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CREATING A LEARNING ENVIRONMENT WHICH TRIGGERS POSITIVE EMOTIONS IN THE PROCESS OF TEACHING MATHEMATICS AT SCHOOL[3]

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Abstract. *The article supports the idea that creating a learning environment, which triggers positive emotions in the process of teaching mathematics, stimulates students to achieve better results. The discussion focuses on two ways of creating learning situations which provoke positive emotions: by using mathematical tricks and by using sophisms.*

Keywords: *emotion, teaching mathematics, mathematical tricks, sophisms*

INTRODUCTION

In his study [2, p.18-19] Prof. Iv. Ganchev reached the conclusion that mathematics education should meet 5 basic requirements, the first of which is explained in the following way: "After one's personality is formed in the process of social practice and manifests itself as a whole in which cognitive activity is one whole with experience, an important role in learning, including learning mathematics, is assigned to positive emotions". For this reason the main focus of the present article is on designing the educational environment. In our study we look at this design primarily in educational terms, as they define all those specific requirements for the design of the environment, which take into account the age characteristics of students' personality and their ability to perceive, conceive, remember and apply specific mathematical knowledge, while focusing on positive experiences and emotions.

Understanding and remembering new mathematical knowledge is at the core of the formation of students' skills to operate with this knowledge. The formation of planned mathematical competencies is a measure of the effectiveness of teaching mathematics in a particular class. In addition, the effectiveness of teaching depends both on the motivation to carry out a particular activity and on the "emotional attitude of the subject in carrying out the activity" [2, p. 18].

In the article [5], we share our views on the possibilities of creating an educational environment in mathematics education in the initial stage of education, which is dominated by positive emotions.

The transition from pimary education to secondary and junior high school is not always easy for the student. This transition is characterized by issues of a different nature and intensity, such as cognitive, social, emotional problems. In lower secondary education, it is noticeable that the interest

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in studying mathematics begins to decline, and as a result, fewer students successfully participate in mathematical competitions.

In this article we explore some ways of creating a learning environment in math education which is characterised by positive emotions.

MAIN PART

Humanising the learning process is an important feature of the modernization process in education. The design of such a process is based on relationships, values, symbols, objects, etc.

The creation of a forming educational environment in the process of teaching mathematics with a humanistic focus is related to a number of parameters such as:

- Creation of modern forms of individual and collaborative work of teacher and students, which are adapted to students' needs, interests, opportunities for self-expression and participation in intellectual activities varying in difficulty and content;
- maintaining and stimulating the creativity of each student;
- establishing clear rules for communication, self-organization and self-government, adopting norms of behavior that ensure inclusion in the environment, as well as students' mental, emotional and intellectual comfort [1, p. 186].

In line with research in psychology, we perceive emotion as a psychological process of expressing one's attitudes towards objects and phenomena from their surroundings, to other people, and to oneself as a cognitive and acting human being.

Emotions and feelings generate new opportunities for precise and intense observation, using memory capacity, optimising thinking and imagination, in order to fully realize the psychological processes, properties and states of the student's personality.

Experimental research proves that positive emotions arise when mental activity corresponds to students' age and is aimed at overcoming certain difficulties. The impossibility of achieving success generates a number of negative emotions - fear, dissatisfaction, depression, etc. Emotions can speed up, maintain or reduce learning motivation as well as related volitional processes.

"It has been established that during the school years the hard work and studying, and good end results f the positive activating facilitated by emotion (inner pleasure resulting from the successful solving of a task) intensify the internal motivation for achievement and stimulate learning with understanding" [9, p.133]. Therefore, we believe that the mathematics teacher is bound to work towards creating an educational environment in which there are conditions for positive experiences. The teacher should be positive and should try to organize the learning process so that students can cope with the tasks, because where there is success, there is a desire and motivation for learning, and in general there is an improvement of learning results. And when the teacher's insistence and demand is accompanied by goodwill, understanding and readiness to help, the results will be evident. Therefore, we can conclude that the formation of a learning environment with positive emotional background is an opportunity to achieve better educational outcomes in the teaching of mathematics.

In maths education, it is possible to create situations in and out of the classroom which trigger positive emotions supplementing cognitive activity of the students. These emotions stimulate learners' thinking, interact with their cognitive interests, and self-improvement efforts in the classroom.

In this article we will look in detail at the possibility of using mathematical "focuses" and sophisms, which create conditions for pleasant emotions in learners.

1. USING MATHEMATICAL TRICKS

Students like doing sums. This is an example of such a task:

Task. *Think of a number. Add 4 to it. Multiply the resulting sum by 3 and then add 3. Double the resulting sum and then detract 12. Next, divide the sum by 6 and subtract the number you had thought of at the beginning from the resulting sum. Multiply the result by 4. I will tell you the final result.*

The answer is 12 and is reached by means of the following calculation:

$$\left\{\frac{\left[(x+4).3+3\right].2-12}{6}-x\right\}.4=12$$

The usefulness of the trick is increased if it is done while studying the topic of mathematical identities, in order for students to understand better the nature of the trick.

The following task increases the positive emotions:

Task. *On a sheet of paper write the number of the building you live in. Multiply this number by 2 and add 5 to the result. Multiply the resulting number by 50 and add 365 to the resulting number. Add to this result your years and tell me the number you received. I will find out the number of your house and I will tell you how old you are.*

This is the way it works. From the final number, the number 615 is subtracted. The resulting difference is a number in which the last two digits show the age number and the first digits form the number of the house.

The educational value of this trick is achieved by proving the assertion on which the answer is based.

Proof. For simplicity, let's assume that the building number is a two-digit number. Let's indicate this number with $\overline{xy}$, and the student's age (the age of the fifth-eighth grade student) is also a two-digit number $\overline{zt}$ ..

Then, from the task of the task we get the following expression:

[(x10 + y) .2 + 5] .50 + 365 + z.10 + t.

After simplification, the expression is:

1000x + 100y + 10z + t + 615 (1)

Now the student can find the key to the trick. After subtracting from the expression (1) the number 615, we get 1000x + 100y + 10z + t = $\overline{xyzt}$

Doing such tasks generates astonishment in the student, reinforcing his desire to solve other similar tasks.

2. SOPHISMS

Our experience shows that the learner often learns from an explanation of mistake more than from a task solved without any problems. Therefore, for the purposes of teaching mathematics, it is important to consider using some sophisms. Students become interested in the way of thinking in solving a task in which there is a deliberate mistake and the way it is resolved, and get involved in discussing the problem.

When studying the topic "Rooting", the following sophism can be used: 4 = 5.

Let's start with 16-36 = 25-45. Then $16-36+\frac{81}{4}=25-45+\frac{81}{4}$.

Let's write the equality in the form $\left(4-\frac{9}{2}\right)^2=\left(5-\frac{9}{2}\right)^2$. Then we have that $4-\frac{9}{2}=5-\frac{9}{2}$ and therefore 4 = 5. Where is the error?

The following sophism can be used in studying logarithms: 3 < 2. We can write the inequality $\frac{1}{8}<\frac{1}{4}$ in the following way: $\left(\frac{1}{2}\right)^3<\left(\frac{1}{2}\right)^2$.

After applying the logarithm to the both sides of the inequality at base 10 we get $3\,lg\frac{1}{2}<2\,lg\frac{1}{2}$

.

We divide the two sides of the inequality by $lg\frac{1}{2}$ and so we get that 3 < 2. Where is the error?

Some sophisms can also be formulated as questions. Usually, the question is formulated in a way that the student is misled to give the wrong answer. An example is the question about the price of a book and the price of its binding, if the bound book costs 11 leva and it is 10 leva more expensive than the binder. Some students rashly give the wrong answer that the unbound book costs 10 leva. , and its binding - 1 lev. This task is suitable for introducing the topic "Systems of linear equations with two unknowns". By denoting x and y respectively the cost of the unbound book and the cost of the binding, the students make a system of two equations with two unknowns. The solution gives the correct answer to the question asked, namely that the bound book costs 10.5 leva, and its binding - 0.5 leva.

The use of sophisms in teaching mathematics often encourages students to read and use additional mathematical literature. Solving tasks of this type always brings an emotional element to students' work. Students experience different situations, observe, carefully examine each step of the task, recall definitions of concepts and their properties, and as a result remember well where the error was made.

CONCLUSION

There is a full spectrum of resources for creating and maintaining a learning environment in which positive emotions predominate. In the article we looked into only two sets of tasks that helped shape the desired learning environment. The smart and balanced use of such groups of tasks contributes to attracting and retaining student's attention, but also encourages learner activation and, as a result, contributes to the continuous learning of new mathematical knowledge.

REFERENCES

Vasileva, Em. (2004). Contemporary Primary School – Reality and Challenges, University Publiching House, S. (***Оригинално заглавие:*** *Василева, Ем. Съвременното начално училище-реалности и предизвикателства, Университетско издателство „Св. Кл. Охридски“, С., 2004).*

Ganchev, I. (1999). Main Activities in Math Class, IF Modul, S. (***Оригинално заглавие:*** *Ганчев, Ив. (1999) Основни учебни дейности в урока по математика, ИФ „Модул-96“, С.).*

Ganchev, I. (2005). Idea of Analogy of the Methods of Instruction in Euclid's "Elements", Proceedings Mathematics and Mathematics Education, Borovets, 2005 *(**Оригинално заглавие:** Ганчев, Ив. Идея за методически аналог на „Началата“ на Евклид, Сб. Математика и математическо образование, Боровец, 2005).*

Karakasheva, L. (2015). Opportunities fro development of thinking characteristics through mathematics training in primary school, Proceedings of the Shumen University, Vol. XIX D, Shumen, p. 590-596 (***Оригинално заглавие:*** *Каракашева, Л. Възможности за развитие на някои качества на мисленето чрез обучението по математика в началното училище, Годишник на ШУ „Еп. Константин Преславски“, том XIX D, ПФ, Ш., 2015, с.590-596).*

Karakasheva, L. (2016). About Positive Emotions in mathematics training, Proceedings of the Shumen University, Vol. XX D, Shumen, p. 522-526 (***Оригинално заглавие:*** *Каракашева, Л. За положителните емоции в обучението по математика, Годишник на ШУ „Еп. Константин Преславски“, том XX D, ПФ, Ш., 2016, с.522-526)*.

Litsman, V. (1975). Where is the mistake? Publishing House Technica, S. (***Оригинално заглавие:*** *Лицман, В. 1975. Къде е грешката? София: Издателство „Техника“,)*.

Pirov, G. (2000). Problems of the Cognitive Psychology, Acad. Publishing House, S. (***Оригинално заглавие:*** *Пирьов, Г., 2000. Проблеми на когнитивната психология, София: Академично издателство „Проф. Марин Дринов“).*

Rangelova, P., R. Mavrova (2013). Emotions in mathematics training, Published by "Koala Press", Plovdiv (***Оригинално заглавие:*** *Рангелова, П., Маврова, Р., 2013. Емоциите в обучението по математика, Плевен: Издателство „Коала Прес“)*.

Yankulova, Ya. (2012). Pedagogical Psychology, Published by "Paradigma", S. (***Оригинално заглавие:*** *Янкулова, Я., 2012. Педагогическа психология, София: Издателство „Парадигма“).*

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