Abstract. One-to-one technology involves equipping each child with a computing device that provides personalized learning tools. While one-to-one learning is showing promise in classrooms, it has revealed problems, including management of the technology-enabled classroom, lack of support for collaborative and whole class working, the design of lessons that switch easily between activities, and difficulty in re-use of lesson components. In this paper we describe the ScoDer system to orchestrate learning with one-to-one technologies. It provides an authoring system for teachers to design lessons, an interchange language to describe lesson sequences and resources, and a delivery system that enables the teacher to manage collaborative one-to-one learning in the classroom. The system has been tested in school classrooms and the results show that it is effective in managing a fluid movement between individual, group, and whole class learning activities.

Keywords. Learning design; orchestrating collaborative learning; 1:1 technology classroom; distributed learning platform; wireless and mobile technologies

1. Introduction

The emergence of one-to-one technology (one computer device or more per student) has the potential to enhance learning in the classroom [1]. A literature survey reveals two main areas of interest. The first is a pedagogical approach, with a focus on the study of effective patterns of face-to-face classroom activity. The aim is to capture and describe common learning situations, particularly for collaborative learning [2, 3]. The second is focused on the technology and is concerned with creating innovative software and hardware tools that can enhance specific learning scenarios. A key issue with this research is how to balance the pedagogical and computational approaches, so that technologies for classroom interaction can support effective collaboration in real classrooms [4]. On the one hand, teachers should be easily able to design and manage collaborative learning supported by a mixture of computing devices (such as a combination of tablet PCs, desktop PCs and electronic whiteboards). On the other hand, the computational system, including hardware and software technologies should be able to support a range of effective learning scenarios. Pedagogical modelling tools such as educational modelling languages (e.g. IML/LD)[5] or graphical modelling of learning design [6] are unlikely to be effective for a 1:1 unless coupled with an appropriate execution environment that exploits networked collaborative learning.
2. Methodology

We have designed a framework for orchestrating collaborative learning in a 1:1 technology classroom. The system, named SceDer, consists of a scenario designer tool (SceDer Authoring), a Classroom Orchestration Modelling Language (COML), an interpreter engine, and orchestrating tools, embedded in Group Scribbles [7] (GS-SceDer), to provide a single platform that satisfies both the pedagogical and technological aims. SceDer Authoring, built on Flash technology, allows teachers to design learning scenarios for individual, group and whole class activities. The learning design is then exported to COML, a lightweight language based on a generic XML description. This loaded to GS-SceDer, a delivery system that enables teachers to conduct a designed lesson in the classroom [8].

3. Evaluation

Table 1. The first two pilot experiments and the main evaluation

<table>
<thead>
<tr>
<th>1st investigation</th>
<th>3 interface design experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd investigation</td>
<td>9 groups of 2 (designers)</td>
</tr>
<tr>
<td>Classroom evaluation</td>
<td>3 groups of 2 (teachers)</td>
</tr>
<tr>
<td>Main Evaluation</td>
<td></td>
</tr>
<tr>
<td>GS only</td>
<td>GS-SceDer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 7 (Mathematics)</th>
<th>Number of Students: 16 / Teacher A</th>
<th>Number of Students: 12 / Teacher B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 9 (Geography)</td>
<td>Number of Students: 21 / Teacher B</td>
<td>Number of Students: 19 / Teacher A</td>
</tr>
</tbody>
</table>

As shown in Table 1, two initial investigations and one classroom evaluation were undertaken in this study. The initial investigations were mainly to establish proof of concept and to identify usability problems with the SceDer authoring and delivery system. The main trial was carried out with two mixed ability classes, Year 7 (age 11-12) and Year 9 (age 13-14). The first session had the aim of evaluating teaching and learning with Group Scribbles alone, and the second session was to evaluate the combination of SceDer and GS-SceDer. Data collection included video observations of the learning activities in the classroom and interviews.

4. Results and discussion

The results in terms of usability, usefulness and expressiveness are discussed from the perspective of both teachers and students. For usability, three aspects of the software were analysed: learnability, flexibility and robustness. Teachers and students were able to learn how to use Group Scribbles in a short time (for SceDer Authoring, the teachers learned how to create a basic learning scenario in 15 minutes). Results in terms of usefulness relate to the questions: Can SceDer generate useful lessons? Did GS-SceDer meet teachers’ expectations? Did it help teachers to perform tasks? The teachers claimed that it was straightforward to design a lesson due to the graphical interface and the ability of SceDer to allow them to edit and reuse. With ‘next’ or ‘back’ or by navigating with the step number, the teachers were able to go back or forward or resume at any step they wanted where the students were also synchronised to the same
board. They could resume the lesson knowing that all students would see the same working board and images on the screen. The students reported that SceDer was useful to allow them to share their ideas and work together. Expressiveness refers to whether the system is able to enact a range of scenarios for teaching and learning. We analysed the expressiveness of SceDer by considering the interaction pattern of the two scenarios created by the teachers during the evaluation, plus 13 scenarios produced by SRI International [2, 9], to see if they can be fully expressed by the system. We found that SceDer Authoring is able to enact 9 out of 13 scenarios. The scenarios which are not currently supported by SceDer Authoring involve a role play or a pair turn-taking activity.

5. Conclusion

This paper has proposed a set of tools for supporting the orchestration of collaborative learning in a 1:1 technology classroom. The framework and the results of experiment have highlighted the potential of the system for supporting teaching and learning within a 1:1 technology classroom in practice. However, this research has also indicated design, orchestration, and technology issues that might be addressed in the future to enhance the effectiveness of this system.

References