MATHEMATICA

V

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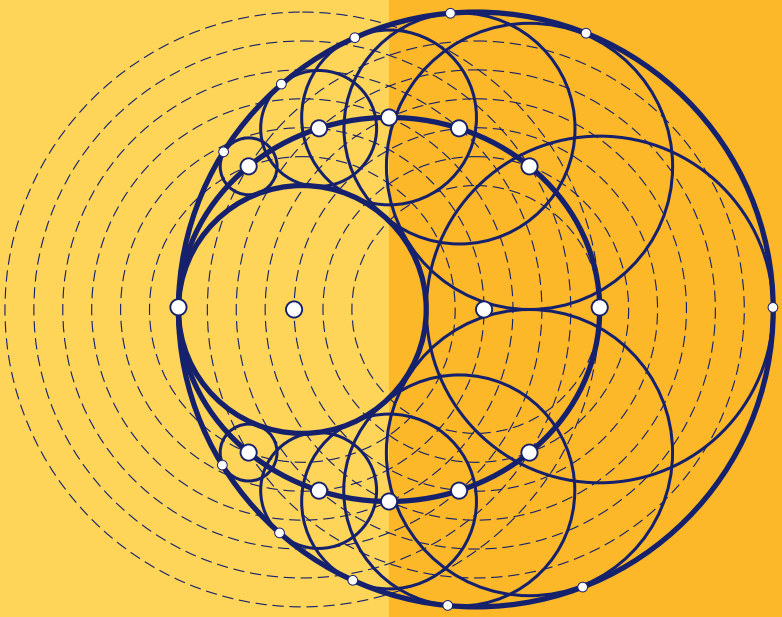
Martin Billich



Scientific Issues

MATHEMATICA V

The publication was published with the support of
the Catholic University in Ružomberok
Faculty of Education, Department of Mathematics

This volume is published thanks to the support of the grant
KEGA 002UJS-4/2014

Scientific Issues
Catholic University in Ružomberok

MATHEMATICA V

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Ružomberok 2015

MATHEMATICA V, Scientific Issues

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ISBN 978-80-561-0296-1

CONTENTS

Using of Tangram in the mathematics education at primary school

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Abstract. Geometry is difficult for pupils at every stage of education. Because of this reason is important to develop space imagination from the early age and to use proper didactic tools for this. One of them is puzzle Tangram that is ideal connection of game and didactic tool.

Keywords: Geometry, space imagination, early age development, Tangram.

Classification: G10; U60.

1 Introduction

After decades of educational activities we confirmed with the colleagues the fact, that geometry makes a problem to pupils and also students at all degrees of education. It is a serious problem, because it is related for example with readiness of students to choose within the orientation of university study faculties of technical orientation. We have seen that it is not sufficient to deal with this problem only at the 2nd degree of primary school, for which as well as for the secondary schools we prepare at our faculty future teachers. Achievement of good results at geometry depends also on good spatial imagination, including geometrical. In the publication (Půlpán, Kuřina, & Kebza, 1992) we learn a lot of interesting facts; the following definitions of vision and imagination will be from this publication:

Normally we understand imagination as "ability to develop and create visions". A vision is then an image, created in our mind, based on a previous perception, by mental activity, or based on experience.

Z. Půlpán, F. Kuřina and V. Kebza characterize the geometric imagination as a summary of capabilities, concerning our images about shapes and mutual relations between geometric objects in space (Půlpán, Kuřina, Kebza, 1992).

The results of pedagogical research indicate that for development of a spatial imagination is very suitable already a pre-school age. According to J. Piaget is such first genetically suitable period 5–7 years. Children can devote to developing of spatial imagination during various games and educational activities. We gained many good results in this area. As J. Molnár has stated in his publication:

Generally it is possible to say, that at the entrance to the school the geometric imagination of children is at much higher level, than mathematics curriculum for elementary schools presuppose (Molnár, 2009).

We consider as problematic an attitude to education of geometry just at the 1st stage of a primary school. It is a pity that thus we miss a genetically suitable period, as it was stated. Just here we can see the reasons of insufficient results in geometry.

Each degree of education is important regarding mathematical orientation, development psychology, and also the level of a spatial imagination defined by Van Hiele for given age category as visual, analytic and spatial.

During the pre-school age and in the 1st year of a primary school we can talk about the visual level of children. Children recognize geometrical shapes regarding

concrete visual images, such as the square like a frame of the picture, rectangular like the door, circle like a round, etc.

Pre-school age and the 1st year of a primary school is important in term of propedeutics of mathematical terms, such as equality, similarity, axial symmetry, and so on.

In the 2nd-4th year of a primary school we already observe the analytic level of geometrical thinking. Here we create the terms, such as straight line, ray, line segment, plane, perimeter and surface of simple plane objects.

In the 4th year the children progress to the abstract level of geometrical thinking. They deduce here the contents of terms and they start to use the elementary logic rules for example at classification of quadrilaterals.

2 Activities for development of geometrical imagination using Tangram

A puzzle Tangram enables us to realize and also to develop a spatial imagination in many tasks. It represents a very good connection of game and a didactic material. It is a square, divided to 7 pieces: five triangles, (two biggest, one middle and two smallest), the square and the parallelogram.

It is possible to work with Tangram in two ways: To compose individual parts into predetermined outlines and to create figures of the people, animals, known objects, things, geometrical shapes, according to their own imagination and note down the results.

We can explain to pupils the relationships between individual pieces of the Tangram at the age-appropriate level. For example, we can point out, that we play only with isosceles triangles having equal angles, which are similar, the individual pieces are identical by some parties, etc. Thus, Tangram can be used on many issues directly in teaching geometry. However, we can realize through it for example also competitions in composing and various didactic games as well. We have dealt with these topics in the following publications:

For a pre-school age: (Uherčíková, 2014).

For 1st and 2nd degree of a primary school: (Brincková, 1996).

For the 2nd degree of a primary school and for the secondary school: (Brincková, Uherčíková, & Vankúš, 2013).

Samples of tasks from the publication (Brincková, Uherčíková, & Vankúš, 2013):

Task 1: Create from all parts of Tangram house according your fantasy.

Task 2: Create some object by putting the parts of Tangram in the way, that each part touches other with the side of the same length. Name this object!

Task 3: Create from two puzzles Tangram object with axial symmetry. Name this object!

Task 4: Create two rectangles with different perimeter by putting together two biggest, one middle and two the smallest triangles from the Tangram puzzle. Do they have the same surface?

Task 5: Create all possible objects using one middle and two smallest triangles from Tangram.

Task 6: Proof using Tangram Pythagorean theorem!

Solutions can be found in the publication (Brincková, Uherčíková, & Vankúš, 2013) available online at the address **www.comae.sk/netradicnemetody.pdf**.

Acknowledgements

The author has been supported by the grant KEGA 074UK-4/2014 Efficacy of teaching mathematics by the method of didactic games.

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