Introduction

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Welcome to this special issue of the *International Journal of Learning Technology* specifically focusing on the design of technology-supported learning. While the use of technology to deliver and assess learning activities is not a new idea, the notion of utilising technology to specifically *support* learning activities is a very different concept. The very concept of using computers and other forms of technology to facilitate as opposed to deliver instruction necessitates the view that technology's role in a learning environment should not necessarily be that of a tutor, but should involve a more supportive role to assist learners in acquiring, analysing and synthesising knowledge. The papers included in this issue present a variety of methods in which technology can provide this support in a wide range of learning situations.

In the call for paper for this special issue, we listed a plethora of potential topics that could be relevant to the topic of learning environments, including methods for designing and developing technology-based learning applications, the use of hypermedia and multimedia for instruction, web-based instruction, interface design, online learning and the use of learning objects. However, after examining the papers that were accepted for inclusion in the special issue, three types of papers seemed to emerge. Several of the papers discuss more theoretical views related to designing learning environments and report the results of studies dealing with specific components of learning environments. For example, Limbach, Pieters and deJong collected data regarding the knowledge needs of designers when creating discovery learning environments. Their data revealed that many of the needs focused on learner control and assessment. Designers specifically discussed the need for additional skills and experiences in designing assessment for discovery learning environments as opposed to more expository learning environments. This is not surprising given the fact that assessment procedures in more open-ended learning environments tends to be much more complex and thus much more difficult to standardise.

The use of virtual objects to facilitate teaching concepts such as art and other content areas where visualisation is critical is explored by Rountree, Hannah and Wong. In their study, they found that QuickTime VR was an effective tool for providing students with virtual views of sculptures and other three-dimensional artefacts. However, they argue that the optimal learning environment for students would include both virtual and authentic versions of the artefacts.

The last paper of the first type is by Uden on the design of web interface for learning. Uden describes an object-oriented user interface approach to designing web learning that

would help learners to achieve high usability. The use of objects as the focus in designing web interface enables learners to organise objects in their learning environments similarly to the way they organise objects in the real world. Designing web learning using this method allows the designer to develop the interface that learners find it easy to use and learn.

The second type of paper included in this issue focuses on descriptions of learning environments that have been developed and discussion of features within those environments that support learner efforts. Brush and Saye, for example, describe a 'TESCLE', or technology-supported student-centred learning environment that includes a content database and embedded scaffolds to assist learners with locating, organising, synthesising and presenting information. They further categorise scaffolds in terms of 'hard' and 'soft'; hard scaffolds being those embedded within the computer-based environment itself and soft being those dynamic supports provided by a teacher or tutor as students interact within the environment. Several examples of these scaffolds are included in the paper.

Murray explores design issues with adaptive hyperbooks and describes a 'metalinks' approach to providing information in a hypermedia format. This approach attempts to address common issues associated with disorientation, distraction and heavy cognitive load by including several design features within the hyperbook environment. For example, to reduce cognitive load, users have the option to reduce or expand the information available to them on a specific hyperbook 'page'. To reduce the potential for disorientation, the hyperbook environment includes several navigational features such as an index, table of contents and dynamic navigation menus.

The third and final type of papers included in this issue focused on case studies dealing with the actual implementation of specific learning environments (or learning environment modifications) in school settings. Brinkerhoff and Glazewski's paper, for example, discusses the implementation of a problem-based unit with two sixth-grade science classrooms in the USA. The unit utilised a hypermedia database as a content resource for students. The database also included various scaffolds to assist both the teacher and students with the central task: designing a balloon to travel around the world. Their analysis of the implementation with both a 'novice' and 'expert' teacher revealed that the teacher with less experience tended to de-value the support structures built into the environment, whereas the teacher with greater expertise and experience tended to more effectively utilise the scaffolds to support the goals of the problem-based unit. These results have implications for the inclusion of embedded scaffolds and other support structures within learning environments.

Finally, Ehrlich and Dundis' paper discusses the implementation of a set of courses delivered using various distance learning strategies and describes the differences in interactions (i.e. learner–instructor, learner–interface, learner–content and learner–learner) based on the strategy employed. They also discuss ideas for improving the implementation of distance learning classes and for improving interaction within those classes.

As you can see, there is a wide range of areas covered in this special issue. However, the overall theme remains constant: What is currently being done to enhance the design, development and implementation of technology-supported learning environments? We hope that the papers included in this issue will provide some insight into this question and generate further research for this important topic.

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Supporting learners in technology-enhanced student-centred learning environments

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Abstract: Technology-enhanced student-centred learning environments (TESCLEs) provide learners with computer-based tools and resources to facilitate the completion of problem-based tasks. However, with TESCLEs, technology serves as a support and resource for students in their efforts to solve overarching authentic problems. Student success in these environments may be attributed to the types and amount of support they receive both from the environment and from the teacher. This paper will discuss different methods for providing students with support – defined as hard and soft scaffolding – and will provide examples of how these support structures are embedded into Decision Point! a TESCLE focussing on the African-American civil rights movement that occurred in the USA in the 1960s.

Keywords: scaffolding; student-centred learning; hypermedia.

Reference to this paper should be made as follows: Brush, T. and Saye, J. (2004) 'Supporting learners in technology-enhanced student-centred learning environments', *Int. J. Learning Technology*, Vol. 1, No. 2, pp.191–202.

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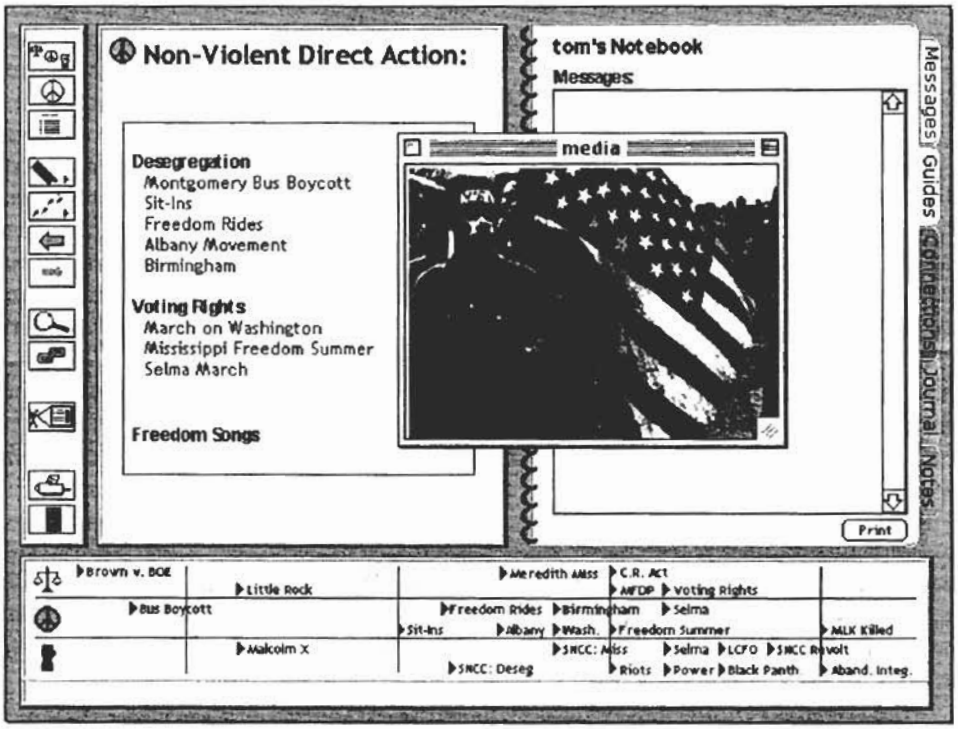
1 Introduction

Technology-enhanced student-centred learning environments (TESCLEs) provide learners with computer-based tools and resources to facilitate the completion of problem-based tasks [1]. However, with TESCLEs, technology serves as a support and resource for students in their attempts to solve overarching authentic problems [2]. These problems may range from successfully navigating a river [3,4], to building a roller

Figure 1 The Decision Point! interface



Working with a classroom teacher, we developed a two-week TESCLE unit with DP serving as the primary resource for the unit. In the unit scenario, students assumed the roles of civil rights leaders in 1968, following the assassination of ML King, Jr. Students worked collaboratively to develop a solution for the unit problem: What strategies should have been pursued in 1968 to continue the struggle for a more just, equal society? Student groups used DP tools to construct a persuasive multimedia presentation that explained possible actions, evaluated the likely consequences of each alternative and defended their solution as the best course of action. Individuals then composed post-unit essays on a related problem.

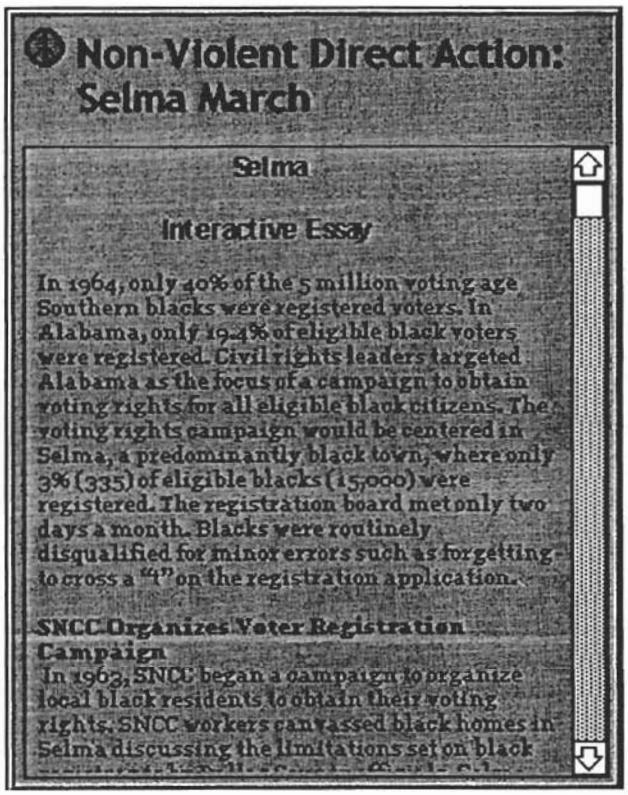
4 Hard scaffolds embedded in DP

Within the DP environment, there are two types of hard scaffolds: conceptual and metacognitive [5]. Many of the conceptual scaffolds (i.e. scaffolds to assist students with determining what data to consider when solving a problem), are embedded within the database itself. The metacognitive scaffolds (i.e. scaffolds to assists students with self-monitoring and self-regulation) are provided within the notebook section. These scaffolds are described in more detail below.

4.1 Interactive essays

Each of the events within the DP database contains an 'interactive' essay that provides students with a conceptual scaffold for that event [5]. The essay provides an overview of the historical event and gives suggestions for additional documents within the database that students should explore (see Figure 2). To extend the integration of the interactive essay with the other documents in the database, hyperlinks are embedded within the essay linking specific contextual areas of the essay with specific documents (similar to the 'themantic criss-crossing' provided by Jacobson et al. [20] in the hypermedia databases they created). Students can read each of the interactive essays and easily navigate to supporting information regarding various aspects of the event described in each essay by following the hyperlinks.

Figure 2 Interactive essay



4.2 Recommended documents

During initial testing of the DP database (see [21]), students had difficulty in determining which resources to access when asked to summarise an event. Many of the students failed to even visit the interactive essays to gain an overview of the events. Based on this feedback, the content expert identified eight to 10 specific documents within each event as critical for students to explore in order to gain an understanding of the event. These documents were highlighted in the event menu and students were guided to examine