



Project number: 2018-1-IT02-KA201-048274

Intervention Tool

Estimation game

1. Introduction

This intervention tool aims to develop the students' skills in mental calculations.

2. Theoretical framework of reference

Karagiannakis's and colleagues (2016), propose a model classifying the skills involved in learning mathematics into four domains: core number, memory, reasoning, and visual-spatial. The results of their research support the hypothesis that difficulties in learning mathematics can have multiple origins and they provide a means for sketching students' mathematical learning profiles.

The herein described intervention tool is related to the Memory domain as well as with the mathematical domain Arithmetic since the students are asked to memorize and perform calculations with the numbers that appear in the dice.

1) From another point of view, the **Center for Applied Special Technology** (CAST) has developed a comprehensive framework around the concept of Universal Design for Learning (UDL) (<http://www.udlcenter.org>) with the aim of focusing research, development, and educational practice on understanding diversity and facilitating learning; UDL includes a set of Principles that focus on individual differences as an important element to understand and design effective instruction for learning. To this aim, UDL advances three foundational principles:

- 1) Provide multiple means of representation;
- 2) Provide multiple means of action and expression;
- 3) provide multiple means of engagement.

2) Another theoretical reference comes from the **European Project FasMed**, focused on formative assessment in mathematics and science, (<https://research.ncl.ac.uk/fasmed/>), conceived as a method of teaching where information around the student's accomplishments is interpreted and used by instructors, learners, or their peers, to make choices about the following steps.

3. Design

In the subsections, the activities of the intervention tool are presented in detail:

3.1. Difficulties identified through the B2 questionnaire

The intervention tool is presented in reference to the difficulties shown by the students performing calculations as in exercises 4, 5 and 8 of questionnaire B2.

3.2. Cognitive area and math domain of interest

Memory/Arithmetic

3.3. Educational Aims

Performing calculations involving the four basic operations.

3.4. Addressing to Student /class



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The intervention tool may be addressed to all the class.

3.5. Educational activities: the Intervention Tool

It is expected that this activity provides an opportunity to work the student's self-regulation and persistence (UDL principle *Engagement*), improve the ability to set goals and strategies to achieve them (UDL principle *Action and Expression*) as well as the skill of understanding information given in different supports and analysing visual information (UDL principle *Representation*).

The discussion that will arise throughout the experience will allow the teacher to informally evaluate the students' comprehension and progress and identify concepts that students are still struggling to understand so that adjustments can be made to future lessons, therefore allowing formative assessment.

Required material:

- Two dice, paper and pencil.

The activity is planned to last 30 minutes. The paper is divided into two columns; one column lists the values on each dice face, whereas the other contains arbitrary numbers previously chosen. For instance:

Dice	Number
1	235
2	787
3	361
4	456
5	999
6	501

Pair students together. Taking turns to roll the dice, they must add the obtained numbers together in their heads. In the current example, if a student rolls five and six, the calculation to be performed is $999 + 501$. Without pencil, paper or calculator, the student must perform the addition. If he/she she is wrong but within a range of five numbers — verifying the solution with a calculator — the answer is considered correct. The first student to answer five questions right wins.

For a more advanced version, the numbers can be smaller but multiplication instead of addition must be performed. The game can also be adapted so that subtraction or division can be trained.

4. References

[1] Karagiannakis, G. N., Baccaglioni-Frank, A. E., & Roussos, P. (2016). Detecting strengths and weaknesses in learning mathematics through a model classifying mathematical skills. *Australian J. of Learning Difficulties*, 21(2), 115–141.

[2]<http://www.nctm.org/> (Addition and Subtraction: The Big Ideas and Essential Understandings)



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