



Project number: 2018-1-1102-KA201-048274

Intervention Tool

From 3D to 2D - Planification of solids

1. Introduction

This intervention tool aims to help students overcome their difficulties in visualizing in 3D and converting a three dimensional form in its 2D planification.

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 Visual-spatial domain as well as with the mathematical domain Geometry since the students are asked to identify patterns and relationships and analyse visual information.

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 activity aims to overcome the difficulties that students expressed in questions related to the planification of 3D forms as is the case of question 33 in the B2 questionnaire where the student is asked to choose among four planifications the one that corresponds to a given solid.

3.2. Cognitive area and math domain of interest

Visual-spatial/Geometry



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3.3. Educational Aims

The activity aims to overcome the difficulties that students expressed in the questionnaire questions related to volumes and planification of 3D figures.

3.4. Addressing to Student /class

The intervention tool may be addressed to a single student.

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 identifying patterns and relationships 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 materials:

- Pieces of polydron
- Ruler
- Pencil
- Notebook/Squared paper

Some pieces of polydron are given to the student and he/she builds a few cubes.

With respect to one of the cubes and with the aid of a ruler, the student measures the length of one of the edges and calculates the volume of the obtained cube (or cubes).

Using some previously constructed cubes, he/she forms different solids and indicates the volume of each constructed solid.

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] Palhares, P., *Elementos de matemática para professores do ensino básico*. Lisboa: Lidel, (Org.) (2005).
- [3] *Padrões em Matemática – Uma proposta didática no âmbito do novo programa para o Ensino Básico*. Lisboa: Texto Editores, Lda. (ISBN: 978-972-47-4588-6)



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