THE PIANO GAME: USING LOW COST LAPTOPS FOR MUSIC EDUCATION

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ABSTRACT

Music Education is rarely explored in basic education, especially in Brazilian public schools. Mainly, the lack of music instruments and specialized teachers is the reason for such little time dedicated to music in schools. Nevertheless, music is part of a child's education. As recent low cost laptops have appeared and will be inserted in large amounts in schools to provide a one-to-one technology, music education can be introduced to children thru these machine.

In this paper we present the Piano Game, a software program developed for low cost laptops. The Piano Game is a computer program for music education that stimulates audition and execution activities and improves music notes recognition. The research intends to develop, evaluate and distribute a free and open source software program for low cost laptops.

KEYWORDS

Music Education, Mobile Learning, Low Cost Laptops, Free Software, Python

1. INTRODUCTION

Music Education is a fundamental part of a child's complete education. In basic education, art educators usually only work with visual arts or theatre, mainly due to the lack of music instruments and specialized teachers. Recently, low cost laptops have appeared on the market and the intention is to insert them in great quantities in school environments on the one-to-one basis. This situation makes every classroom become a computer lab, since the machines are always available and can be used by teachers and students as yet another learning tool. With these new digital media available for each child in the classroom, new learning experiences can be created and can enrich different knowledge areas empowering learning. This new tool used with specific educational software programs can support different learning activities like for example music education, without initially requiring specialized teachers or music instruments. Learning experiences can now occur in different times and places, the learner becomes a mobile learner and the application supports mobile learning.

This paper presents the research and development of the Piano Game, a software program that uses computer and telecommunications resources to offer a program that supports music education of children. The goal of this research is to develop, evaluate and offer a free and open-source software program that stimulates musical notes recognition.

2. MUSIC EDUCATION THEORY

In Brazil, very little can be found in research involving education and technology, especially when compared to other countries. When referring to music education, especially composition and audition, research in this area is scarcer. These two areas are central to the musical development and education (Krüger et al, 1999).

The CLASP model, presented by Keith Swanwick (Swanwick, 1979), suggests five parameters that constitute the relationship between people and music: Composition, Literature, Audition, Skills and Performance. Composition, Performance and Audition are considered the basis for music understanding since they allow direct involvement with music in a practical way (Swanwick, 1979) and (Hentschke, 1993).

The Piano Game supports the user in two primary characteristics: performance and audition. Therefore this project combines new technology with recent music education studies.

3. GAME DESCRIPTION

The goal of the Piano Game is to recognize music notes on a virtual piano. The game includes different challenges, represented by sticks, divided in two levels: easy (top bucket) and hard (bottom bucket).

The game's interface includes a virtual piano, where the user can listen to the sound of every key just by laying the mouse symbol on the key (Figure 1).

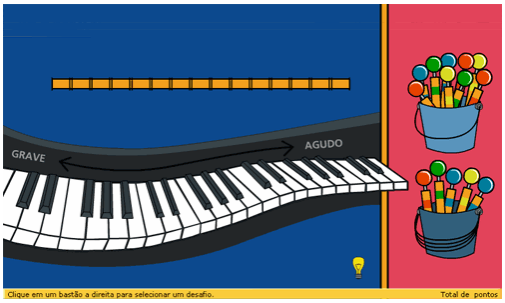

Figure 1. Piano Game Interface

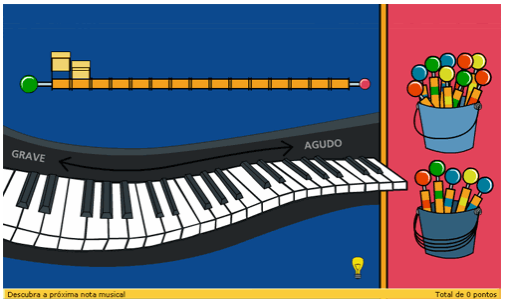

Figure 2. Animation

After choosing a stick, a piece of music is played, an animation appears on the screen (Figure 2), the challenge is set and the user needs to discover the sequence of notes that has been played.

The user can play click on the left ball to replay the piece of music of the challenge or can hear one of the notes to be discovered by laying the mouse on one of the cubes that represent the notes (Figure 3). In that case, the symbol of an ear will appear on the screen and the specific note will be heard.

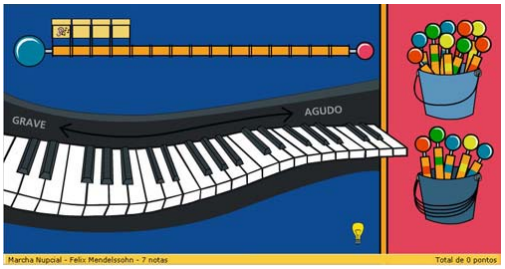

Figure 3. Cursor changes to an ear

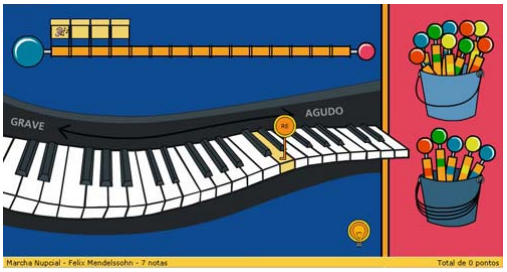

Figure 4. Help tool activated

In the order of the sequence, the user interacts with the software to discover the next note by scrolling over the virtual piano and clicking on the key corresponding to the note. If the key pressed is the correct key, points are added to the total number of points; otherwise a message appears on the bottom bar suggesting the user should try a higher or a lower pitch.

A help tool has also been implemented. To use the help tool, the user must activate it clicking on the lamp on the bottom part of the screen. With the help tool turned on, the user can lay the mouse on one of the notes of the challenge sequence, and the software will point to the piano key that corresponds to the sound (Figure 4). The user accumulates fewer points completing the challenge using the help tool.

When the user concludes the recognition of the complete sequence of notes, an animation is shown and the original music piece from which the challenge was inspired is played. The original music piece played to the user when discovering the whole challenge can be considered an audition activity suggested by Swanwick, but is also a positive re-enforcement feedback and comes as a pleasant surprise after the exercise.

Users develop performance and audition skills playing the Piano Game. When users scrolls on the piano keys and hears the notes, they are working on their performance skills. The audition skill is worked on when the user listens to each note and tries to recognize it on the virtual piano and when the user completes the challenge and hears the complete piece of music the challenge was inspired by.

4. IMPLEMENTATION METHODOLOGY

Originally, the Piano Game was implemented in Adobe Flash (Adobe, 2007) as part of the Edu Musical Portal (Ficheman et al., 2004). This programming language was chosen for the Portal's development because of the possibility to create animations and interaction with users, and to allow sounds reproduction. Also, free Flash player are available and can be downloaded from the Web and installed on the users' computer.

The OLPC XO (One Laptop Per Child, 2007) has a Gnash (GNU Project, 2007) installed, a flash player with open source that supports flash implementations including animations. Initial testes made on the XO with the available Flash player showed that user interaction and animations are very slow, which makes the Gnash use unacceptable on this platform. However, as the Gnash is under development, it does not have an accurate forecast of when this problem will be solved.

All the programs being developed for the XO follow the concept of free software and should have open source. As the Adobe Flash player does not follow this idea, it cannot be distributed with the XOs.

Moreover, another inconvenience of the Flash version of Piano Game is that the user needs to be connected to the Internet to access it. This becomes a problem since many Brazilian public schools, which are the focus of these low cost laptops, do not have Internet connection yet and when they do, the bandwidth does not support users simultaneous demands.

Because of all the problems explained above we decided to implement the Piano Game using the Python programming language. Its' main characteristics are that it is an object oriented programming language, it has a very simple and comprehensive syntax, facilitating code programming and understanding and it is necessary a Python interpreter. Programs developed in Python are open source by standard and there are already many libraries that implement several functionalities. One of these libraries, used in the Piano Game, is the PyGame graphics library (Python Game Development, 2007), which main objective is to facilitate the game development in python and which is included in the XO operating system.

Initial tests of the game have been performed and the results show the correct functioning of the game, and performance improvement when compared with the version tested with the Gnash.

5. FUTURE WORKS

In the next step of the research, we intend to conduct some tests of the Piano Game with end users (children between 7 and 12) to verify usability, acceptance and to collect suggestions of improvements. Interaction with users to verify the pedagogical usefulness of the Piano Game has been suggested in (Ficheman et al., 2005), (Benini et al., 2004) and (Krüger, 2000). Also work with teachers will help verify and explore the alternatives of classroom use.

Furthermore, we plan on studying the possibility to include a tool that allows the user to modify the game by adding personal challenges. These challenges could be created by the children themselves or their teachers and could be made available to other users on the school server. Also, when Internet access is available, challenges could be posted on a Website and could be downloaded, allowing interaction between users.

The XO laptop connects to other laptops using a Mesh Network protocol. This means that a group of students using their laptops can connect to each other without a network infrastructure like access points. As a consequence, groups of students are able to work together using their laptops. We plan to take advantage of this, studying and implementing a way that users can interact with each other using the Piano Game.

6. CONCLUSION

This work has presented the Piano Game, whose main objective is to make available a tool that allows music education on low cost mobile platforms, stimulating music education in schools.

In the technological point of view, the Piano Game made possible advances in the development of sound programming techniques using the Python programming language, as well as its integration with graphical elements. The game's differential is mainly for having been developed for low cost educational laptops that has many limitations in terms of its computational power.

In the pedagogical-musical area, the importance of this program is to provide the possibility to insert music education in schools, to stimulate children's creativity (Lopes and Krüger, 2001) and to provide users' social and digital inclusion (Ficheman, 2002).

The game described in this paper, as well as other similar software could reach a great amount of students and teachers of public schools, since low cost laptops will be widely distributed in many countries. Thus, the use of the Piano Game could stimulate the intensification of social and cultural activities in public schools around the world and, concomitantly, provide social and cultural improvements of its users.

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