EDUCATION CONTENT ASSEMBLY TOOLSET

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Abstract: The Education Content Assembly Toolset is a simple programming toolset designed to enable educators who do not necessarily have prior software development skills to create their own simulations and interactive educational applications. The power of the toolset derives from being able to incorporate components of arbitrary complexity that range from simple buttons and picture viewers to video, sophisticated animations and Multiple Choice Questionnaires etc. The Toolset is the subject of an extensive 18-month programme aimed at evaluating and improving its functionality, usability and acceptability. The project participants include users based at universities and enterprises in industry, medicine and business.

Keywords: E-learning, interactive content, simulation, education, technology, software, toolkit

1. Introduction

Electronic teaching materials are becoming regarded by many educators as an essential adjunct to conventional methods used in training and education. Computer-based applications using simulations and scenarios allow students to interact with the learning materials and can be more enjoyable and effective than textbooks. Computer-based learning also offers educational benefits not obtainable by other methods (e.g. automatic assessment). Currently there is a global shortage of high quality interactive content, and where it does exist there is often little choice of products. The high cost of producing commercial interactive educational materials makes such material non-commercially viable for niche areas. However much of education is in niche areas.

The current process for creating education software requires at least two different skill sets, highly skilled software engineers, and educators, who must communicate with each other. This approach is expensive, error prone and time consuming. It also inhibits the teacher's creativity and ability to experiment with new ideas. We believe that a significant contribution towards achieving this goal can be made by putting simple tools for creating interactive teaching materials directly in the hands of the educators (Fig 1). Many of the current tools available are too complex for casual use and have a steep or long learning curve. Few teachers have the programming skills necessary to use these tools to create simulations and interactive applications. Others are simpler to use but have limitations, e.g. unsuitable for creating simulations. The Education Content Assembly Toolset is a possible solution that aims to make the creation of high quality interactive educational material as simple as possible for the non-computer professional.

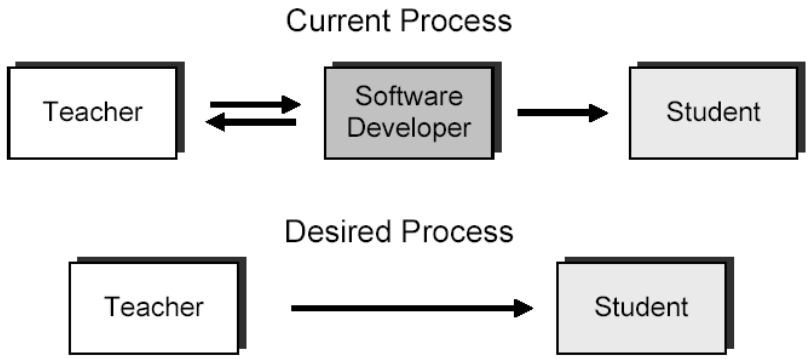

Figure 1: The problem and possible solution for creating interactive education content.

2. The Education Content Assembly Toolset

The Toolset is a simple multimedia programming technique that is not based on a formal programming language and utilises reusable software components. It is sufficiently powerful to allow development of simulations and other interactive content. The Toolset and applications created with it can be used over the Internet or stand-alone on a desktop computer. The power of the toolset derives from being able to incorporate components of arbitrary complexity which range from simple buttons and picture viewers to video, sophisticated animations, Multiple Choice Questionnaires, speech synthesis etc. It uses a simple drag-and-drop approach, and ***components*** generate ***events*** that are linked to ***procedures***.

The toolset can run stand-alone or inside a browser over the Internet on any system which supports Java. When run online the resources (e.g. graphics, videos etc) are accessed from the server. Applications are stored in XML and are assembled into Java components that can be run on the Internet as an applet.

The Toolset is at prototype/proof of concept stage and the subject of an extensive, recently completed 18-month programme aimed at evaluating and improving its functionality, usability and acceptability. The project participants included users based at universities and enterprises in the areas of industry, medicine and business. The project was sponsored by the European Commission's Information Society Technologies Programme (EDUCAT IST-2000-29247).

3. European Commission Multicentre Project

The project had 2 main objectives: 1) to improve the toolset and make it more usable, functional and acceptable, and 2) to explore the creativity of participants in interactive education content development. The participants were asked to use the toolset to create their own education applications and to suggest improvements in functionality and usability. ***Usable*** was taken to infer that the toolset was easy to use and understand, was intuitive and could be learnt by exploring, and was pleasant and rewarding to use. ***Functional*** was defined as capable, easily extensible and robust, and ***acceptable*** suggested that the toolset would be the users tool of choice and they would recommend it to their colleagues.

3.1 Project Participants

8 centres within the European Commission evaluated the toolset (Table 1). 1 of these centres provided specialist laboratory usability testing and 1 other performed a comparative evaluation with commercially available programming and authoring toolsets, e.g. Flash, Visual Basic, Authorware, Agentsheets, Imitation.

Website facilities were central to project integration. The website provides online access and use of the toolset. It was the main source of project communication and dissemination. Training was a pre-requisite to granting access to the toolset. Courses were of 1- or 2-day duration depending upon the computer background of the trainees.

Coordination, training, web site and user support	Imperial College London, UK
Toolset provider and customization	Gazebo Computers, UK
User testing medical applications	Imperial College London, UK
	Technical University Munich, Germany
	University Medical Centre Utrecht, Netherlands
User testing business applications	RDI, UK
User testing engineering applications	IDEC, Greece
Usability specialist laboratory testing	CURE, Austria
Comparative evaluation	European Medical Network, Switzerland

Table 1: Project participants and their roles

3.2 How the results were obtained?

50 project participants were recruited. All were computer literate, but the majority had no prior programming experience. Users built applications using the toolset and feedback was obtained from bug reports, user queries, evaluation questionnaires, and discussion at regular project meetings. Usage of each participant was monitored via the website. Gazebo Computers, the toolset provider, modified the toolset based on the recommendations of the users. 3 versions were released at 6-monthly intervals, each version aiming to improve the usability of the software and to incorporate the feedback and "wish-lists" of the participants.

3.3 Users Views on Final Version of the Toolset

The usability and acceptability of the final version of the toolset was assessed by a questionnaire answered by all users. They reported their views with respect to 1) ease of navigation, 2) intuitiveness, 3) ease of remembering (i.e. using after sometime away from the toolset), and 4) ease of learning (Fig 2). Acceptability of the toolset to create multimedia content was encouraging. 75% of users would like to continue to use the toolset to create interactive educational content after the end of the project (Fig 3).

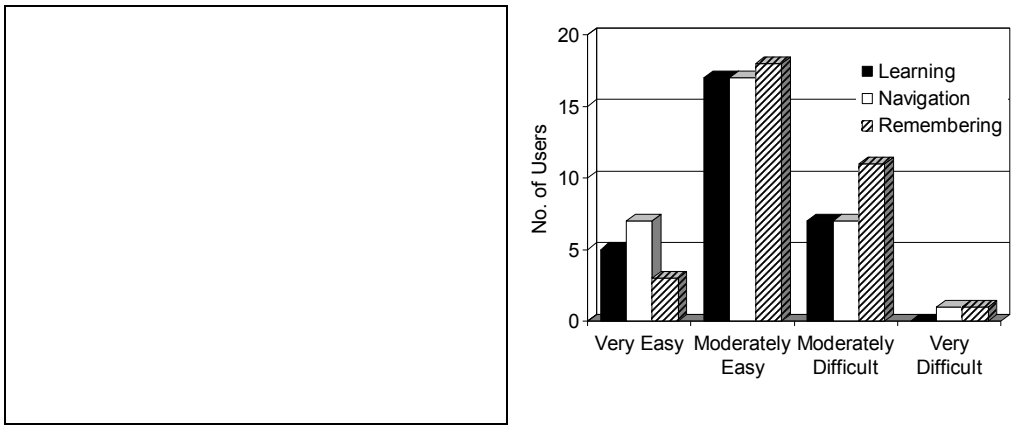

Figure 2: Results of usability testing for the final version of the toolset.

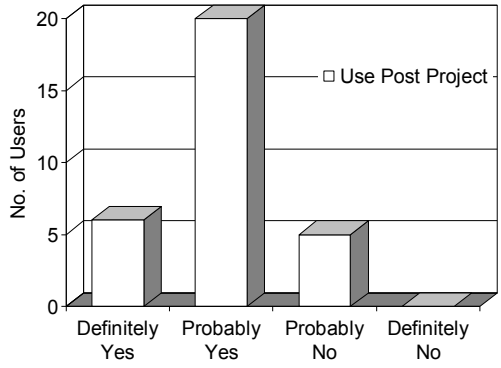

Figure 3: Results of acceptability testing for the final version of the toolset.

In general, users were excited by the possibilities of the toolset. They were inspired and motivated by the fact that they, non-professional programmers, were able to create simulations and interactive educational software quickly. It was observed that the toolset was easy to learn for participants with programming experience. The training needs for this group were minimal. Participants with no programming skills required a 2-day formal training course and a training manual with step-by-step examples. This was sufficient to allow them to quickly develop the skills to build interactive applications.

3.4 Applications Developed by Project Participants

Users were encouraged to use as many of the toolsets' features to develop multimedia educational material. Overall, 27 applications were produced to a sufficient level of sophistication for use as teaching aids. All were interactive and

half of the applications were developed as simulations of medical, engineering and business scenarios.

One example from a medical user is CareMan – a simulated intensive care patient (Fig 4). The trainee doctor can interact with the computer to alter the treatment of the 'patient', for example give blood or drugs, and observe the effects of their interventions on parameters such as blood pressure and respiration.

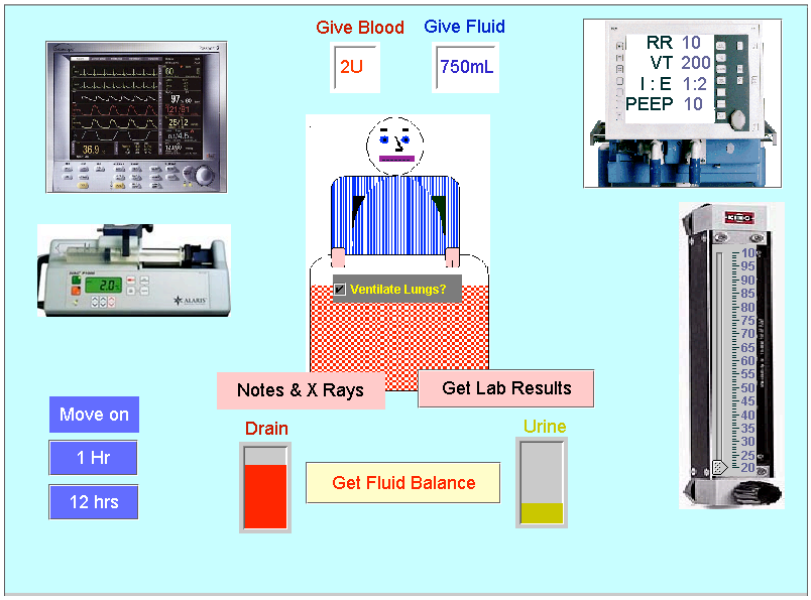

Figure 4: A simulated intensive care patient with monitoring attached and a full suite of physiological responses to critical illness.

Engineering participants visualised and simulated an interactive batch production line for the clothing industry. "Factory managers" can experiment with factors that affect the efficiency of a production process, e.g. distribution of the workforce to balance the production line so that there are no bottlenecks or times when a worker is idle (Fig 5).

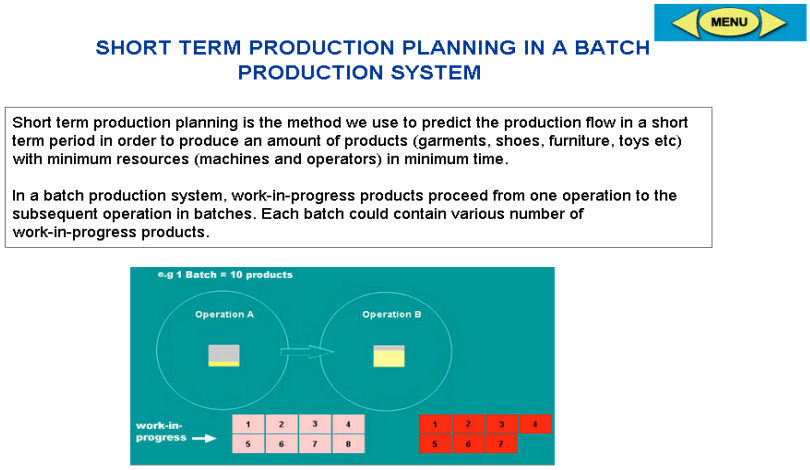

Figure 5: Simulation of batch production planning for the clothing industry.

A 'snakes and ladders game' was developed for players to test their business management skills. The application used features of the toolset to simulate the rolling of a dice and to move players around the board. The game was linked with the toolset's quiz component and players interactively answered questions on decision making, teamwork, and communication. Scores of the contestants were updated automatically by the software.

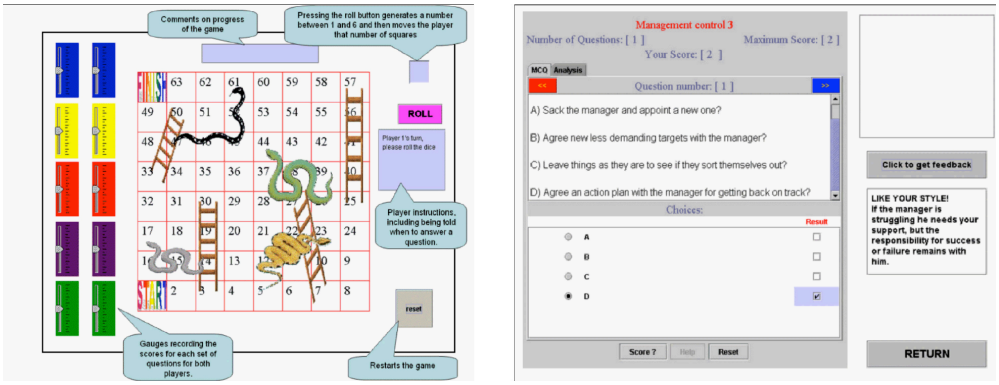

Figure 6. 'Snakes and Ladders' business management quiz.

4. Conclusion

The European project suggests that educators can create interactive educational material with relative ease if provided with the appropriate tools. Building

the material themselves encourages experimentation and creativity. The ability to assemble small units of content that can easily be modified according to teaching needs has obvious advantages over the commercially produced material supplied on CD-ROM. It also allows niche products to be commercially viable.

It is envisaged that early promotion of the toolset will be free trial use via the internet and access to quality examples of educational material. Libraries of simulations and interactive tutorial material will be developed by a community of educators for use within their institutions or between institutions.

The Education Content Assembly Toolset will be developed to the standard of a commercial product and it is foreseen that content libraries will be available to consumers by publication houses specialising in electronic learning materials.