Supporting cooperative learning in the classroom

Exploiting large multi-touch displays

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Abstract—The main goal of our project is stimulating, by means of technology-enhanced tools, students’ engagement and participation in the educational process. We exploit the affordances of large multi-touch displays in everyday classroom activities to allow new cooperative learning opportunities for students. Our preliminary work in designing for Interactive WhiteBoards emphasizes issues largely neglected in these kinds of applications.

Keywords: cooperative learning; participative learning; multi-touch technology; single-display groupware

I. INTRODUCTION

The actual school system suffers from various deficits. Teaching is mainly a mere transmission of knowledge from teachers to students with little active participation of students in the educational process. Learning programs and activities are designed with a “one-size-fits-all” approach without any appropriate personalization towards individual learners, or an adaptation to the actual context. Classrooms are taken out from current technology-pervaded world. Moreover, the educational processes are restricted by the physical and temporal boundaries of classroom lessons, supporting few connections with students’ social relationships as well as failing in activating a virtuous life-long learning process. We claim that the focal point that can reverse the actual situation of the school system can be stimulating students’ engagement and participation in the educational process by means of technology-enhanced tools.

II. THE FAIRYTALE BOX APPLICATION

Our work aims at designing a pervasive classroom—with technology embedded in everyday tools and diffused in the environment—allowing cooperative and participative learning of students during the lessons. In line with Weiser’s vision [8], we plan to have few interactive tables and large-screens (e.g., augmenting teachers’ desktops and blackboards); various tablet and portable computers; and a multitude of technology-enhanced gadgets (e.g., bracelets, pens). Some gadgets follow the students outside the school allowing a learning process available ‘anytime, everywhere’. All these artifacts are part of a context-aware platform, providing appropriate adaptability and personalization to the users. In particular, we adopt a framework called SIS (Space Integration Services) [3], which supports the exchange of contextual information among client-components, using a publish-subscribe mechanism.

At present, we focus on designing applications suited for large interactive screens, or Interactive WhiteBoards (IWBs), with multi-touch technology. On purpose, we start from IWBs for their valuable characteristics. It is well known that pupil’s learning is reinforced by the physical and tactile interaction with the IWB. These devices seem to facilitate a co-learning approach, where teacher and pupils work together, inducing a more independent and self-directed learning [6]. The multimedia possibilities of IWBs stimulate a more engaging and funny way of learning, that can be effective, especially for children, and support a beneficial knowledge sharing across the whole class. By adopting multi-touch technology—allowing multi-user interaction—students’ engagement in learning activities and collaboration in building knowledge could be stimulated. Our application is developed on MultiTouch Cells [9]. We use RFID technology for recognizing students in front of the board or in the classroom; sensors and cameras, already available in our experimental classroom, will be adopted for recognizing persons in the next future.

The FAIRYTALE BOX application is suitable for primary schools’ literacy lessons during which 7-10 year-old pupils can create stories (for a complete scenario of use see [1]). Cooperative storytelling can “increase the level of engagement of less motivated children without affecting the involvement of the more active ones” [4]. In order to involve all students as much as possible, the FAIRYTALE BOX facilitates a smooth turn-taking in using the IWB by splitting the writing activities into different phases, that can be easily assigned to different groups of pupils. By default, we provide three phases (Preface, Development, and Conclusion) which can be revised as necessary. To support practicing on logical and grammatical structures, the collaborative writing is based on four sets: Where the tale takes place, When it happens, Who the main characters are, and What the characters are going to do. Therefore, the main area of the screen contains four rounded sets, empty at the beginning, surrounded by images with single-word labels. Pupils fill sets little by little with images—representing nouns and verbs—to build the fairytale. Small groups of children, one at a time, write the sentences in a textual area placed in the bottom using a colored chalks-box. Whenever necessary, appropriate
corrections and revisions are made with the collaboration of the whole class. Beginning from a particular fairytale and its subjects, the FAIRYTALE BOX supports various extra-activities allowing teachers the design of a complete multidisciplinary project. For instance, with the music teacher, pupils can record funny sounds or their voices to be associated with characters or action verbs of the tale. Later on, these sounds could be activated during the reading of the tale to make it more amusing. Moreover, during the arts lesson, pupils can draw the sceneries of a theatrical performance, possibly starting from the chosen images.

III. DESIGNING FOR COOPERATIVE LEARNING

Many educational applications for IWBs already exist and, from many point of views, the FAIRYTALE BOX prototype is not able, and does not intend, to compete with them. Our work aims to emphasize design issues largely neglected in these applications that, too often, seem designed for ‘a PC with a huge monitor’ and restrict their possibilities to exploit multimodality. In the following, we recall some of these questions.

Teachers and students should have an ample freedom of interaction for allowing creative, unanticipated use [7]. The flow of the activities must not be predefined. In this way, the development of the lesson could freely adapt to the actual requirements; switching from one activity to another one is simple and the learning process flows without boundaries, holding students’ attention. Even if our proposed lesson offers a structured process (i.e., a division in phases), students are left free to choose, to build and to share with their mates the work done, “according to constructivist modalities implying collaborative-cooperative behaviours” [5]. The possible students’ interaction with the screen and its objects should not be bound by their roles: all students should have the same access rights. In case the accomplishment of a task asks for establishing roles, these must be defined only from a strategic point of view, not to impose different rights and behaviors to pupils. This choice allows children to help each other as well as to exchange their responsibilities. Teachers should rarely interact with the technology, acting as a mediator between the technology and the class as well as a facilitator of pupils’ cooperation. Our approach is in contrast with the teacher-centric one proposed in [2] for using multi-touch surfaces in classrooms.

The organization of the activities of the lesson should allow as many students as possible to use the interactive board and should be organized to accommodate the rotation of the children actively using the device (e.g., decomposing the learning process in steps or phases).

Applications should not automatically correct pupils’ mistakes. The automatic correction could be useful in those applications devoted to support individual activities; on the contrary, in those applications aiming to support participative learning processes, it is preferable that the whole class can act as a reviewer.

The adoption of multi-touch technology is of paramount importance for stimulating students’ engagement and collaboration as well as for making the IWB a tool shared by the whole class. Whereas multi-touch technology is by now widespread in cellular phones, generally applications for IWBs are still devoted to single-touch displays. Moreover, the IWB should not be considered as an isolated tool placed in the classroom. It has to be a brick in the wall of the classroom of the future, where portable technology-enhanced devices and large multi-touch displays hold new opportunities for experiential learning through both the dialogic interaction between students (minds-with) and the simultaneous physical interaction with the screen (hands-on).

Finally, IWB applications must provide adaptation to the actual context of learning and personalization for the individual learner.

IV. CONCLUSIONS AND FUTURE WORKS

In this paper, we described our complete view of the classroom of the future even if the actual version of the FAIRYTALE BOX is quite limited. We claim that, to match digital natives’ needs, new tools and new ways of teaching should be designed to stimulate students’ cooperation and their active participation to the lessons.

At present, we are starting the experimental phase in collaboration with an Italian primary school. Together with the literacy teachers, we have chosen a prehistoric set for the tale. This topic seems appropriate both for its links with the historical lessons and for the kids’ predilection for dinosaurs and the like.

REFERENCES


MultiTouch Ltd