A Knowledge Discovery Platform for Spatial Education: Applications to Spatial Decomposition and Packing

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This workshop introduces a novel kind of math manipulatives and activities aimed to develop spatial intelligence in middle school students. The participants are trained through a series of 2D and 3D geometric puzzles that involve hands-on activities. A short introductory presentation and several brief videos present the platform and the plan of the workshop. Participants receive the manipulatives and the instructions needed to accomplished two projects. They group in four teams and they work together within each team. Here we present one 2D puzzle and one 3D puzzle that were solved during the workshop:

The Shadow Puzzle

For each of the shadow regions in Fig. 1b find all feasible decompositions using only one element of the alphabet in Fig. 1a at a time. How many such decompositions do you find?

A 2D Packing Problem

Using folding and taping, one can transform the 2D element shown in Fig. 2a into the 3D module shown in Fig. 2b. You are given a 2D region shaped as an equilateral triangle such that on each side you can fit four identical 3D modules as depicted in Fig. 2c. Find the maximum number of 3D modules that could be packed

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Fig. 1 **a** The alphabet of 2D elements, **b** the shadow regions

Fig. 2 Transformation from 2D to 3D

into this 2D region. The height of the packed region should not exceed the height of one 3D module. Do you find the answer is 16?

A Brief Brainstorming Session Concludes the Workshop

The participants are confident that this kind of manipulatives can be successfully used for increasing the effectiveness of teaching geometry to middle school students, for improving the level of communication in class and for increasing students' interest in learning geometry.

Further developments of the Knowledge Discovery Platform that expand the scope of this research are planned through ongoing joint international educational projects involving workshop's organizers and participants.

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