



## CREATIVITY IN TEACHING MATHEMATICS

*Original scientific paper*

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### ABSTRACT

*Modern education aims to form a versatile and creative personality that will leave school equipped for life, and mathematical skills are deemed necessary skills to participate in modern society. So, one of the challenges of modern education is precisely to enable the conditions for the development of creativity in school. Therefore, the aim of this paper is to review the relevant literature to define the concept of creativity in mathematics teaching, point out the need to stimulate creativity in students and present some of the strategies for encouraging creativity in mathematics teaching. The paper presents the connection between mathematics teaching and creativity, as well as the factors that influence creativity in mathematics teaching. Strategies for encouraging creativity in teaching mathematics were also presented, as well as a presentation of games that can be used in teaching, with a review of their application in working with students with intellectual disabilities.*

**Keywords:** *creativity, mathematical creativity, teaching, education, mathematics*

### INTRODUCTION

The phenomena of human creativity had a role in science throughout history, since it is creativity that enabled societal progress, from science, to art, technology, and business. Human creativity was a research focus throughout history (Patrick, 1935, 1937; Wallas, 1926, all according to Runco, 2004; Rossman, 1931, according to Arar & Racki, 2003), but only after 1950, thanks to the work of American psychologist J. P. Guilford this phenomenon started to be researched more closely (Kunac, 2015; Somolanji & Bognar, 2009). In one of his lectures entitled “Creativity” at the University of Pennsylvania, Guilford first introduced the notion of divergent thinking, which he believed was synonymous with creativity, as opposed to the common convergent thinking (Makel & Plucker, 2014; Stankovska, 2020).

Divergent thinking and problem-solving means solving a problem in a new, creative, and unusual way

or redefining the existing way of solving a problem, while convergent thinking is based on memory and reproductive knowledge (Koludrovic, 2009; Richards, 2001). Today it is considered that creativity and divergent thinking are not synonyms, and that creativity includes different divergent thinking skills. Therefore, tests that measure divergent thinking only represent the potential of being creative (Runco & Acar, 2012). Creativity refers to a complicated and comprehensive process, therefore it is difficult to define it with one universally accepted definition (Anusic, 2016). According to Pedagogical encyclopedia, creativity refers to a specific cognitive activity that leads to something new, or a thinking activity that is directed towards what can become and not toward what is (Kadum, 2011). One of the ways of seeing the term creativity is to divide it into ‘creativity’ with a small letter c and with a large letter C.

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According to this division, creativity with a small letter is seen as a feature that enables and encourages creative products, while ‘Creativity’ with a large starting letter is seen as the process of creating new and original products in human activity (Klincic, 2018; Kunac, 2015).

Nowadays it is considered that creativity is one of the main starting points in youth educational process and that schools should strive toward formation of versatile and creative individuals that will be well equipped for independent living upon school finalization (Kadum, 2011; Stankovska, 2020) and mathematical skills are necessary for participation in modern society (Furner et al., 2005). Therefore, one of the main challenges of modern education is to create possibilities for enhancing creativity in schools. The school should transform itself into a cooperative and creative community, with the aim of improving children’s freedom of expression, originality, and flexibility in contrast with traditional education that is focused on reproducing learned lessons (Koludrovic, 2009; Koludrovic & Reic Ercegovac, 2010). Students’ creative abilities can be encouraged in mathematics classes by their teachers (Kadum, 2011).

Young children are naturally curious, and it is crucial to encourage that skill in mathematics as well and use it to teach them different mathematical constructs (Mann, 2006). Therefore, the teacher’s task is to recognize the creative potential in every student and use their curiosity to enable them to master the lessons (Kunac, 2015). Meanwhile, often the contrary occurs. The mathematics teachers present the children with some mathematical problems and expect them to follow certain steps to find the solutions. It is of crucial value to give them the opportunity to find solutions on their own (Gardner, 2006) because this correlates with successful performance in future real life situations, where the children would not get steps to problems solutions (Hirsh, 2010). Students with mild intellectual disability (MID) have the same creative potential as their typically developing peers and it is necessary to encourage it (Arbutina, 2011, according to Gagic et al., 2015).

However, children with MID have limitations when it comes to mathematical skills and they require more time to master certain mathematical skills (Duric-Zdravkovic et al., 2011; Japundza-Milosavljevic et al. 2016). They also have difficulties in acquiring functional mathematical skills (Buha-Durovic, 2010) and because of it, it is necessary to implement creative strategies while teaching them these skills. The newly published research (Japundza-Milisavljevic et al., 2019a; 2019b) shows that students with MID feel mathematical anxiety while solving mathematical problems and that older students exhibit more fear than younger students (Japundza-Milisavljevic et al., 2019a; 2019b). This data shows that it is of crucial value to teach creatively in lower grades, because it can create an encouraging atmosphere and give students more confidence, which consequently eliminates fear of mathematics.

Therefore, the aim of this literature review is to precisely define the term creativity in mathematics, to emphasize the importance of stimulating creativity in students and to give examples of some of the teaching strategies that can be used to enhance creativity in mathematics classes, as well as to explain the possible uses of those strategies while working with students with mild intellectual disability (ID). Introduction should contain the outlines of a research problem. References that describe the problem and reinforcement feasibility study.

## RESEARCH METHOD

For literature search, search engines Serbian Library Consortium for Coordinated Acquisition (KobSON), Google Scholar, SCIndeks, and ScienceDirect were used. The literature that was published in Serbian and English language was used. Syntagma’s that were used as keywords were: creativity, mathematical creativity, teaching mathematics, intellectual disabilities, and creativity.

After initial search, the articles were selected by their titles and keywords. Articles published more than 20 years ago were excluded and articles that did not focus on creativity in teaching mathematics.

Methodological limitation of this article refers to the authors not being able to find sufficient research that focused on the use of creative strategies in mathematics while working with students with ID, therefore we gave the hypothetical suggestions for application of found strategies with students with ID.

## CREATIVITY IN TEACHING MATHEMATICS

If we applied the above-mentioned view on creativity through creativity with lowercase and uppercase letters “C” to define the concept of mathematical creativity, we would get that mathematical “Creativity” is the ability to create a unique work that significantly improves the field of mathematics and/or the ability to open new questions for other mathematicians. While mathematical creativity with a small initial letter “c” on the other hand is a process that leads to unusual, new, or clever solutions to certain tasks or problems, as well as the ability to create new questions and the ability to look at old problems from another angle (Sriraman, 2005). Thus, it can be said that mathematical creativity is a process that, regardless of the complexity of the problem, leads to an unusual and surprising solution, and that this solution is not necessarily unusual for the whole environment, but only for the individual (Sriraman, 2004, according to Stankovska, 2020).

In addition to the above-mentioned definition of mathematical creativity observed through the concept of creativity with lowercase and uppercase letters “c”, we can list several important definitions of this term. Thus, for example, Amabile (2012) and Gregoire (2016) consider mathematical creativity to be a student’s ability to create a new answer or solution that is appropriate for an open task.

Other authors (Chamberlin & Moon, 2005; Haavold, 2014) define this term as the ability to generate new and useful solutions to simulated or applicable problems using mathematical expression. Nadjafikhah and co-workers (Nadjafikhah et al., 2012) point out that mathematical creativity consists of creating a new mathematical concept, discovering unknown relationships among mathematical facts and reorganizing the structure of an existing mathematical theory, while the same authors a year later (Nadjafikhah & Yaftian, 2013) view mathematical creativity as the ability to create new, useful, and appropriate mathematical combinations from pre-existing mathematical concepts or to discover unknown relationships among mathematical facts. Domestic authors equate mathematical creativity with any type of activity that leads students to independent acquisition of knowledge in an innovative way (Pinter Krekic & Ivanovic, 2013).

Originality, fluency, flexibility, and correctness of solutions are some of the features of mathematical creativity. Originality refers to the creation of unique and new ideas, fluency to the ability to produce many ideas (e.g., finding several ways to solve a particular task) and flexibility refers to the approach that leads to solving a task (Assmus & Fritzlar, 2018). In addition to the above, the correctness of the solution is also an important criterion of mathematical creativity, and it refers to the fact that the student's answer must be mathematically correct (Haavold, 2014). In addition to knowing the features of mathematical creativity, it is necessary to know mathematical reasoning in children to enable the development of students' creative potential.

Mathematical thinking and reasoning involve several different processes that are a prerequisite for the acquisition of mathematical knowledge. The primary process is the ability to recognize the problem, and it refers to the ability to notice the main question in a mathematical task and the tendency to find answers to that question in accordance with the previously presented data. The secondary process that implies the ability of mathematical reasoning refers to the richness of ideas, which can be stimulated by giving different logical games or continuing the series in accordance with the observed patterns (Pinter Krekic & Ivanovic, 2013). As the next ability, we emphasize originality, which refers to the ability to create new ideas and solutions. However, the role of the teacher is important, because if the teacher gives more freedom for creativity to students, consequently children will have more original solutions (Tekin & Taşgın, 2009). Redefining is the next ability built into mathematical reasoning, which implies the ability to use already known information and acquired knowledge when approaching the unknown. However, it is necessary for the teacher to show the students the ways to use previously acquired knowledge in solving new tasks (Pólya, 1979, according to Pinter Krekic & Ivanovic, 2013). Another ability involved in mathematical reasoning is fluency, which refers to the ability to produce many new ideas (Koludrovic & Reic Ercegovac, 2010).

Flexibility is the ability to vary the approach to a problem. Elaboration requires the ability of mathematical reasoning related to reshaping, changing, and adapting original ideas, and the ability of curiosity has an additional role to motivate students to solve a problem. Willingness to take risks is the ability of mathematical reasoning, which is of great importance, because it encourages students to express their opinions, attitudes based on their own experience and for its development, the influence of teachers is crucial. Imagination is a predisposition for the development of mathematical reasoning and implies thinking that comes from an idea (George, 2005), it is expressed in the ability of students to express themselves in different ways. Complexity as a mathematical ability requires the construction of alternative ideas and cause-and-effect relationships between different ideas, as well as the search for consequences for some fictitious problems (Koludrovic & Reic Ercegovac, 2010). It is necessary to encourage all these abilities in students, especially in the lower grades of primary school, when students are just getting acquainted with the teaching of mathematics.

## THE IMPORTANCE OF ENHANCING CREATIVITY IN TEACHING MATHEMATICS

The teaching of mathematics has always had an important place in the educational system, so all students should have an equal chance to adequately master mathematical knowledge. For everyone to have this opportunity, the role of the teacher, his attitude towards mathematics and the approach to motivating students that would lead to success in this discipline are crucial (Furner et al., 2005). Encouraging the creative potential of students is provided in most curricula in mathematics, but unfortunately in practice it usually remains at the declarative level, where the encouragement of these potentials depends on the individual affinities of teachers, students, and textbook publishers (Koludrovic & Reic Ercegovac, 2010). In mathematics teaching, teachers most often use rigid algorithms and reproduction of facts, which in turn hinders the development of abilities such as divergent thinking, independent recognition of mathematical problems and the development of original solutions to problems (Pinter Krekic & Ivanovic, 2013). However, there are also examples of good practice when it comes to encouraging mathematical creativity. For example, in countries like Finland, the emphasis is on flexible and creative handling of complex mathematical situations and problems (Krzywacky et al., 2016). Taking into consideration that children's creativity is reflected in themselves creating ideas, organizing information and thinking about questions, they should be encouraged to ask questions and not be afraid (Simel & Gazibara, 2013). This way disables the possibility of students acquiring knowledge in a passive way, yet the focus is on a student and the teacher's role is to direct the teaching process (Acman & Doutlik, 2017).

### *A. The factors that influence enhancing students' creativity - encouraging environment*

There are many factors that influence the development of creative potential in children, and these are individual differences among students, but also the opportunities provided to them during classes (Sternberg et al., 2004). Therefore, it is very important to enable students to participate in extracurricular activities that would encourage their creativity (Pinter Krekic & Ivanovic, 2013), assuming that the development of creativity in one sphere of life is transferred to others, including mathematics. All students have different interests, which should be nurtured, as well as different levels of ability and affinity for certain aspects of mathematics teaching (Beghetto & Kaufman, 2014), and all students should be given the opportunity to express their potential in the field of interest. Teachers' support in these areas is reflected in choosing between activities in which students will participate, because it has been shown that the role of teachers was more important for the development of creativity than students' predispositions (Niu, 2007), which includes the use of different teaching materials (Davies et al., 2013).

It is considered that teacher creativity is one of the important factors in the development of creativity of the student (Somolanji & Bogнар, 2009), in the form of accepting different answers of students (Simel & Gazibara, 2013), giving opportunities for autonomy, and highlighting the value of innovative solutions problems (Runco, 2004). It is important for teachers to understand that their role is to create an environment that encourages the development of creativity, through respect for the ideas of each of the students (Robinson & Kakela, 2006). It is also necessary to create in students the habit of creative thinking, by rewarding innovative solutions (Sternberg, 2012), instead of restraining creative freedom and setting expectations for conformism (Tekin & Taşgin, 2009). In addition to the above, it is necessary that the teacher has an adequate level of knowledge in the field of mathematics, to properly guide students in the process of acquiring mathematical knowledge, because it is a prerequisite for increasing student motivation in the learning process (Newman, 2004).

If the teacher approaches the lessons by asking students questions and giving divergent tasks, this will increase motivation, develop students' imagination and research spirit, because such questions and tasks allow students to give more different answers to one question and allow the teacher insight into ways of thinking of students (Vizek Vidovic et al., 2003; Walsh Burke, 2003), and provide students with the opportunity to give a variety of answers that promote the development of creativity (Koludrovic & Reic Ercegovic, 2010). Even some inappropriate types of student behavior, some teachers can use in a positive context (Armstrong, 2010), or as an opportunity to engage students in some additional activities and thus motivate them to work (Jensen, 2005).

Some teaching formats are considered to have an advantage over the others in the context of creativity development in students. It is believed that it is best if teachers used individual format and while organizing group format, it is recommended that the teacher only induces creative and divergent thinking in students, while giving important feedback (Stankovska, 2020).

In addition to teachers, the environment in which teaching is conducted is also of great importance. An environment conducive to the development of creativity in students must encourage freedom of expression without fear of condemnation (Sriraman, 2005), a sense of freedom to take risks while solving a task (Nadjafikhah, et al., 2012), and a lack of fear of error. Koichu & Orey, 2010; Pitta-Pantazi et al., 2018 Sheffield, 2018). Teachers must encourage students to be innovative in their approach to a particular task (Pham & Cho, 2018), appreciate their efforts to find an original solution and recognize those efforts (Shen & Edwards, 2017), ensure a positive emotional climate in the classroom (Kadum, 2011), and teach them to value their creative endeavor instead of being critical of it (Yushau et al., 2005). Bogнар (2010) gives recommendations for teachers that would encourage creative thinking in students, such as removing the time limit for solving certain tasks, as well as encouraging student cooperation and exchange of ideas, while Anusic (2016) states that competitive spirit and reward adversely affect to the development of creativity in teaching, hence they should be kept to a minimum. It is important to encourage cooperative play from an early age and prompt children to explore different materials and didactics (Kamii et al., 2007), because these activities enable further finding of solutions for potential problems that children can come across with (Hirsh, 2010). It is important to enable different resources, materials, use of different environments and activities in classes to encourage the development of students (Vasconcelos, 2017). The ability of teachers to use the various resources at their disposal, to carry out appropriate classroom activities (Pitta-Pantazi et al., 2018), as well as their self-confidence in the ability to transfer mathematical knowledge (Gregoire, 2016), has been shown to play a major role in this. If teachers have all or most of these qualities, they will succeed in creating a habit of creative thinking in students by involving students more often in creative activities, finding additional opportunities to express student creativity in teaching and rewarding such participation (Sternberg, 2012).

### **STRATEGIES FOR ENHANCING CREATIVITY IN TEACHING MATHEMATICS**

Some authors state that potential ways of enhancing creativity in teaching mathematics is giving the students mathematical problems that are appropriate for their abilities (Christou, 2017), while others highlight that it is important to include technological advances in teaching mathematics (Dubovicki, 2012).



The teachers should encourage students to apply mathematical knowledge in real life and new situations (Shriki, 2009), give them the opportunity to find different solutions for one mathematical task (Sriraman, 2005), and enable combination of mathematical ideas and reshaping mathematical problems (Klincic, 2018). In addition to teachers, school textbooks should be one of the methods of encouraging student creativity in teaching and even in mathematics. School textbooks are a source of knowledge and without them work in most subjects would be unthinkable (Koludrovic, 2009). The textbook must be written in accordance with the laws of the learning process in children and in accordance with different levels of student abilities (Koludrovic, 2009), as well as the age of students and teaching topics that are currently covered (Dubovicki, 2012). Tasks from the textbook must encourage students to look for new and unusual solutions, so in teaching mathematics this can be done by requiring students to set the task independently (Koludrovic, 2009). Unfortunately, mathematics textbooks in most cases do not encourage students to think creatively enough (Dubovicki, 2012) and often boil down to a passive role that excludes the possibility of students' creative contribution (Yerushalmy, 2009). It is believed that neglecting creativity in mathematics teaching leads to the inability of teachers to notice the talent for mathematical reasoning in some students (Mann, 2006), and for students to develop mathematical talent, they must be given the opportunity for increased creativity in teaching (Suastika & Wahyuningtyas, 2017). If the teaching of mathematics does not require creative reasoning from students, it will not enable students to develop mathematical talents and potentials (Mann, 2006). It is of great importance that the teacher and the persons in charge of creating textbooks know the features of mathematical creativity to recognize them in students and adequately encourage them in teaching.

The teacher's role to encourage creativity in classes is of crucial value, but it is also very important to distinguish the terms: a) creative teaching and b) teaching for creativity (Jeffrey & Craft, 2004, according to Grohman & Szmids, 2013). The term creative teaching refers to teaching approach which makes learning more fun to students, while the term teaching for creativity represents teaching directed toward the development of creative thinking of students (Jeffrey & Craft, 2004, according to Grohman & Szmids, 2013). To achieve the best results, it is necessary to combine those two approaches (Kunac, 2015).

### *B. Creative teaching*

Creative teaching involves the efforts of teachers to include creative methods and techniques (Simel & Gazibara, 2013; Starko, 2021), in a Taiwanese study, the authors (Clifford & Chou, 1991, according to Beghetto & Kaufman, 2014) divided students into two groups, where they told the experimental group to play a game in which they practice the way of thinking, and the control group to have a test.

It was shown that students who were told to play the game on assignments had better success than the control group. That is why it is important for teachers to redefine and adapt their approach to students, to develop students' creativity. Teachers can also do this by using activities that require students to generate a variety of ideas, redefine a problem, and think in a variety of ways (Beghetto & Kaufman, 2014). It is important to give students the opportunity to choose and opportunities to explore different materials, to encourage group work and collaboration of students through the exchange of ideas. When teachers decide to use extinct motivators in their work, it is very important to explain to students the value and importance of participating in a task, as well as to present opportunities for creativity in the classroom and that they have access to teaching students as an opportunity for personal expression of creativity (Beghetto & Kaufman, 2014). Teachers should therefore have a quality methodological approach, concretize the goals and tasks of teaching, and make them more creative, and choose contents and tasks that are diverse (Kadum, 2011; Koludrovic, 2009). It is important to give students the opportunity to independently create tasks in mathematics (Bilopavlovic et al., 2001). It is very important that teachers encourage humor in the classroom because it can lead to relaxation of students and lead to even more creative responses and solutions, and some authors point out that fantasy is a great technique to encourage creativity (Simel & Gazibara, 2013) and in that way, children also remember new and difficult contents easier and longer (Cupic et al., 2017). It is also important to use a variety of objects to generalize knowledge, such as Lego bricks (Dubovicki, 2012; Rudec, 2007), Coca-Cola cans, balloons, hair dryers, flowers, or fruits (Shijan, 2009).

### *C. Teaching for creativity*

Teaching for creativity involves teachers' efforts to develop intrinsic motivation in students, encouraging diversity of students' ideas through reinforcing innovative and nonconventional solutions (Pintér-Krekić, 2007; Pinter Krekić & Ivanovic, 2013). Teachers should not underestimate children's ideas, but they should encourage them to create different solutions, reinforce creative approach to tasks and not allow students to feel fear and judgement when expressing those ideas (Kunac, 2015; Vranjkovic, 2010). Teaching for creativity involves explaining to students all the possible uses of mathematics in their everyday lives (Pintér-Krekić, 2007; Pinter Krekić & Ivanovic, 2013). Students must be prepared for creative solving of real-life mathematical problems (Simel & Gazibara, 2013; Starko, 2021), because often mathematics is taught to be conventional and mechanical and students are expected to listen and copy board work without any opportunity for taking initiative (Siswono, 2014) and thinking (Izzati, 2009), therefore this should be avoided. It is of great value that mathematics teachers teach students tolerance

and giving unique answers to mathematical problems (Sharp, 2004) and to continuously explain to students that the result is not important, but the process of solving problems (Suastika & Wahyuningtyas, 2017). Teaching for creativity can be achieved through involving students in conducting research, because children have the potential for finding unique and original ways of problem solving (Yushau et al., 2005), but it is also important to make sure that every student's interests and preferences are met (Mann, 2006). It is important to involve students in solving challenging mathematical problems that will tackle them to think and create new ideas (Freiman, 2006). Meanwhile, those tasks cannot be too difficult and must be in accordance with their previously acquired knowledge (Yushau et al., 2005) and their life experiences (Stankovska, 2020). If teachers disregard teaching for creativity, the students will not acquire necessary knowledge and it will disable the mathematical skills development (Pham & Cho, 2018) and it is emphasized that it is of crucial value that students have the knowledge of mathematical concepts, because they are the foundation of developing new ideas that can later transfer to different school subjects (Weisberg, 2006, according to Kattou et al., 2012). If the students could make decisions independently on how they will solve a certain mathematical issue, it is considered that this will improve their creativity (Palsdottir & Sriraman, 2017, according to Pitta-Pantazi et al., 2018). In further text we give examples of games and techniques that can be implemented in mathematical classes with the aim of developing students' creative potential.

#### *D. Games in teaching mathematics*

It is emphasized that it is necessary for teachers to apply different types of games in mathematics teaching (Cupic et al., 2017) to encourage students' creativity and ensure active participation of all students in teaching (Pinter Krekic & Ivanovic, 2013). Today, a whole series of methodological procedures has been created that encourage creativity in teaching (Bognar, 2012), and some of the teaching units in which there are great opportunities for creativity are form, space, and measurement. These teaching units may include activities related to different occupations in which measurement is performed, then the application of tangrams in teaching, which are an excellent tool for applying their own ideas and combinations, which also contributes to creative development of students, logical and abstract thinking. Geo Plates can be used very successfully in teaching units in which surfaces, or fractions are processed, because it encourages students to think critically in the context of noticing different features of certain shapes (Stankovska, 2020). The Geo Plate is a wooden or plastic board with nails arranged in a square net and rubber bands can be stretched around them. When processing teaching units that include geometric bodies, it is important to get students to notice the given geometric bodies in their immediate environment.

Another game that teachers can use in the classroom, which in turn encourages students' creativity, is a game called random concepts. This game works by having students extract a word and then write their associations and connect it with a given mathematical problem (Bognar, 2010). Also, it is recommended that teachers teach students to use mind maps when learning some difficult or extensive content (Simel & Gazibara, 2013). The Six-hat Technique is also a great way to encourage creativity in teaching, because it teaches students to think in different ways, as well as a game of provocation, which requires presenting different opinions of students about one mathematical problem. A similar game is Brainstorming (Wilson, 2009). The detailed description of the application of these techniques in mathematical classes, as well as the possible use of these strategies while working with students with ID is given in Table 1.

Humor is also a very important aspect of developing creativity in classes (Simel & Gazibara, 2013). If the teacher creates the atmosphere where all students feel safe and as if they are free to express their thoughts and ideas, the teacher can use humor as an important aspect of students' creativity expression. Some examples of using humor as techniques of improving students' creativity are 'Memories from the future' and 'Leading phantasies'. Both techniques enable students to give extraordinary statements while using their imagination (see Table 1) (Simel & Gazibara, 2013).

All techniques can be used while teaching different school subjects as well and success of their application depends on the teachers, students, and school policy. But, when it comes to teaching mathematics, the teacher must keep an eye on two things while selecting activities. Firstly, the task itself cannot be too difficult for students. Secondly, the task's context must refer to real life situations or include something interesting to students. These two criteria are of great value and if they are not implemented, it can lead to students seeing it as too difficult, monotonous, or uninteresting (Yushau et al., 2005).

Table 1. Review of the strategies for encouraging creativity in teaching mathematics and their potential application in working with students with mild intellectual disability

Reference	Strategy name	Strategy description	Application in math class	Application in math class with learners with mild intellectual disabilities
<b>Bognar, 2010</b>	<i>Random terms</i>	This activity aims to encourage divergent thinking in class. It is conducted in such a way that the student must draw the so-called "random word" and then write down on paper its properties and associations, after which the word relates to the given problem.	This activity could be applied by allowing the student to extract a random word and make it a textual task that is related to what they are currently learning in mathematics. Also, instead of words, the student can draw e.g., a piece of paper that says e.g., an angle of 90 degrees and children are asked to design and draw a figure in which one angle will have that many degrees.	Hypothetically, this type of activity involves modifications, depending on the student's abilities (e.g., instead of the text to be a picture or a real object if the child does not read).
<b>Bognar, 2010</b>	<i>Several "Why" questions Technique</i>	The teacher applies this technique by asking the students "Why did something happen?" Then he asks questions again, beginning with the word "why" and so on four times. The goal of this activity is to encourage divergent thinking and creative reasoning.	In math class, the teacher could write a series of numbers e.g., 2, 4, 6, 8 on the board and ask students why these numbers are listed just like that. In relation to their answer the teacher asks four more questions that begin with why. It can also be applied within a text task, e.g. "Three workers paint a house in 16 days, in what time would four workers paint a house?" When students give their answer, the teacher then asks them why they think they need so many days and, depending on the answer, asks four more questions that start with the word "why".	A special educator or teacher can modify the order and give an example of the task (with a picture example): Maya has two apples, and Milan has three. They have five apples together. "Why do they have five apples now?" The modification would be reflected in the fact that the teacher starts with one question "why" and gradually, depending on the student, he could add question after question until he reaches four questions "why".
<b>Simel &amp; Gazibara, 2013</b>	<i>Six universal questions Technique</i>	The goal of this activity is to encourage divergent thinking in students. The teacher can apply this technique in class by asking students six questions: Where? When? How? Why? Who?	In math classes, we can apply this technique within textual tasks or when we want to present equations with one or more unknowns.	Hypothetically, we can try this technique in teaching mathematics to students with mild intellectual disabilities. For example, a special educator or teacher gives a story in pictures with a mathematical problem, children would be asked to put together a story as they thought they should, after which a special educator or teacher would ask a question to the student and thus see a solution together.
<b>Simel &amp; Gazibara, 2013</b>	<i>Six hats Technique</i>	The goal is to notice the possibility that everything can be viewed from several angles, thus encouraging the ability to think in parallel. The activity can be realized individually or in groups. To achieve the goal, hats in different colors are given metaphorically, and each color represents one angle from which the problem can be seen. The white hat is used to draw attention to information we have or lack, and students who received this hat should look at the problem through the questions, "What do we know?" "What information do we need?" "What questions do we need to ask about this idea?" The black hat serves to warn the student of the possible shortcomings of the decision he makes regarding the problem. When a student gets a black hat, he should think about the risks and possible negative consequences of the idea. The green hat is the so-called creative hat. It is intended for planning and creating new ideas. The red hat has to do with intuition and feelings. It serves to express students' feelings. The yellow hat serves to find everything that is positive in the proposed solutions. The blue hat is intended to consider the thought process itself. It serves to identify problems, plan discussions, and consider what was done at the end of the activity.	Teachers can apply this in class by dividing students into groups, giving them colored hats, and explaining how they should observe the mathematical problem. The problem could be the following: "How many cm <sup>2</sup> of cardboard is needed to make a box in the shape of a square 30 cm, 20 cm wide and 25 cm high?" Then each group gives an answer to the question in relation to the color of the hat, and at the end, when all the answers are summed up, the students make a box together.	We believe that this technique could be hypothetically applied, but it is necessary to gradually introduce each hat. E.g., two hats until the students gets acquainted with each of them and their role, then gradually increase the number of hats (views on the problem) until all six are reached.

Table 1. Review of the strategies for encouraging creativity in teaching mathematics and their potential application in working with students with mild intellectual disability

Reference	Strategy name	Strategy description	Application in math class	Application in math class with learners with mild intellectual disabilities
<b>Simel &amp; Gazibara, 2013</b>	<i>Provocation Technique</i>	The goal of this activity is for students to see different and unusual possibilities of a problem. The task of the teacher is to start the activity with an unusual statement, the so-called provocation that students know is not true in the current situation, this provocation provides an original starting point for creative thinking.	The teacher can start the activity with an unusual statement such as “How many legs would a snake which is wearing football boots, ballet flats and sneakers at the same time?” In relation to students’ answers, teachers can devise further provocations.	We believe that special educators could use this technique in their work in mathematics classes. The modification could be reflected in the fact that there is a graphic presentation or a specific teaching tool with which students would solve the provocation.
<b>Hirsh, 2010</b>	<i>Visual thinking</i>	The goal of this technique is to encourage the student to visualize the problem and to solve the problem through illustration. Visual thinking is the ability to understand and interpret what we are learning. As a technique for encouraging creativity, it is used in teaching so that the teacher gives the student the task to illustrate the steps to solve a problem.	The teacher can tell students to illustrate the steps to the algorithm, organizational tables, mathematical tasks with visual stories and other visual representations of mathematical concepts.	We believe that visual thinking techniques are also applicable to students with mild intellectual disability. Students would be able to draw a mathematical problem and come up with a solution through drawing. If the student is not skilled in drawing, teachers could give him some specific teaching aid, or make a presentation to solve a certain mathematical problem.
<b>Bognar, 2010</b>	<i>Brainstorming</i>	The goal of the activity is for the student to present as many ideas as possible on a given question or problem. It can be performed in groups or individually. All ideas are recorded without prejudice and judgement of their accuracy. There are four rules to follow when using this technique. 1. The problem needs to be clear and understandable. 2. Every idea needs to be accepted and written down. 3. Students need to be encouraged to build on and build on other people’s ideas. 4. It is necessary for the teacher to encourage strange and unusual ideas.	This technique can be applied in mathematics in almost all areas. The teacher only needs to pose a clear problem e.g., in what ways can we reach the sum of 101 and let the students give their proposal for a solution to the problem.	We believe that this technique can be used in working with children with mild intellectual disabilities, considering that the problem that is posed does not exceed the knowledge that students have in mathematics. For example, they can be given the following text task: “M has 5 marbles, D has three more than M and N has twice as many as both combined. How many marbles does N have?” Students could give their suggestion on how to calculate how many marbles Nikola has and write it on the board.
<b>Ivosevic, 2013</b>	<i>Mind maps</i>	Mind maps are an analytical process that serves to better understand the problem we are dealing with. Mind maps can also be used to create new ideas. They are a means of creative thought organization. Some of the recommendations for making a mind map are to first define the topic (problem) in the middle of the paper. It can be represented by a picture, drawing, symbols, or words. Then, from that central theme, lines branch out that expand the theme, and those lines are logically interconnected. Each of the lines can have a keyword, it is recommended to use colorful colors to make the map more picturesque and impressive.	Mind maps have a wide application in teaching mathematics. For example, students can make a mind map for a curriculum of round geometric bodies. In the center of the map, the student can draw a ball, a roller, and a pile, then draw a branch for each shape in which he would use drawings and formulas to mark important components such as surface, cross-section, and volume. With this map, the student can more easily remember the formulas he needs to solve the task.	We believe that students with mild intellectual disability could create mind maps in class that would serve them in solving mathematical problems. They would need the help of educators, but they could make maps consisting of pictures or of real objects.



## CONCLUSIONS

Creativity is one of the essential characteristics of a person. Therefore, it is of great importance that this characteristic is nurtured and developed in students through education. Teaching for creativity and creative teaching should be an integral part of every school subject, including mathematics teaching, which is usually reduced to learning facts without the possibility of entering one's own ideas and solutions. Observing the definitions of mathematical creativity, we can conclude that every type of non-reproductive activity of students, which leads to independent acquisition of knowledge or solving a mathematical problem, is mathematical creativity.

In this paper, it is presented how the application of creativity in teaching mathematics can positively affect the acquisition of knowledge in this area in students as well as techniques that can be used in teaching mathematics. From the mentioned techniques for encouraging creativity in teaching, we would single out the Mind Maps, the Brainstorming as well as the Technique of Random terms, because these techniques can be applied in teaching mathematics when processing different teaching units.

Considering that encouraging creativity in teaching mathematics is of great importance for the education of all students, instead of the classic conclusion, we want to open a new question: "How to encourage creativity in teaching mathematics in working with lower primary school students with mild intellectual disabilities?"

We consider this question to be of great importance knowing the research of recent data in our environment (Japundza-Milislavljevic et al., 2019a; 2019b) indicates that students with mild intellectual disabilities feel mathematical anxiety when solving mathematical problems, especially in higher grades. Pinter Krekic and associates believe that to encourage creativity in teaching mathematics, it would be much more efficient to abandon the numerical grading system and to introduce descriptive grades (Pinter Krekic et al., 2013). In this way, the pressure to achieve standardized academic achievement would be reduced and the focus would be on creativity and open thinking (Basic et al., 2021; Pinter Krekic & Ivanovic, 2013).

Considering that there is a small number of studies dealing with mathematical creativity in students with mild intellectual disabilities, instead of a conclusion, we recommend conducting research to examine the characteristics and possibilities of applying some of the techniques to encourage creativity given in Table 1 with a sample of students with mild intellectual disabilities.

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