Work In Progress - Learning via Gaming: An Immersive Environment for Teaching Kids Handwriting

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Abstract - **Immersive learning using computer animation and simulation is an attractive concept. Use of immersive technology to deliver flying lessons to NASA astronauts is well known. While the efficacy of immersive environments for education and training is well established, their accessibility to elementary and middle schools students is negligible. Until recently, hardware costs and long development-times were two major factors impeding creation of such environments for younger students. Computing technology, specifically human machine interface development, has come a long way in the last decade. The authors are making use of this emerging technology to develop an immersive gaming environment to teach handwriting to elementary school children using a tablet PC delivery system.**

Index Terms – Immersive learning, Intelligent Tutoring Systems, Serious games, Tablet PC's.

INTRODUCTION

There has been a fair amount of research on user interface design for children [1, 2], error rates in text entry user interfaces [3], interactive teaching environments using Tablet PC's [4, 5] and using games as tools to promote learning in and out of the classroom [6, 7]. There has been very little research done on combining all of these elements into a tool suitable for teaching children how to write.

A tablet PC comes equipped with a touch screen that is designed to work with a pen input device or stylus [8]. Students can use the stylus to perform all functions found in an ordinary mouse, but more importantly, the Tablet PC allows students to use the stylus write directly on the display screen. Interacting directly with the display screen provides users with an environment that is very easy to use [8]. Studies suggest that young children may have problems using the standard QWERTY keyboard as a compositional tool. There is some evidence that suggests children may write more easily using a Tablet PC than by typing on the keyboard [3].

Some teachers feel that computer games can motivate students to maintain their attention on the goals of particular learning activities. Many of these same people feel that games may enhance the classroom environment by allowing the teacher to play a less dominate role and by not be forced to serve as the sole judge of student performance [9]. Games can be a powerful and pervasive way to take learning outside the classroom [6].

When playing a computer game, children may notice the multimedia content in the game, have fun interacting with game elements, and observe how easy some things are to learn [10]. There are several interface design issues that need to be addressed when creating game environments for children. Some of these include: creating consistent and predictable user dialogs, offering informative feedback, providing simple error handling, and reducing the user's short term memory load [1].

Children learn at different rates, in different ways, and with different capacities [11]. Intelligent tutoring systems go beyond the limitations of traditional computer-based training systems [9]. Intelligent tutoring systems use information on a student's current and past performance to deliver customized content in a style best suited to the student's current instructional needs [12].

SYSTEM DESIGN

The goal of this project is to create an immersive gaming environment using a Tablet PC that teaches children how to write using the D'Nealian [11] handwriting system. While playing the game, students are taught to write new letters as a means of opening reactive game elements. Students gain access to new game features by writing required key letters using the method taught. An intelligent tutoring system provides feedback on the children's work, telling them what they did right or wrong, and how to correct any errors made. Players progress through game levels with increasing difficulty as they work their way through the game world. Figure 1 shows a screenshot from the immersive game system.

The system design contains three key modules: (1) an interactive gaming environment where students play a in game environment to find hidden treasure, (2) a student writing evaluation and feedback module, and (3) a teacher evaluation and feedback module. Macromedia Flash is the implementation language for the computer animation in the game module. Microsoft C# is the implementation language

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for remainder of the system (including the user interaction and intelligent tutoring modules).

FIGURE 1
STUDENT SCREEN LAYOUT.

Figure 2 shows the architecture of the intelligent tutoring system. Our system incorporates a series of remediation rules developed by our research team working in collaboration with Donald Thurber, the creator of the D'Nealian handwriting system [11]. When implemented the complete set of rules, will allow for the differences between: fast and slow learners, girls and boys, even left-handed and right-handed users. These rules, in turn, guide the users through the game and help them develop their handwriting skills. Audio output and narrated animations are used to provide instructions and feedback to non-reading students.
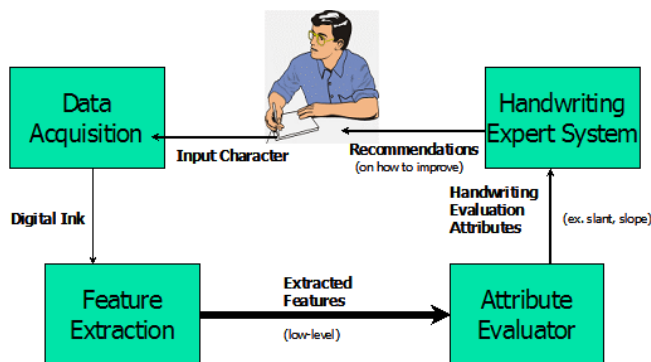

FIGURE 2
INTELLIGENT TUTORING SYSTEM ARCHITECTURE.

CURRENT STATUS

The authors have created a working prototype for the game environment and demonstrated the feasibility of using Flash and C# as a development platform. Sixteen senior and graduate level students studying game design at the authors' institution evaluated the prototype through play testing. These students used a five-point scale (1=poor, 5=excellent) to rate the prototype. Their average rating of the usability of the software is 4.9, the reliability of the software is 4.9, the entertainment value of the software is 4.5, and the quality of the game premise 4.7. The knowledge acquisition phase for the intelligent tutoring system is on going, as is the design of the knowledge base architecture.

FUTURE PLANS

The authors are working with Dr. Thurber to create the initial knowledge base for the intelligent tutoring system during the summer of 2007. Creation of art assets is a time consuming process and students from a nearby art college will be working to enhance our multimedia game asset library during the fall of 2007. The authors plan to begin testing the system with young children during the winter of 2008.

ACKNOWLEDGMENT

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