized by briefings, instructions and lessons addressing the whole class **at the** board. The teacher has the main word and presents the subject matter, asks questions to individual students and gives instructions to the upcoming task. Students easily lose concentration and only some of them are motivated to grasp the content. Work on individual assignments is often thematic in these classes. Students work individually or in pairs on computers or in textbooks. Computers and ICT in general engage these students and they find it motivating to for instance search for facts on the Internet or in textbooks, and create presentations of the content in PowerPoint or Notebook. However, individual students lose quickly focus in the individual work.

Gains and obstacles with interactive whiteboard

The teachers expressed in general positive experiences and describe the introduction of interactive whiteboard in their classes as *"Fun for me to learn something new, makes teaching more fun."* They give, however, a varied picture of what the implementation meant to their competence. Some feel they have learned a lot and are quite confident in their development and others express a wish to learn even more and a need for more practice and continuity. They believe that with the interactive whiteboard, it is easy to create a stimulating and active learning that motivates the students, an aspect that they feel they are bringing more in their planning of teaching: *"How can I make it more interesting or more active for the students."* Most appealing is the simplicity and effectiveness of the interactive whiteboard and the possibility to save notes and lessons: *"Being able to plan and prepare, save and continue at another time."* The teachers describe their students as willing to work in Notebook and with the interactive whiteboard and that most of them like to approach the board, but not everyone wants to do it in front of the whole class. They cannot see clearly if there are students in the class who benefit more than others of the use of the interactive whiteboard in the classroom,

however the visual aspects is something they believe students with reading and writing difficulties can benefit from to much greater extent than others. They experience that more students have become more active with the interactive whiteboard in mathematics, or depending on the subject.

Regarding the students, the majority expresses that they learn more when the interactive whiteboard is used in the classroom, mostly because it's more fun: *"to play towards learning"*, as one student put it. They experience that it is easier to explain and understand better with the interactive whiteboard and that they learn more from each other and take part of how others in the class think. They feel that they make progress and are much better at presentations and in general more active. One student's view was that there is much less waste of paper in the classroom now. Some do believe that there has been little change since the interactive whiteboard was introduced: *"It can be fun but the lessons are the same."* The interactive whiteboard is used often and a lot in the classes is the general view of the students (*every day, always, almost every lesson*) and mostly in mathematics, followed by the subjects of Swedish and English, but also in science, civics and geography. Many say that they use the interactive whiteboard sufficiently often in the classroom, while others claim the opposite and argue for using it more.

Summary of results

The results of this project can be summarized in that the introduction of interactive whiteboard has during the past school year meant a general move towards a more conscious effort on an ICT-enhanced teaching at the two schools. The teachers have during this short period of time developed a more ICT-oriented practice in the classrooms and initiated teaching that is stimulating and active with students that participate, communicate, collaborate and learn from each other.

The aim in the subject of Swedish to develop students' textual competence and linguistic awareness has resulted in that the students have had the opportunity to meet and develop language in different contexts. They met texts of richer and varied genres, primarily through the work with comics, newspaper-related texts and work with the shared wiki. They have also got a recipient outside their class on their wiki site. The students have during the school year produced and presented subject matter in different formats and forms of expression from plain text to images, animations, sound effects, narrations, etc. They have worked with mind maps and written scripts over facts they gathered. They created their own presentations and slide shows, worked on crosswords and word puzzles, etc. Also the teachers have through the lesson material with interactive features and access to current information on the Internet given the students the opportunity to come across texts of different formats and modalities.

It has been motivating for both students and teachers to get a new, interactive tool in the classroom, which has begun to be used frequently in teaching and that many students experienced as a tool especially facilitating learning and encouraging to activity and dialogue in the classroom. Both teachers and students have developed digital competencies on several levels during the project and in the process of introducing the interactive whiteboard in classroom practice. This meant not only to acquire knowledge about the functionalities of an interactive whiteboard, but this work has also led to discussions on and testing of other digital artifacts above all by the teachers, such as electronic mind maps, speech synthesis applications and collaborative writing arenas such as blogs and wikis. The teachers are stimulated by the efficiency and simplicity of

creating and re-using lesson materials and generally express high demands on their own competence and skills in handling the interactive whiteboard.

Classroom observations indicated during the past school year on didactic approaches developing towards more interactive, dialogical and student-centered climate in the classroom, but also teacher-controlled lectures addressing the whole class in front of the board. Results for inclusive and differentiating practices in the classroom were not that explicit. While the didactic development in the project indicates signs of that the board's potential for interactivity supports collaborative learning and encourages active, authentic and dialogical education, the results show, parallel with previous studies (see Introduction), that implementation of new technology in teaching takes time and above all requires that educators develop a user competence that allows them to develop more advanced forms of teaching.

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