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Kinect TEAM: Kinesthetic Learning Applied to Mathematics Using Kinect

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Abstract

The human interaction with computer can be used to create a wide range of learning technics that can be visual, animated, or interactive. Kinect can support kinesthetic pedagogical practices that can benefit students of mathematics, having also the potential of increase classroom participation, and improve the motivation of learning math. Kinect is a device development by Microsoft, originally designed for the Xbox 360 but later making a new version for pc and xbox one. Kinect is able to provide skeletal tracking, audio recognition and provide the developer with a depth camera and a normal camera and is able to capture movement up to 2 people simultaneously. With this capacity the Kinect makes a perfect hardware piece for Kinesthetic learning. Our main objective is to develop a set of tools involving augmented reality and virtual reality for the understanding and learning of Calculus for students in High School and College. The purpose this work is to show the progress made at the time in the application we have called "Playing with DOT". In it, students can interact visually and using gestures with the graphs of functions of a real variable. A character (DOT) is the way that represents the interaction with Kinect through the fist of the student. The gesture that occurs with the fist will result in a graphic representation of motion in a straight line it has been simulated with the fist. The student will identify different characteristics of movement performed by the graphics functions and their derivatives in a coordinate system. With the challenge that the game presents, it is expected that the student arrives to swiftly identify different behaviors of graphs. Features of growth or decrease and concave up or down will be associated with increasingly fast or slow movements, left or right.

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Keywords: Kinesthetic; motion sensor; math education; human interaction

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1. Introduction

The technology is currently at each point of our daily life, the use of this from an educational point of view pass through the use of so-called educational software, these materials are supposed to use the computer with a didactic purpose. Educational software functionality is determined by the characteristics and the use made of it, its adaptation to the context and organization of teaching activities. The use of these materials is therefore potentially many advantages such as motivation for academic tasks, continuous intellectual activity, development of the initiative, learning from mistakes, cooperative activities, high degree of interdisciplinary, individualization and autonomous learning [1].

The study of mathematics itself represents a system of expression and abstraction, is a language that expresses ideas, concepts, theories and responds to phenomena and events at the degree that if you have mastered this "language" you have the possibility of establishing a full dialogue from the symbols are handled.

As the years pass, the learn of mathematics are taking more complex forms and is common to hear a lot of students at any level of education, a rejection of the matter causing in these students, instead of being present mathematical knowledge as a tool to better understand their environment, is an obstacle and a continuous barrier in their studies.

This difficulty in learning and in the way we perceive this science has all explanation and logic through based on the inviolability of mathematical concepts, which leads us to question whether the way we solve the information in this science differs or it is governed by similar methods to those of other areas as we are indicated by the epistemological theories of development, where it is assumed that cognitive processes are relatively common in all areas of study [2]

Some emerging technologies base their technological contribution to the field of visual information under new schemes. As an important example we can mention the use of motion sensors, and as a specific case of Kinect, which allows students to control and interact with educational applications without having physical contact with a controller through a natural user interface that recognizes gestures, voice commands, objects and images.

Nomenclature

A	Motion sensing, is the process of detecting a change in the position of an object.
B	Kinect, is a motion sensing input device by Microsoft.
C	Kinesthetic learning , is a learning style in which learning take place by having a physical activity

1.1. What is kinesthetic learning?

Kinesthetic learning is a learning style with the use of verbal and visual learning, in which the student makes a physical activity. Kinect can support kinesthetic pedagogical practices that can benefit students of mathematics, having also the potential of increase classroom participation, and improve the motivation of learning math. Despite Kinesthetic learning have recognition as an important learning style, this activities have not received much attention at the schools. The degree to which physical activity is present in the classroom appears to drop to nearly zero as students' progress from primary to secondary to post-secondary school [3].

1.2. Kinect and math education

One of the reason for the use of a motion sensor in the classroom, in this particular case Kinect, is to create a visual and tangible experience that motivates student learning, this makes viewing and learning concepts taught in mathematics courses, directing them to tangible situations, this being a student first approach to a much more visual process of applying the concepts.

The idea of seeing in the technology a infrastructure that provides knowledge of mathematics can change the ways we interact with mathematics, where technology is well regarded as a "cognitive partner" which provides new learning skills [4].

The analysis of the different motion capture technologies that are emerging should be part of the foundation since it must justify new patterns of interaction and applications to educational projects with their respective implications. Kinect allows students to break the barriers of what is possible with human interaction, opening up endless possibilities for innovative ideas in the field of education [5].

2. Progress in the application Playing with Dot

"Dot" is the main character with whom the student will identify and manipulate to interact with the application, in which he will identify different characteristics of movement performed by the graphics functions and their derivatives in a coordinate system.

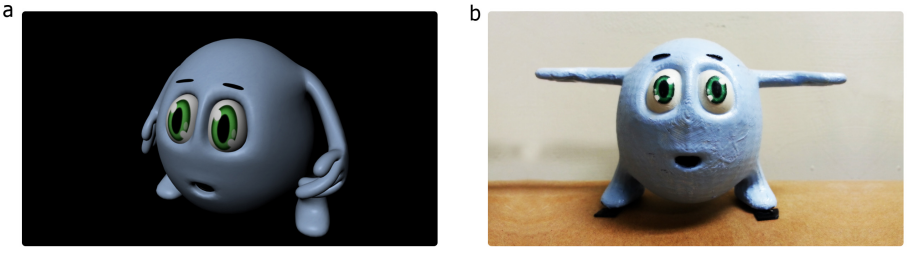

Fig. 1. (a) "DOT" 3D render; (b) "DOT" 3D Print model.

There are two scenarios, developed using Autodesk Maya software, the main menu through which the student will access the different challenges, using her hand to enter each of these, and the second stage in which they carry out educational exercises, called the playground.

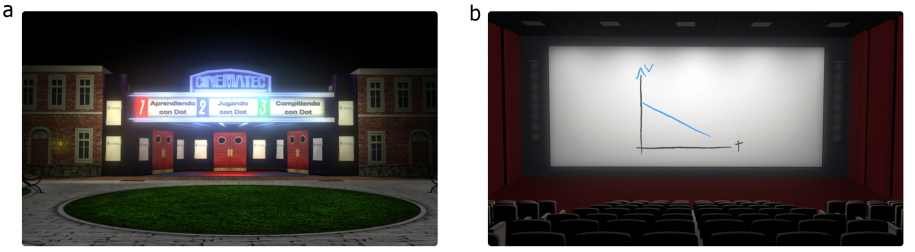

Fig. 2. (a) Application main screen; (b) Application playground

With the challenge that the game presents, it is expected that the student arrives to swiftly identify different behaviors of graphs. Features of growth or decrease and concave up or down will be associated with increasingly fast or slow movements, left or right.

There have been demonstrations inside Tecnológico de Monterrey, in which not only sets in use kinect sensor movement, if not a higher level of immersion is achieved by using the virtual reality headset Oculus Rift.

Fig. 3. Application test and demonstration (Campus Monterrey)

3. Conclusion

The main objective of this application is to provide new tools as alternatives to current methods of teaching mathematics, based on the interaction of elements through motion sensors as a fundamental part of the education of the students.

It also aims to integrate the use of various multimedia elements such as moving images and virtual spaces on the contents of the mathematics programs in the Tecnológico de Monterrey.

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References

1. Cebrian M. El papel de los medios tecnológicos en la didáctica. Revista de educación, 1991; **294**: 427-443.
2. Duval R. A crucial issue in mathematics education: The ability to change representation register. ICME 10, 15,16. 2004.
3. Begel A, Garcia D. and Wolfman S. Kinesthetic Learning in the Classroom, ACM SIGCSE Bulletin, 2004; **36**(1).
4. Moreno-Armella L. Mathematical thinking and technology: some views on their co-evolution. Matemática Educativa. 2008.
5. Eisler C. Kinect and The Education. (Interviewer).2012.