*Extended Abstract*

# Origami and Technological Prospectives in Mathematical Education

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**Abstract**

Origami is the Japanese art of paper folding, (折り紙; oru - bending, kami-paper). Definition of origami says that you should fold paper without using scissors and glue, and the result of the folding is variety of forms that imitate the nature and things that are uses in everyday life. When origami is mentioned, people are usually associated with paper cranes and flowers, but it is much more due to its axiomatization. In the 20th century origami has been connected scientifically with mathematics. Humiaki Huzita designed a set of six basic ways of defining a single fold by aligning various combination of excising points, lines, and the fold line itself. These six operations are known as Huzita's Axioms. In 2001, Koshiro Hatori added one more axiom. Huzita-Hatori axioms define what can be constructed with single fold in terms of lines and points. Some of the basic origami notions are: common shape used in origami is square, a line in origami is a crease made by a paper fold of the boundary of the paper and a point is the intersection of two lines (Alperin & Lang, 2009).

An ancient Japanese origami skill can be used in math lessons related. Folding paper into three-dimensional geometric object is a kind of an exercise. Mathematics learning through the model from the close environment of students and new methods of teaching mathematics such as discovery learning, improve teaching process and increase student interest and motivation. By folding paper students experience possible solutions, the multiform of the problem and path to accomplishment. The research has shown that origami is a beneficial method for teaching mathematics (Boakes, 2009, Robichaux and Rodrigue, 2003, Cipoletti and Wilson, 2004). It contributes developing mathematical vocabulary, special abilities and visualization. "Mathematics come alive in the mind of young students", is said by Huse, Bluemel and Taylor (1994). Mathematical concepts can be conveyed to

students by hands-on activities where the atmosphere in the classroom is more relaxed and motivating to students. Students become more curious and interested in investigating mathematical topics more profoundly (Budinski, 2009). Features of origami such as creating a model and following the procedure, spatial manipulation, generalizing procedures of different models or cooperation, application and students oriented activities are beneficial to process of learning and teaching mathematic (Meyer &Meyer, 1999). Presentation gives examples of how to use origami in teaching mathematics, on different levels, from elementary to the advanced mathematical concepts.

The fundamental problem of origami design is how to fold a square to produce a representation of desired object. The mathematics underlying origami address: existence, complexity and algorithms (Lang, 2008). There are many mathematical contents interwoven in origami and that connection influenced the mathematical education. There are more and more examples of beneficial application of origami in the classroom and some of them are supported by technology. It is an interesting combination of ancients and contemporary techniques (Fenyvesi et al, 2014). Both reach the solution successfully and comprehensibly even to average teenage student. It gives students opportunity to solve one problem in different perspectives. Combining different aspect of solving problem in the math lesson, we can improve problem solving and reasoning skills of the students. Mixed approaches to one problem can overcome weakness of a single and give students clearer picture about the problem and solution.

Origami requires following procedures of folding paper, while GeoGebra allows creating set of procedures that will lead to the solution. One hand, origami is based on one solution, while GeoGebra, on the other hand provide creation lots of examples. Also, origami requires accuracy and neatness. Combination of origami with dynamic-geometry-algebra systems, such as GeoGebra, can provide new knowledge to students. In the example constructions that combine origami and GeoGebra, we have adjusted some already known examples (Hull, 2006). Those examples are known as basic hands-on mathematics-origami, and suitable for learning various mathematical concepts. Through our examples, students solved, for example “ancient unsolvable problems” and investigated mathematical concepts that have inspired lots of mathematicians through centuries.

## References and Notes

Alperin, R. and Lang, R. J. (2009). One-, two-, and multi-fold origami axioms. Origami 4, 371-393, A K Peters, Natick, MA.

Boakes, N. (2009). Origami instruction in the middle school mathematics classroom: Its impact on spatial visualization and geometry knowledge of students. Research in Middle Level Education Online, 32(7), 1-12.

Cipoletti, B., & Wilson, N. (2004). Turning origami into the language of mathematics. Mathematics Teaching in the Middle School, 10(1), 26-31.

Fenyvesi, K., Budinski, N. and Lavicza, Z. (2014). Two Solution to An Unsolvable Problem: Connecting Origami and GeoGebra in a Serbian High School, Proceedings of Bridges 2014: Mathematics, Music, Art, Architecture, Culture, 95–102.

Hull, T. (2006). Project Origami: Activities for Exploring Mathematics. A K Peters, Ltd.

Huse, V., Bluemel, N. L., & Taylor, R. H. (1994). Making connections: From paper to pop-up books. Teaching Children Mathematics, 1(1), 14–17.

Lang, R. J. (2008). From Flapping Birds to Space Telescopes: The Modern Science of Origami. Usenix Conference, Boston, MA.

Meyer, D. and Meyer, J. (1999). Teaching Mathematical Thinking through Origami. BRIDGES, Mathematical Connections in Art, Music, and Science, Winfield, Kansas.

Robichaux, R. R., & Rodrigue, P. R. (2003). Using origami to promote geometric communication. Mathematics Teaching in the Middle School, 9(4), 222-229.

Будински, Н. (2009). Оригами- пример за примену у настави математике, Педагошка Стварност, LV (9-10), 932-944.