

An Interactive Educational Game For Children in Education

Mehdi Qasim, Salim Aly, and Walters Kristy
Game Simulation and Artificial Intelligence Centre
School of Computer and Information Technology
University of Wolverhampton, UK
Q.H.Mehdi@wlv.ac.uk

Abstract

This paper presents an interactive educational game for Primary School children studying KEY Stage Two History. This game is designed specifically for children to support their continuing studies and to enhance their knowledge and memory retention. The work involves the investigation into Multimedia Design Methodologies and Instructional Systems Design (ISD) Models to support the development of the Instructional Multimedia Model (IMM) in order to provide a structured approach to the development of Interactive Educational Games.

In this work, the development process of the interactive educational game will be outlined together with examples. This development is based on a model tailored for an educational multimedia application development which combines ISD and multimedia disciplines contributes to the success of the resulting application. The paper will discuss how each phase has an influence upon the next and the pedagogical factors which the model takes into account work in line with those required for Multimedia Design.

Key Words: Interactive Educational Game, Instructional Design (ID), Instructional Multimedia Model (IMM), Platform Game.

Introduction

Information Technology becomes an increasingly popular subject in education yet it has been a subject of many a debate. In

2002, The Royal Economic Society conducted a study of one hundred thousand in thirty one schools around the country and the findings were published in the Economic Journal (Angrist and Lavy 2002). It suggests that there is no evidence that Computer Aided Instruction (CAI) is an effective way to teach children.

This study sparked a huge debate amongst both Academics and Educational Software authors alike. David Gilbey (2005) argued that computers, when used correctly, can play an important role and the interactive medium offers a vibrant and varied accompaniment to the textbook inside the class.

Research has shown that the argument for the lack of effectiveness of some pieces of educational software may have been due to the failure to adopt a suitable methodological approach which takes into consideration the learning process of a child and the complexity of a solid design and structure specific to the engineering of educational applications.

This work will not go into depth on the debate over the use of Information Technology (IT) in education. It will rather discuss the frameworks and methodologies for designing and developing an interactive educational game. The factors which contribute to the success of this application in education and how it will influence the teaching will depend on the success of the teaching material using interactive games. This work involves substantial research into the fields of Instructional Design (ID) and

Multimedia Application Development in order to create a methodology to support the analysis, design, development and evaluation of a piece of educational software aimed at children in Key stage 2 primary school education. It is necessary to determine the link between the multimedia design methodologies and practices and how educational software is currently used in schools. This led to the discovery of Instructional Design and Instructional Systems Design which are methods for the creation of educational material. It was discovered that this approach could be significant for the design of this particular application.

The application is to be developed using Macromedia Flash Actionscript 3, which provides a rich and visually impressive interface that was deemed to be very suitable for this work. This educational has been developed in such a way to allow those who are not familiar with Instructional Design and Software Engineering to understand the problem and solutions and is therefore, rather in depth for a product of a technical nature.

In the next section, the literature review and references needed to clarify and back up information and assumptions used in this work will be presented. This is followed by the software design and development of the interactive educational game based on a Platform game genre.

Related Work

Mikropoulos (2000) describes educational software as the software that involves didactic goals, integrated educational scenarios, metaphors with pedagogical meaning and induces didactic and learning outcomes. The educational software is designed to instruct the user on a specific topic or subject using the strategies, techniques, and approaches that teachers use to facilitate learning in the classroom. These types of software all have a predefined set of

goals and learning outcomes for the student. What they are depends upon the nature and target audience of the application.

Early versions of mainstream educational software for children were developed primarily for home use and were usually oriented towards the mathematics and literacy arenas. Due to the fact that these applications were designed for home use, they were not created using a structured pedagogical approach. They were designed simply to supply the child with an interactive and visually stimulating learning environment.

Modern educational applications, due to advances in the research of Computer Aided Learning and Instructional Design, are usually designed in accordance with the National Curriculum of the corresponding target audience age group. This enables the child to use the software in conjunction with their in-class studies, as part of their educational development.

A pedagogical approach to development is common in modern applications. Designers and developers study the science of how a teacher teaches and how a child learns from this, and will apply this methodology to their design. This theory is supported by Nunes and Fowell (1996) who state that in order for it to be effective, hypermedia applications need to be tailored to suit the particular learning tasks planned. They then go on to propose that the academic learning should be seen as the process of construction of knowledge and the development of an automatic awareness of the subject. It seems as though in order for this to be so, the child should be able to interact and engage with the software in a rich and engaging multimedia learning environment. The multimedia methodological approach to the design and development of interactive multimedia application should be therefore an ideal platform. However, the effective approach to the development of educational software is to firstly analyse and eventually incorporate in the design the teaching and

learning process in classroom. Hinostriza and Mellar (2000) investigate the implications of an educational software model upon the processes of designing, developing and evaluating educational applications. The authors suggest that a possible reason for the ongoing debate surrounding the overall effectiveness of educational software is that minimal attention is paid to actual classroom practices and that in order to design software, the key issue is the role that the software will play in the teaching strategy implemented by the teacher. From their findings, the author's implement a software development model appropriate for the incorporation of IT into the classroom. The model stresses the importance of the computer acting as a "*Rehearsal Tool*" (Hinostriza and Mellar 2000) which the student uses to extract and expand upon knowledge.

Grabiner and Dunlap (1995) describe a learning process that allows the student to learn through interaction with rich learning environments and participating in engaging activities. Cummings et al (1999) suggest that educational learning environments should be designed in to incorporate rich activities for the pupil, which will enable them to learn from worked examples, games, challenges and tests. They state that a key aspect to the success of a computer based learning environment is a good educational design, "*Educational design that gives rich activity sets to go with a learning environment is the key to effective learning with computers*". Rich Environments for Active Learning (REAL's) allow the student to extract knowledge from the process of negotiation, conversation, testing and challenging. By allowing the student to interact with information, socially or electronically, they can share, exchange and extract knowledge allow learning to be active and experimental. (REAL's) are an aspect of educational environments that stress the importance of collaboration and interaction

by incorporating modern teaching and learning practices and classroom environments into the software Grabiner and Dunlap (1995). Phillips (1997) states that research and practice indicate that an iterative approach to multimedia educational applications is required that allows the involvement of the end users in the design process to help ensure that the product designed meets their needs and is usable due to the fact that in Multimedia applications frequent change of design and requirements is normal practice.

This educational application will require a multimedia methodology that allows for the change of design criteria as the project progresses which also incorporates a pedagogical approach to design, development and evaluation. A development methodology 'Incremental Prototyping Model' in which the process is gone through repeatedly, as many times as required will be needed. This methodology is used in this work to design, construct, and test our interactive educational game. If the prototype fails to meet the requirements of the project, it can be discarded and a new prototype be developed which incorporates the necessary changes to the design and the new requirements which have been identified. "*This way, the design can be continually refined and problems eliminated step by step*" (Phillips, 1997).

Interactive Educational Game Prototype

The proposed Instructional Multimedia model (Walters, 2006) for an educational interactive game was implemented into a platform game using Macromedia Flash action-scripting 3.0 (Rosenzweig, 2008). The application prototype developed is a platform game that immerses the player into a gaming experience whilst acting as a testing tool that reinforces learning during lessons. The application is aimed at children in an ICT classroom environment studying key-stage two history. Children are presented with various options and sub categories regarding the topic of Roman

study and the children have the liberty to navigate freely about the program. The children will be able to learn a specific topic at their own pace. A rich user interface is especially important when designing for children as a visually stimulating environment will keep the student engaged in the application and hence prove effective.

In the design phase, the Romans history curriculum for key stage 2 and 3 (BBC Ancient History, 2008) was implemented into the game. This allows teacher and instructor to test the memory retention of the students at the end of a history lesson. The story line of the game starts as the player becomes a roman soldier having acquired enough knowledge about the Romans. The player controls the movement of the avatar while it collects items and answers questions as it moves towards its goal. The player must avoid being captured by the guards while navigating through the game environment to maintain a high score. The player must answer all questions of the randomly selected before it gets the treasure key that allows for advancement to the next level. The score has been designed to give correct answer a certain amount of points and points deducted from the total score for each wrong answer. When the key is obtained the door can be opened which takes the player to the next level, here the player can find the treasure box to complete the game. The game offers a good platform for combining learning and entertainment to help teachers to promptly assess the performance of students taking part in this activity. It can support children with their continuing studies and enhance their knowledge and memory retention.

Conclusion and Future Work

Entertainment and education can be an exciting field if combined together. This will positively contribute to the learning experience by allowing children to consolidate on the material they already have been taught, and will help introduce

new material that will broaden understanding. Games can provide a test-bed to assess students' knowledge and success of the instructions that they have been taught.

The proposed prototype game is in its early stages of development and requires a great deal of improvement to reach its potential. The application can benefit from the inclusion of a database to store students' scores to enable teachers to monitor their progress and highlight any areas of concern. Further more, this will enable teachers change questions and subjects in the game during the class session.

References

- Angrist, J., Lavy, V. (2002) New Evidence on Classroom Computers and Pupil Learning. *Economic Journal*, **112**(482), p.760.
- BBC Ancient History, accessed 10.6.08 <http://www.bbc.co.uk/history/ancient/>
- Cumming, G., Finch, S., & Thomason, N. (1999), Educational Design for effective learning: Building and using a computer based learning environment for statistical concepts, *Advanced Research in Computers and Communications in Education*.
- Gary Rosenzweig (2008), *ActionScript 3.0 game Programming*, Que Publication, ISBN-13 978-0-7897-3702-1.
- Gilbey, D. (2005) Are Computers bad for kids development? *.NET magazine*, June 2005, p.18.
- Grabiner, R., Dunlap, C. (1995), Rich Environments for Active Learning, *Association for Learning Technology Journal*, **3**(2), p.5 – 34.
- Hinostroza, J.E, Mellar, H. (2000) Considering Pedagogy in the Design, Development and Evaluation of Educational

Software, *World Conference on Educational Multimedia and Hypermedia*.

Kristy Walters (2006), "The Design and Development of an Interactive Multimedia Tool for Children in Education", Final year project, University of Wolverhampton, UK.

Mikropoulos, T.A. (2000) Design, Development and Evaluation of Advanced Learning Environments: An overall Approach.

Nunes, J.M., Fowell, S.P. (1996) Developing educational hypermedia applications: a methodological approach, *University Of Sheffield: Information Research*, 2(2), p.3.

Phillips, Robert (1997), *The Developers Handbook to Interactive Multimedia: A practical Guide for Educational Applications*. London: Kogan Page.