DEVELOPING AN INTERACTIVE LEARNING TOOL FOR GRADE III MATHEMATICS USING ADOBE® FLASH®

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TABLE OF CONTENTS

ABSTRACT

Game-based Learning (GBL) gave rise to a new method of teaching that allows active participation and involvement from the students. At present, webcam games are widespread on the internet. However, most of them, if not all, are for entertainment purposes only. The proponents designed and developed an educational game in Mathematics for grade three students that allow user input from webcam or mouse. The project analyzed motion-tracking concepts using the multimedia platform Adobe® Flash®. The game is composed of three levels that vary according to difficulty. To test its efficiency and acceptability, 28 grade three students and 4 teachers from the Ateneo de Davao University Grade School Unit were selected to test the game by undergoing familiarization, actual game play, and evaluation. The results of the study indicated positive interest in the webcam game in learning Mathematics.

Keywords: *Game-based Learning, Educational Game, Webcam, Motion Detection, Mathematics, Adobe® Flash®*

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The internet provides a wide market for interactive learning tools, which gave rise to the term Game-based Learning (GBL). It refers to software applications that make use of games in providing competitive exercises for education and learning. They are created to develop awareness and motivation for children since it allows active participation and interaction from being involved in the game.

Web cameras, or simply webcams, have been available in the industry since 1991. They have been used for video conferencing, video security, input controlling and video recording. Nowadays, webcams are also used for playing games for a Kinect-like kind of experience. However, only few games utilize the technology of the webcam. On the internet, there are only few webcam games and most of them, if not all, are entirely for entertainment purposes. Concisely, there is a huge viability for a webcam game, which is educational and purposeful.

According to Thomas (2008), many children find Mathematics the hardest subject in school. Last 2003, Trends in International Math and Science Study (TIMSS), the most comprehensive study of mathematics and science proficiency in the world, conducted a study, and Philippines ranked near the bottom. In Mathematics, the Philippines got 358, third from the bottom among 25 countries wherein the international math average was

495. As the government points out, the result was due to the country's lack of properly trained teachers in math and the lack of resources of the students to pursue this subject.

With Fun with Math, children are tested with their knowledge through a game. It displays basic mathematical figures and problems. It allows the player to select an object on the screen using his body movement, as detected by the software. The player has an option to use mouse if his computer does not have image capturing capabilities. The game is also capable of recording the progress of the student. The next level will be unlocked if the player is able to complete the preceding level. Since children like to play interesting games, they can experience new ways of learning and understanding Mathematics while having fun.

1.2 Technology Application Context

Fun with Math was developed using Adobe® Flash® Professional CS5. It can add animation, video and interactivity, which were all applied game. It also captured user input web camera and mouse. Adobe® Flash® Professional CS5 also uses the object-oriented programming language ActionScript 3.0 which was used to manipulate graphics with precise results. Both the mouse and webcam functions were written using ActionScript 3.0. The integration of the webcam video to Flash was also made possible using the classes and libraries that currently exists in Flash. Motion detection was also programmed using ActionScript 3.0 by plotting the x and y coordinates of the movement as detected by the webcam.

To save the player's information such as username, scores, and current game level, the SharedObject class is used. It reads and stores limited amounts of data on a user's computer, as stated in Adobe Help. Shared objects provide real-time data sharing between multiple client SWF files and objects that are persistent on the local computer. Local shared objects are similar to browser cookies.

The graphics and images were edited using Adobe® Photoshop® CS5. The proponents developed a desktop application through Adobe AIR 2 that served as the environment for the game. Adobe® AIR® runtime includes both the WebKit HTML and Adobe Flash® engines, which enables developers to build applications using HTML, JavaScript, Flash Professional, or Flex. Adobe® Flash® Professional CS5 software provides integrated support for delivering interactive experiences on the desktop with Adobe AIR (Adobe, 2011).

1.3 Objectives of the Study

The general objective of this study is to design and develop an interactive educational game in Mathematics for grade three students.

The specific objectives are:

- To learn how motion detection works in webcam
- To utilize Adobe® Flash® Professional CS5 in developing the game
- To use the classes and libraries of Adobe® Flash® in tracking motion on web camera
- To evaluate the usability of the game to the students

1.4 Significance of the Study

This study is significant for grade three students and their mathematics teachers. The teachers can use this interactive game as a learning tool for the students. This will help maintain the students' interest in the lesson, specifically in Mathematics, because it is more interactive and challenging. The student will feel more involved in the lesson through this webcam game.

With the implementation of this interactive game, it introduces a new way of learning Mathematics to the students since they can play it through a webcam. It caters the subject as well as the visual and kinesthetic aspects. The learning tool presents an opportunity for more interaction and collaborative learning inside the classroom.

By using the webcam as an input device, it allows flexibility in terms of the type of interaction the game wants to occur. It will allow different interactive experiences without the need for a new input device. Through this, the interactive webcam game can also be a form of physical activity for the students because it involves the use of the whole body.

1.5 Scope and Limitations of the Study

The study generally focused on analyzing motion detection techniques in creating a webcam game in Mathematics for grade three students. The project focused on selected topics for grade three Mathematics (Odd and Even Numbers, Multiplication, and Division without Remainder) and was tested in Ateneo de Davao Grade School students and teachers. During the user acceptance testing at Ateneo de Davao Grade

School, only the webcam as game controller was used. The mouse controller was not used due to the limited time given to us because of the grade school department's incoming activities.

The game is a standalone desktop application. The game was tested and developed specifically for a computer with 1280 x 800 screen resolution. The player has the option to play the game using the webcam or mouse. In relation to the webcam technology, the game is only effective under certain conditions. Specifically, the player should be in the center of the screen and stands out from the rest of the background. Ideally, the player should also stand in front of a relatively static background, to prevent false motion detections by the webcam. It may also be necessary to disable Auto Exposure and Auto White Balance in the webcam's settings or configuration, to prevent sudden intensity changes from affecting the game play.

1.6 Definition of Terms

ActionScript

ActionScript is the object-oriented programming (OOP) language used in creating games and animations in Flash. It is an event-based language.

Image differencing

Image differencing is an image processing technique used to determine changes between sequences of images. It is computed by finding the difference between each pixel in each image, and generating an image based on the result.

Optical Flow

Optical Flow is used to determine movements from sequence of images. Each part of the image is broken into square patches and searched for the best match within the previous image and calculates the image movement.

Thresholding

The process of image segmentation used to create binary images from a grayscale image is called thresholding.

Web camera (webcam)

Web camera is a real time camera whose images can be accessed using the World Wide Web, instant messaging, or a PC video calling application.

Adobe AIR

Adobe AIR is a cross-operating system runtime developed by Adobe Systems that enables developers to build Rich Internet Applications using Adobe Flash and Adobe Flex to the desktop.

SharedObjects

SharedObjects, also referred as Flash Cookies, is a Flash component that stores data, such as usernames, on the user's computer. The flash cookie files are stored in the computer's Local Disk with an.sol extension.

Motion Tween

"Tween" refers to the creation of successive frames of animation between key frames. In Flash's "shape tweening" and "motion tweening" processes, the user can define two key frames and Flash will automatically create the in-between frames, either morphing one shape into another over a set period of time or moving a shape from point A to point B.