Designing a Teacher-Friendly Editor for Configuring the Attention-Aware Smart Classroom

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Abstract. Technological advancements and contemporary learning theories have redesigned the school environment to embed ICT technology in many aspects of the learning process. In particular, ICT technology can be exploited to monitor learners' behaviour during learning activities, for example to identify whether a learner is paying attention to the lecture. This poster presents the functional requirements of a visual tool for the smart classroom, which allows teachers to view and customize the attention monitoring subsystem for each individual student and for the classroom as a whole, in order to improve the educational process. Preliminary usability findings regarding its design are reported, as collected through a cognitive walkthrough evaluation with HCI experts.

Keywords: Smart classroom · Ambient intelligence · Attention monitoring · User interface evaluation · Teacher-friendly UI

1 Introduction

Attention is often considered as a fundamental prerequisite of learning, both within and outside the classroom environment, since it plays a critical role in issues of motivation and engagement. Given that the average class size worldwide is 23 students [17], obtaining and maintaining the students' attention is an important task in classroom management [10], and teachers apply various techniques for this purpose. However, currently only limited technological support is available to monitor attention levels of students and assist teachers in obtaining optimal attention for each classroom activity. The emergence of smart classrooms, where learning activities are enhanced with the use of pervasive computing [13, 14], makes it possible to identify whether a learner is paying attention to the lecture through behavior monitoring.

Despite the fact that an attention-aware smart classroom will be able to identify some cues whether the learners are inattentive or not, the expertise of a human instructor is irreplaceable. Therefore, teachers need to be involved in the customization of classroom monitoring. To this end, this work presents the design of an editor which allows teachers to view and customize: (i) the attention monitoring subsystem and (ii) the intervention mechanism that aims to re-engage students. Preliminary evaluation findings are also reported.

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2 Related Work

ICT has become an integral part of modern educational environments with positive benefits [5, 21]. Educators acknowledge its added value in organizing their classroom activities and saving them time [7] to spend on meaningful learning-oriented activities across a range of subjects [18], via various technological applications such as educational games [7, 11] or fully-featured Learning Management Platforms [2, 6, 15], while the physical environment can employ attention-aware artifacts [3] in order to deliver targeted interventions when necessary [1, 4].

Besides classroom management though, ICT has generated monitoring tools which can provide valuable information about the students' learning processes, allowing the identification of difficult or inappropriate learning material, and can therefore significantly contribute to the design of improved student support, including analysis of students' logged behavior to provide information about their learning processes [9], activity classification in classroom discourse [20], and automatic learning styles identification and modelling [8].

All these data however would be worthless without proper visual tools that facilitate their exploration. Therefore, many GUI applications have been developed to simplify classroom management activities such as communication between students and teachers [2], management of learning assets [6, 15], distant learning [19], real-time activity monitoring [16], and on-the-fly creation of educational software [12].

3 Functional Requirements of the GUI Application

The work reported in this article is part of a larger smart classroom suite that incorporates the necessary hardware and software infrastructure to monitor students' behavior and determine their level of attention. The tool under development offers the following facilities: (i) an overview of the attention level of the entire class that could also facilitate focusing on particular students, (ii) a mechanism that asks the teacher's opinion on ambiguous behaviors, (iii) a rule editor that simplifies the formulation of new and the modification of existing rules that signify inattention, (iv) an intervention editor that facilitates the management of the available interventions and the creation of new ones, (v) an intervention-oriented rule editor that controls which intervention should be applied in any given case, and (vi) a control panel through which the teacher can manually override the system's decisions and modify the selected pedagogical activity on demand. In that particular case, the system automatically attempts to identify potential patterns that could support such a decision and request the teacher's confirmation to append them to the active set of rules.

4 Interface Design and Evaluation

A cognitive walkthrough was conducted by three (3) Human Computer Interaction experts in order to uncover any usability errors and identify problems users would have as they try to use the interface using paper prototypes (Figs. 1 and 2 present indicative mockups).

Firstly, the evaluators were asked to browse through the paper prototypes and express their thoughts and questions about the design, while two coordinators were taking notes of their comments. Secondly, they were given a scenario with some tasks to complete and they were asked to follow the Thinking-Aloud protocol and pinpoint any usability-related issues that they identify. Finally, as soon as their comments were consolidated in a single list, they

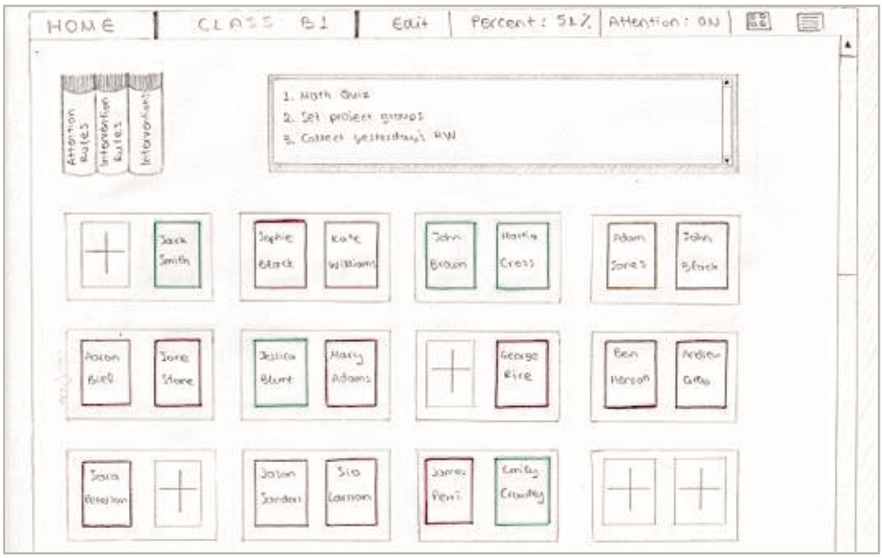

Fig. 1. Paper-based mockup of the classroom overview (including attention-oriented visual cues).

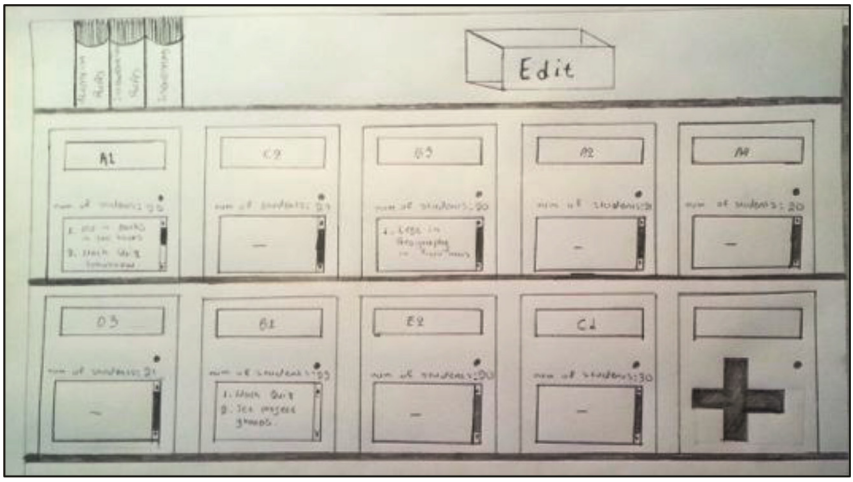

Fig. 2. Paper-based mockup that displays the classes that an individual teacher has under his jurisdiction and the available administrative actions.

were asked to grade them in terms of severity so as to compile a prioritized list with the issues that have to be addressed.

The evaluation process uncovered various problems regarding not only the design of the User Interface, but also regarding the overall concept. The major findings are summarized below:

- The functionality available to the teacher during class hour should be limited to configuring the attention and intervention mechanisms. Other operations could possibly overwhelm the user while they would take over much of the teaching hour. For example, adding students to the class and rearranging their positions should be performed during the teacher's spare time or, even better, a secretary should be responsible for such activities.
- The edit button was used to reveal the delete and add buttons, while the edit screen of an item (e.g., a classroom, a student, a rule) is displayed when clicking on its name, independently of the "edit" button, which affects the consistency and the expected behavior of the visual interface.
- One out of three evaluators thought that the "classroom" metaphor (doors, books, desks, board) that is used throughout the design would be cumbersome for a teacher that uses the system on a daily basis and wants to concentrate on important and time-critical tasks.
- All evaluators pointed out that the lists displaying the rules and interventions should be accompanied by a rich filtering mechanism to assist the educators in finding whatever they want quickly.

5 Conclusions and Future Work

This work presents the preliminary design and evaluation findings regarding a visual tool for the smart classroom, which allows teachers to view and customize the monitoring of attention levels of each individual student and of the classroom as a whole, in order to improve the educational process. The major findings were mostly related to the complexity of the most frequently used screens, and secondly to the metaphors used in the design, suggesting their refinement in order to simplify the interaction paradigm used to execute time-critical or common functions expected to occur on a daily basis and minimize visual clutter.

Future work will aim to refine the design based on the evaluation findings, while a functional prototype is currently being developed in order to be evaluated in-vivo by teachers, educational experts and school students of various ages.

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