

# Kinesthetic Promotion of Function Graph Recognition at University Level

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**ICME13**

Hamburg 2016

13<sup>th</sup> International Congress on Mathematical Education, July 24-31, 2016 in Hamburg - Germany

# Presentation Structure

1. Introduction
2. The Development of Kinesthetic Digital Resources
3. The Development of Recognition Test
4. Method and Procedures
5. Results
6. Conclusion



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# Introduction

# Main 3 Hypotheses

- Involving other senses, than the usual reading and listening, in learning might lead to better learning, engagement and motivation of particular subjects.
- The use of the kinesthetic approach would develop students' recognition and understanding of mathematical function graphs.
- Some students might need to use other senses as a preparation to abstract and symbolic thinking at University and Undergraduate levels.



# Presentation Structure

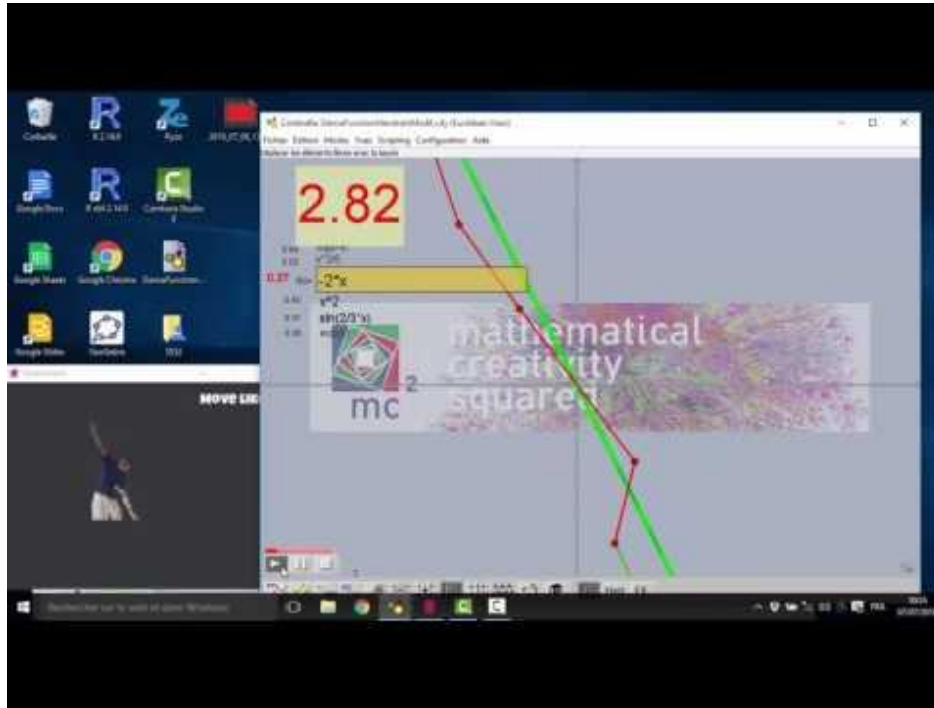
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# The Development of Kinesthetic Digital Resources



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# The Development of Kinesthetic Digital Resources



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# The Development of Kinesthetic Digital Resources

- Microsoft Kinect Sensor.
- Unity 3D Development Kit.
- Microsoft Kinect Software Development Kit.
- CindyScript: A programming language associated with Cinderella (DGS).
- UDP (User Datagram Protocol).





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# The Development of Recognition Test

Function Type	No. of Items	%
Constant function	2	10%
Linear function	2	10%
Quadratic function	2	10%
Cubic function	2	10%
Square root function	2	10%
Absolute value function	2	10%
Fractional function	2	10%
Trigonometric function	2	10%
Exponential function	2	10%
Logarithm function	2	10%
<b>Sum</b>	<b>20</b>	
<b>%</b>		<b>100%</b>



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# Method and Procedures

## 1. Subjects

- The setting for the experimental study was at CFAI Savoie Chambéry.
- CFAI is a college training for careers in industry for young people, employees and companies. It offers quality training to industrial companies.
- The enrollment of this college is approximately 280 students. The subjects of the study were 51 students of the first year of Maintenance of Systems and Technical Assistance engineers.



# Method and Procedures

## 2. Experimental Design

- The pre-experimental one-group, pretest – intervention – posttest design was used to investigate the effectiveness of the prepared kinesthetics digital materials in enhancing the students' recognitions of mathematical function graphs.



# Method and Procedures

## 3. Before Intervention

- The researchers prepared two computers connected with two Microsoft Kinect sensors in order to get kinesthetic feedback from the students. Cinderella and Unity 3D Development Kit are also installed so that the software recognizes students' **body gestures** as input representations for mathematical function graphs.
- The researchers met with the subjects of the study explaining to them the aims, the nature of the study, what is required from them during the study (Starting from the pretest, going through administering dancing as a “**Function Hero**” game, and ending with the posttest) and what is expected from them by the end of the experimentation.



# Method and Procedures

## 4. Administering the Pretest

- The **recognition pretest** was administered to the study subjects as a pretest at the beginning of the experimental study to assess their recognition of mathematical function graphs. The subjects were informed that the duration of the pretest is **ten** minutes.



# Method and Procedures

## 5. Administering the “Function Hero” Game

- The class was divided into two groups of students according to their side in the classroom (left or right). At first, as a warm up, two different sets of functions were used and each group was subjected to a given set of functions. Each student got a score according to his performance.
- Then the students edit the choreography and enter the functions of their choice.





# Method and Procedures

## 5. Administering the “Function Hero” Game

- Students used their handheld calculators in order to propose functions to their group. They tried to enter complicated functions that the other team would not know or would not be able to perform. But it appeared to be complicated and difficult to them as well, so most of them went back to propose simple functions.
- Afterwards, the first team perform their own choreography, then the second team trying to get comparable scores. A comparison of the scores for the two teams elected a winner team and an overall winner of the game. Small prizes were then distributed.



# Method and Procedures

## 6. Administering the Posttest

- The **recognition posttest** was administered to the study subjects as a posttest at the end of experimental study to assess their recognition of mathematical function graphs after administering the “Hero Function” game. The subjects were also informed that the duration of the pretest was **ten** minutes.
- We should have waited for the completion of the post-test before giving away the prizes because the students lost interest and were not eager to have their posttest.



# Method and Procedures

## 7. Researchers' Notes During the Experimentation

- As the subjects of this study are in a technical school, they are not particularly interested in maths, but the playfulness of the activity proposed engaged them in the action, even very weak students, usually very passive, tried to play and they all enjoyed the game.
- The students have generally difficulties with abstraction, they are not used to create mental representations. The challenge has stimulated their curiosity, they explored new representations and they were happy to discover their algebraic expressions, according to one of their teacher.



# Method and Procedures

## 7. Researchers' Notes During the Experimentation

- The subjects were not that interested in the posttest because they had their break just one or two minutes before this test, they were in a hurry to go out. Then, they confessed that they didn't actually care for their answers, hence the results of the posttest didn't bring anything to the fore.



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# Results

- The pretest and posttest approach proved of no use in our context: the measured learning gain is significantly negative, not correlating with the observation of their great engagement in the game and the good game scores that even weak students got. The anticipation of the graph of the function has to be anticipated from its algebraic expression in order to get such high scores.
- The pre posttest comparison doesn't prove this qualitative data we have collected.



# Results

- Most elaborated functions were given by higher achieving students while lower achieving students, were not concerned much with producing new algebraic expressions but they were more concern in participating in the game and performing the dance.
- A fourth result was the heavy use of hand-held calculators to propose mathematical graphs that were then tested in the game.



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# Conclusion

- The game was very engaging for students, pleased and motivated them to represent and propose some mathematical function graphs.
- The results are not conclusive, the experimentation needs to be repeated in a context where the didactical contract ensures motivation for the post-test.
- New experimental protocol is being considered in order to answer the research questions including recognition and understanding.



**Thanks for Your Attention!**



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