JCEC
THE JOURNAL OF ENGINEERING AND EXACT SCIENCES

OPEN ACCESS

The Journal of Engineering and Exact Sciences – jCEC, Vol. 08 N. 05 (2022)
journal homepage: https://periodicos.ufv.br/jcec
eISSN: 2527-1075
ISSN: 2446-9416

Teaching Process and Emotional Reactions in Mathematics

Processo de Ensino e Reações Emocionais em Matemática

Article Info:
Article history: Received 2022-06-03/ Accepted 2022-07-28/ Available online 2022-07-28
doi: 10.18540/jcecvl8iss5pp14497-01i

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Abstract
Teachers are increasingly required to have mathematical subject knowledge described as lists of facts, skills and competencies. Different emotional reactions are present in the classroom every day. Emotional reactions are most often divided into positive and negative, and negative emotional reactions are most often related to the evaluation process. Teaching mathematics at all stages and levels of education is often a challenge for students. It is known that mathematics is not very popular and one often hears this misconception: "common sense and mathematics do not go together". Unfortunately, statements such as "not for me", "I don't know math" and "my mom is not a mathematician" can often be heard from students. The popularity of mathematics is on the scale of less popular subjects in schools, although teachers are forcing the teaching of mathematics, and even the curriculum offers more math classes than some other subjects.
Keywords: Motivation, Teaching process, Teaching mathematics, Mathematical anxiety.

1. Introduction

Mathematics as a subject in school has a prominent place in the entire educational program, not only as a subject that educates people, providing students with useful knowledge for life or continuing

education, but also as a subject that has an educational function and broadly participates in building a scientific view. to the world. One of the requirements of teaching mathematics, as it is known, has the task of developing students' sense of independent work, the ability to express clearly, logically and accurately, the habit of responsibility and orderliness in performing school and other tasks.

Studying the problem of engaging students in the teaching process in relation to interpersonal relationships between students and teachers leads us to find opportunities for quality development and humanization in the field of interpersonal communication of participants in the educational process in school. It is known from experience that the positive socio-emotional climate nurtured by the democratic communication of teachers and students results in greater engagement and stronger motivation of students for teaching and learning. Man is by nature a lifelong being of communication, conversation and has a need for quality interpersonal relationships with others, since he is basically a social being. In order to create, develop, grow and succeed in his social context, he needs verbal and non-verbal communication skills. Man is constantly accompanied by spoken and unspoken messages about the environment and between him and others in his social environment. Conversation became the basic means of his survival and acquired the same meaning as oxygen, water and food (Brajša, 1994, p. 12). The characteristics of successful communication are: understanding, satisfaction, influencing attitudes, improving relationships and provoking action (Bratanić, 1993, p. 100). Communicating doesn't just mean speaking in words. Communication means much more than that. It means exchanging messages, thoughts, participating in the feelings of others. We do not communicate only with words, but with the whole being in the fullness of our relationships. The better people know each other, the better they will communicate. The more and better they communicate, the greater the opportunities for better and deeper acquaintance (Delors et al., 1996, p. 22).

In interpersonal communication, the most difficult task is to develop motivation for engagement and activities, while in teaching and learning it is the most important. The issue of engaged active participation in the learning process is most directly related to the problem of motivation and the question of how the student experiences his school learning. If a student perceives school assignments as something imposed on him by his teacher or parents, he will fulfill them without more intense intrinsic motivation, without strong interest, which will result in alienation of the activity he performs from him, he will not feel joy and satisfaction with its execution. Mutual trust, respect and assistance in the work of the subjects of teaching "stems from the established relationships and joint efforts to successfully overcome difficulties and achieve optimal results. At the same time, they strengthen the dignity of each student, serve to strengthen satisfaction with existing relationships and achieved results". Some psychological theories speak about the importance of using and encouraging student motivation for engaged and active participation in learning, so that in planning learning, the most important criteria to consider are: determining, assessing and meeting children's needs and abilities, using and encouraging children's motivation , giving appropriate rewards and punishments, encouraging active learning, giving feedback, developing a positive self-image, using a moderate amount of new data, and understanding the limited reach of automatic reactions and mechanical learning (Morrison and Ridley, 1988, p. 17).

The problem of insufficient motivation of students for engagement in teaching and learning is still present in a large number of our schools. The cause is often inadequate interpersonal relationships between students and teachers. The problem of this research includes the involvement of students and teachers in teaching and interpersonal relationships. The subject of this experimental research is to investigate the impact of student and teacher engagement in teaching and their interpersonal relationships on motivation, involvement in teaching and pedagogical climate in school. Through experimental content, we encourage positive interpersonal communication and the development of students 'communication skills, which will activate numerous conscious and unconscious motivators of students to learn, and we will measure the development of students' interest in work

and positive emotions. The aim of this pedagogical experiment is to examine in experimental conditions the effects of the influence of greater involvement of students and teachers in teaching and better interpersonal relationships on motivation, student involvement in teaching and pedagogical climate in school.

2. Teaching process and emotional reactions

"Pestalozzi also emphasized that teaching should be the unity of head, heart and hand or, speaking in modern language, the unity of cognitive, affective and psychomotor." (Bognar and Dubovički, 2012, 152) on cognitive and psychomotor aspects (Kolak and Majcen, 2011). Emotional reactions were seen "as something undesirable, and even as a hindrance to teaching and learning", and in the context of teaching emotional reactions were discussed only when they became perceived as difficulties (Burman, 2001, Živković, 2004, all according to Kolak and Majcen, 2011, 343). However, the discoveries that followed and the development of neuroscience influenced the understanding of the role of emotional reactions. Understanding the role and importance of emotional reactions has contributed to placing increasing emphasis on affective aspects of teaching (Kolak and Majcen, 2011). Therefore, it is understood today that what takes place in school in general and during the teaching process affects students' emotions, but emotions also affect how students experience school and the teaching process, which indicates a circular connection between emotions and teaching process. Achievements affect the student's emotional reaction at school, while emotional reaction affects coping strategies, i.e., coping with different situations that the student can adopt and use. "(Kolak and Majcen, 2011, 344) thus emphasizes the existence of two-way an impact in which “student emotions affect achievement, and feedback on success in turn affects emotions”. Following the above, the empirical part of the paper will be focused on the emotional reactions of students in mathematics teaching.

2.1Emotional reactions of students in mathematics teaching

Namely, many researches have shown that their attitudes towards mathematics, the level of self-confidence in learning mathematics and work habits are important for success in mathematics. Emotions appear as a personal reaction to a life situation, so the term "emotional reaction" is often used instead of emotions (Milivojević, 2007). Kolak (2014) divides emotional reactions in teaching into those that are directed towards the subjects of the school and teaching process (students, teachers, parents), emotional reactions among students and emotional reactions related to the teaching process. In addition to emotional reactions, the term "academic emotions" is also used, which refers to emotions closely related to the teaching process, i.e., learning, teaching and student achievement (Pekrun2006). In the teaching of mathematics, they are manifested through the emotions that the student connects with mathematics, his beliefs about mathematics and through the overall relationship of students to mathematics. Among them, it is important to single out emotional reactions related to the teaching atmosphere, the relationship between teachers and students, the general emotional state of students and those that directly affect or are the result of the learning and teaching process.

Emotions that appear in teaching are: anxiety, fear, boredom, shyness, (dis) satisfaction, curiosity, relaxation, anxiety, worry, anger, sadness, self-esteem, self-confidence, carelessness, excitement, interest, pride, etc. Of the many emotions that students show in class, the emotion of boredom often proves to be dominant (Kolak and Majcen, 2011). However, in the teaching of mathematics, the fear of mathematics prevails, which is most often referred to in foreign literature as “mathematical anxiety” (Geist, 2010; Sloan, 2010). Fear of mathematics, by definition, belongs to academic emotions and proves to be one of the main obstacles to success in mathematics. Namely, the emotions and beliefs that individuals have towards mathematics affect their motivation, which is

why they avoid learning mathematics on their own. Mandler (1989) points out that negative attitudes are the result of repeated failures in work, and the associated emotional reactions become permanent patterns of their behavior in and towards the teaching of mathematics. On the other hand, with more successful students, self-confidence and a sense of self-worth grow with each success and mutually support and strengthen each other. Therefore, the cycle of success in the development of mathematical abilities is mentioned more and more often in the literature (eg Koshy et al., 2009).

The teaching process is filled with emotional reactions of students and teachers, and due to the prevalence and specificity of the problem of teaching mathematics, they must be considered more seriously in any teaching planning. According to the guidelines of modern pedagogy, the individuality of the child and his social being are respected, starting from school as a social being (Previšić, 1999). Emotions, attitudes and beliefs play a primary role in motivating students, which is one of the fundamental prerequisites for school success and thus success in mathematics. However, theoretical knowledge about emotions in mathematics teaching is insufficiently applied and is not sufficiently represented in the system of education of mathematics teachers, as well as in practical and / or reflective reflections. Given the prevalence of mathematics teaching, among the social and affective dimensions of teaching, some authors argue that mathematics didactics belongs to the social sciences (egStraesser, 2007), which is one of the open problems of pedagogy in terms of teacher competencies and methods and content of their education. The study of emotions, attitudes and beliefs about mathematics should focus on understanding the "academic behavior" of students in mathematics classes, and this requires knowledge of students' attitudes and beliefs in order to incorporate them into mathematics teaching methods.

The starting point is how teaching methods can directly, and even indirectly, influence students' attitudes and beliefs about mathematics and the corresponding emotional reactions. Authors in this area mostly study cognitive, motivational, or emotional variables separately, and when it comes to attitudes and beliefs about mathematics, specific categories of attitudes and beliefs are most often explored separately. Among school factors, Eynde and De Corte (2003) showed that the system of attitudes and beliefs about mathematics consists of four factors: the role and actions of mathematics teachers, the importance of mathematics and the ability to master it, mathematics as a social activity and mathematics as an area of success. Namely, the teaching process is imbued with emotions that are in constant interaction with the process of student evaluation and a number of teacher methods. The teacher must make sure that there are no unwanted emotions by supporting students in (failures), and that they acquire and / or develop a positive attitude towards mathematical content and, ultimately, to their own abilities and themselves.

Due to the prevalence of negative perceptions of mathematics, the teacher must develop students' self-confidence and confidence in their own mathematical abilities. To achieve this, teachers must develop students' self-esteem, self-esteem and responsibility for their own success. Therefore, the teaching process must be based on all the specifics of students such as: the level of acquired knowledge and skills, acquired educational values, motivation for the subject, emotions, attitudes and beliefs in the context of mathematics and school in general and knowledge of the whole school, social and family environment. In these intentions, it is important to harmonize the intellectual and emotional aspects of students in mathematics teaching. Namely, it is important that the teacher understands the ways of acquiring knowledge and developing mathematical abilities and skills, but also that he equally attaches importance to emotional experiences in order to more easily regulate students' attitudes towards mathematics teaching, his perception of self-efficacy and, ultimately, his motivation and level of activity. teaching process.

In order for a teacher to manage students' competencies, he must master the method of emotional metacompetence (Kolak and Majcen, 2011), which would create a classroom atmosphere in which to nurture a positive attitude of students towards teaching activities. Students in teaching have

relatively permanent and specific forms of behavior, forms of interrelationships, attitudes towards learning and participation in teaching activities, the way they communicate with each other and social interaction with teachers (Jurčić, 2012). Therefore, Jurčić states that the totality of the life and work of teachers makes their classroom atmosphere. All emotions that occur during the teaching process, including the emotional state of students, the relationship between teachers and students and students with each other, are part of the classroom atmosphere. Within the classroom atmosphere in mathematics teaching, the overall emotional state of the participants in the educational process is important, which is how Bognar and Dubovički (2012) determine the emotional climate. In addition to motivation for teaching activities, the classroom atmosphere is a fundamental factor in the mental, affective and social development of students in teaching.

The elements that determine the class atmosphere can be divided into four groups (Jurčić, 2012):

- teacher support
- (re) burdening students with classes
- class cohesion
- fear of school failure.

Elements of the classroom atmosphere act individually, but interact to influence learning and teaching outcomes. Jurčić (2012) states as determinants of the classroom atmosphere: teacher support, (over) burden of students with teaching, class cohesion and fear of school failure. Emotions that students experience in mathematics teaching indicate how students' emotions need to be viewed as an aspect of learning and teaching that is as important as the cognitive aspect of the teaching process. Moreover, according to the representation and effect of emotions on mathematics teaching, it can be said that the affective dimensions of teaching are superior to cognitive ones as they condition the work and motivation of students and are therefore among the basic prerequisites for successful teaching.

2.2 Emotions and motivation

Existing concepts of motivation focus on students' thoughts and beliefs and usually focus on only two components of human learning - cognition and motivation (Ford, 1992). Emotions have not received a deserved place in existing conceptions of motivation and are not a central feature in well-known motivational theories such as: goal theory, theory of expected values and self-efficacy. Ford (1992, p. 8), writing about the role and place of emotions in motivational theories, states that “although the importance of emotional experience for motivation has long been recognized, there is a tendency for emotions to be seen as a separate source of motivational energy. part of motivational patterns”. Similarly, other authors warn that "emotions are often treated as a consequent process in motivation, although there is evidence that they may play a central role in explaining students' reactions to challenging work and learning situations" (Turner et al., 1998, p. 769). These findings suggest that we need to look at emotions in a different way. Emotions are not only a consequence of cognitive and motivational processes, but they are important mediators between motivation and activity, i.e., accessing or avoiding learning. In fact, motivation implies a set of interrelated beliefs and emotions, which directly influence behavior (Martin, 2007; Wentzel, 1999). Buck (Buck, 1985, p. 396) made an analogy with the relationship between matter and energy, which illustrates the need for an integrative approach in considering the relationship between emotions and motivation. Namely, "just as energy is a potential that manifests in matter, motivation is a potential that manifests in emotions.

Motivation and emotions are just two sides of the same phenomenon, two aspects of the same process. " In an article entitled “Discovering Emotions in Classroom Motivation Research,” Meyer and Turner (1997) cite the results of research conducted over the past ten years and discuss many of their surprising findings, which led them to conclude that “emotions are an essential part of studying motivation in the context of the classroom and the interactions that take place in it” (p.

107). Indeed, research confirms that students who show interest in school assignments and who feel positive when faced with educational challenges tend to be more successful in school and on standardized tests than other students (Lepper et al., 2005). Also, students' enjoyment of learning increases cognitive resources in learning, while reducing irrelevant thoughts of students during learning. For negative emotions, such as: anxiety, shame and helplessness, of course, the opposite is true. In summary, positive emotions increase students' interest and motivation to learn, while negative emotions, such as helplessness and boredom, reduce them (Christianson, 2014). Overall, individuals are motivated to engage in activities in situations where positive emotions predominate and avoid situations with a negative emotional charge (Cain & LeDoux, 2008; Lang 2010; Lang & Davis 2006). These findings clearly confirm the assumption that emotions are not only a consequence of cognitive and motivational processes, but motivation is precisely driven by emotions.

2.3 Emotions and attention

Emotions also play an important role in directing attention, which is necessary for learning (Phelps, 2006). It is common knowledge that emotions determine which information to pay attention to, because the information to which emotions are directed receives increased attention (Lang & Davis, 2006). In this sense, the teaching process is no exception, students' emotions can affect the amount of interest and attention paid to teaching tasks (Izard, 2009). In particular, negative emotions narrow the attention, thinking, and repertoire of student behavior, while positive emotions expand them (Fredrickson & Branigan, 2005). Students are more successful in learning and completing tasks when they feel safe, happy, and excited about a subject matter (Boekaerts, 1993; Oatly&Nundy, 1996). Attention control theory assumes that optimal cognitive performance is more likely when attention resources are widespread than when attention is narrowly focused on a particular task (Eysenk et al., 2005). The idea is that focusing on managing and controlling emotions can reduce abilities important for learning, such as listening and thinking (Blankstein et al., 1989). The skills of controlling one's emotions are very important in managing attention and adequate application of mental processes necessary for learning (Blair, 2002). Research results confirm that students with better emotional skills are more successful than other students in focusing and maintaining attention in class (Nelson et al., 1999). One study found that children who were classified as happy children by their peers in the class were also assessed as children with better and higher quality attention by teachers. On the other hand, children who were reported by their peers to be often sad or angry were rated by teachers as having less attention (Trentacosta et al., 2006).

Although emotions have the potential to stimulate students' thinking, emotional states can also interfere with the learning process. If students are too excited, or enthusiastic, they can work carelessly, or quickly, rather than methodically and carefully. In addition, emotions such as anger, anxiety and sadness have the potential to distract students from learning because they hinder them from solving the task. While some types of negative emotions (such as anxiety and frustration) can motivate students to put more effort into learning tasks, other types of negative emotions, such as anger or sadness, certainly have a negative impact because they can easily lead to giving up. task (Efklides 2006). Conflict, or fear, in the learning process can create a negative “affective filter,” which interferes with a student’s ability to process new information (Pennington, 1996). Negative emotionality, such as mood swings or emotional dysregulation, is associated with more inattentive and hyperactive behaviors and lower levels of educational competencies (Bulotsky-Shearer &Fantuzzo 2004).

2.4 Emotions and memory

It is generally known that our memory and recollection of certain events depends on our attention: whether we paid attention at all, how much and on which aspect of the situation. Namely, the attention paid to certain content affects the learning and memory of certain material (Phelps, 2006), as well as the later memory of that information (Craik et al., 1996). Starting from the fact that emotions attract attention that directly affects learning, it was found that the emotional relationship to matter affects the memory process and all subsequent levels in the memory process, from information processing and processing in working memory, to consolidating content in long-term memory (LaBar& Cabeza, 2006).

They are well known, the so-called. Stroop experiments in cognitive psychology, in which respondents are asked to assign a certain color to neutral and emotional words, thus combining a relatively automatic reading process with a relatively controlled color marking process. The results of these studies indicate that respondents need more time to color emotional than neutral words (Pratto& John, 1991). This difference reflects both perceptual bias and automatic encryption of affective information (Williams et al., 1996). Revelle& Loftus (1992) suggest that emotional arousal increases the rate and amount of information encoded per unit time, which in the case of emotionally colored material accelerates material processing and its integration and assimilation with existing cognitive structures. Emotions can play a mediating role towards long-term memory by having an advantage in processing and are processed longer and in more detail in working memory. In addition to the importance of emotions for the speed of memorizing content, they can also be a determinant of the type of content that will be memorized. Namely, the amount of attention and the quality of processing new information will be higher the more the existing information is in line with the person's current mood. According to this hypothesis, pleasant events will be better processed when people are in a pleasant mood, while unpleasant events will be better processed when people are in an unpleasant mood (Bower et al., 1981).

3.Fear of mathematics and mathematical anxiety

Society often has prejudices against mathematics that it perceives as logical, absolutist, rigid, cold, objective, inhumane, and abstract science (Andrews, Rowland, Brindley, et al., 2014). Recognizing the difficulties that students have in teaching mathematics and other specifics in mathematics education, it is shown that emotions sometimes play a crucial role in the success of mathematics.

It emphasizes the fear of mathematics, which by definition belongs to academic emotions, and is defined as a feeling of tension and anxiety that makes it difficult to manipulate numbers and solve mathematical problems in everyday and school situations (Richardson and Suinn, 1972). Many students have a fear of mathematics as a result of initial failures in understanding mathematical concepts, which in the order of primary school content is primarily related to arithmetic. Aschraft (2002) states that in some cases the difference in students' achievements in mathematics is not due to a lack of abilities and potential, but precisely because of the fear of mathematics and different emotions of students in teaching.

Wigfield and Meece (1988) distinguish the cognitive and affective components of fear from mathematics. The affective component refers to negative affective reactions to mathematics, such as nervousness, fear, and discomfort. The cognitive component refers to concern for performance and success in mathematics. Matijević (2005) therefore argues that future teachers should be prepared for the functions of diagnostician, implementer, evaluator and therapist, in pedagogical terms. Only in this way will teachers prepared and trained be able to manage and regulate complex

processes such as upbringing and education during schooling. Research on emotions in mathematics teaching indicates that the classroom atmosphere in mathematics teaching should be at the top of priorities in the subject curriculum of mathematics teaching, and teachers' competencies should be more focused on perceiving emotional states and reactions of students in the context of fear of mathematics. diagnostic and therapeutic action towards students who have difficulties in the affective domain. Some authors therefore define a "curriculum against anxiety" for teaching mathematics that would suppress students 'negative emotional reactions (Geist, 2010). In these efforts, the didactic-methodological determinants of mathematics teaching should contain a stimulating and encouraging classroom atmosphere based on the individuality of students and the requirements and difficulties they encounter in teaching. The goal of the anti-anxiety curriculum is precisely to bring students to a cycle of success in the development of mathematical skills and knowledge (Koshy et al., 2009). It is in the context of the anti-anxiety curriculum that there is a need for a teacher who has the role of a therapist who knows how to direct students 'negative beliefs and attitudes towards mathematics towards success, i.e., towards students' activities that will not be limited by affective deficiencies.

It is important for the student to become aware through teaching activities that he is at the center of teaching and to understand that the teaching process does not fulfill its purpose if the student does not actively participate in teaching. To achieve this in the classroom, it is not enough to just ask questions, whether heuristic or problematic, but to provide a stimulating atmosphere of success, praise, empathy, advice and support to encourage students' components of intrinsic and extrinsic motivation.

Emotions and beliefs that individuals have towards mathematics affect their motivation, which is why they avoid learning mathematics on their own. Research shows how attitudes and beliefs about mathematics, its learning, and solving math problems affect how students approach math problems and what techniques and strategies they use to solve them (e.g., Lester, Garofalo, & Kroll, 1989). In addition, it has been shown that attitudes and beliefs about mathematics are related to motivational processes, i.e., with a desire to learn mathematics which further influences success in the subject (e.g. Kloostermann, 1996). Therefore, in mathematics, as in any activity, self-confidence and self-esteem grow with each success and are mutually supported and strengthened by further activity. Therefore, a model of the success cycle of the development of mathematical abilities was conceived (Koshy et al., 2009). This cycle consists of three key components:
- self-confidence according to one's own abilities, positive beliefs about mathematics
- effort, perseverance and demands for challenging tasks
- achievement and success in mathematics.

These components are cyclically connected and are in constant interaction with the teaching process and the corresponding emotions of students. In contrast, Preis and Biggs (2001) describe the cycle of mathematical anxiety as a kind of "negative" of the cycle of success. In this cycle, unpleasant emotions affect the reduced motivation of students and the lack of independent learning of mathematics. These emotions and beliefs about math are associated with a lack of self-confidence and a sense of incompetence which is why many, objectively capable students, avoid difficult tasks, put in little effort and give up easily when faced with difficulties (Hembree, 1990; Sheffield and Hunt, 2006).

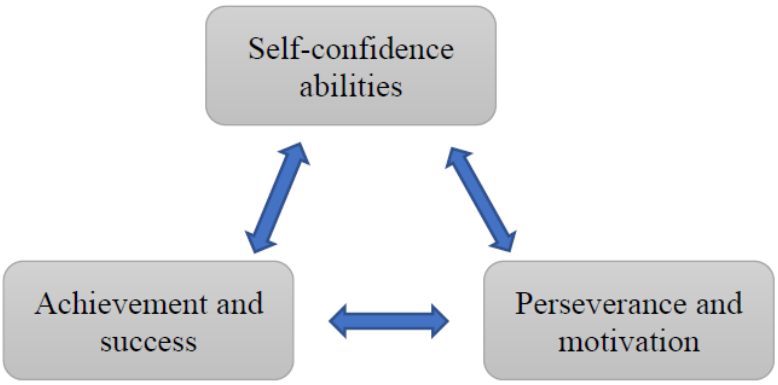

Figure 1. (Koshy et al., 2009)

Bezinović (1988) within his work in the field of validation of the construct of perception of personal competence developed three scales that represent three aspects of the perception of personal competence. In factor analyzes, the scales representing the three constructs stand out as separate factors: the generalized self-efficacy factor, the perceived incompetence factor, and the persistence factor. Bezinović's research (1988) showed that the perception of personal competence (defined by the scale of perceived incompetence) is the backbone of global self-esteem (defined by the Rosenberg scale). There are two basic models that suggest an explanation of the causal relationship between the perception of self-efficacy and achievement. The "self-empowerment" model is based on the assumption that self-efficacy affects school achievement.

The goal of this model is to improve school achievement by developing and increasing beliefs in personal effectiveness. In contrast, the "skills development" model assumes that school achievement affects the perception of personal effectiveness. According to this model, the belief in high self-efficacy is developed by practicing and improving specific skills and abilities of a certain profession or profession. Therefore, the planning of mathematics teaching must include all emotions that occur during the teaching process, including the emotional state of students, the relationship between teachers and students, students' attitude towards the subject, attitude towards learning and participation in teaching activities and the like. It is important to notice which components of intrinsic and extrinsic motivation are present in students in the context of teaching mathematics. The aim is to achieve a stimulating work environment in which the teacher takes into account the emotional state of students, especially in the context of academic emotions and relationships between students in the classroom. It should be an integral part of every lesson to discuss the ways of thinking and skills needed for specific tasks and math in general, as well as ways in which each student can achieve better results and how and how more successful students work and learn math. By striving for this, mathematics teaching will become more accessible to every student, and their educational perspectives should be in line with their capacities.

In order to develop the self-confidence and motivation of weaker students to learn mathematics, teachers must have exceptional authority and trust of students in the learning and teaching process. The authority of the teacher can be seen as a reflection of the interaction of all his competencies in his work, but also as an integral part of his educational work as a product of these competencies. The teacher's understanding of authority and the optimal classroom atmosphere are important in order to determine the optimal measure of mastering the teaching process in the form of teaching content (adapted to students 'interests and abilities so that students' independent work is in ideal proportion to teacher-led activities). on the qualities of the modern school. It is important for the teacher to build a healthy authority based on mutual respect, sincere communication and understanding, and support in student activities. As for the anti-anxiety curriculum, it should be

individualized and should be implemented through supplementary or supplementary classes as a supplement to the established difficulties that the student has in learning mathematics. Given the above, we can say that the teaching of mathematics is facing the problem of "learning how to learn", but as a greater challenge is facing the question "can I learn?". But in order to achieve this, we have to solve two problems: the problem of success and the problem of comparison (Horvat, 2016) among students.

4. Definition and classification of teacher roles

Education is a complex system with a clear organization. Like all actors in education, the teacher in that structure has his position from which his role derives. Every social role represents a system of expected behavior that is related to the position of an individual in a social group (Rot, 1994). The role includes activities that are considered mandatory, activities to which a person in a position in the group is entitled and the expected way of psychological response, but the role also prohibits certain behaviors (Havelka, 2000). Different approaches can be observed in the study of teacher roles. A common feature of most papers dealing with teacher roles is that authors try to classify them somehow, but the classification criteria and the number of roles identified by different authors differ. A simplified classification of a teacher's role is to distinguish between his or her educational role. It is clear that the goal that the teacher achieves through the educational role is related to the general development of students' personalities, and the goal that he achieves through the educational role is that students acquire certain knowledge, skills, attitudes, values and habits (according to Đigić, 2014).

Another important role of the teacher is the motivational role in which the teacher solves problems such as, in what way and in which ways to develop, encourage and maintain curiosity, interest in intellectual work and work habits of students. The role of motivators is reflected in the efforts of teachers to motivate children to work with content that is difficult and incomprehensible to them. This role includes all behaviors of teachers whose goal is to motivate and encourage the child to learn and work, such as: finding ways to reach certain knowledge to the child, developing internal motivation to learn, using existing children's interests to bring teaching closer to students and made it more interesting, encouraging existing and creating new student interests, monitoring the fluctuation of attention and its provocation and maintenance during the class and using positive reinforcements (praise, rewards) to model the desired student behavior. Within the motivational role, it is necessary for the teacher to be a model for professional identification and to attract children with his specific way of work, skillful transfer of knowledge and even personality, and encourage them to love and engage in the subject he teaches (Ivić et al., 2003).

5. Experimental method

Modern teaching of mathematics strives for greater orientation towards students, which means that increases student activity in teaching, especially through experimental teaching. Traditional Mathematics teaching relies mainly on the teacher as a lecturer and then on the students who then solve tasks independently. In other words, the student has a passive role in acquiring new knowledge. Discovery learning refers to the ability of students to independently, through experimentation, come to new knowledge, ideas and solutions to problems.

Experimental work has an important place in the methodology of mathematics because it is related to heuristic strategies and ideas. On the one hand, mathematics is strict and systematic deductive discipline, and on the other hand mathematics is also an experimental inductive discipline because to solve the problem you need to test the possibilities, i.e., experiment and act inductively. So, first we need to use heuristic thinking, assumptions and ideas to build and prepared real evidence. This principle can also be applied in the teaching of mathematics: students can do something new the material is first examined experimentally, and then they can move to a stricter mathematical level.

Also, experimental teaching gives students the opportunity to work at their own pace, thus, the differences between students are more respected. That means gifted math students they can follow the lessons in accordance with their special talents and thus learn something new the way. On the other hand, students with difficulties in mastering the material can experiment and pass from a passive role to an active one. This could free them from fear and stiffness in front of the mathematician content.

Experimental work in mathematics teaching can be especially pronounced during use of computers in teaching mathematics. There are many possibilities for experimental application computers in mathematics teaching. Various interactives are often used for models and simulations tools (Flash, web tools, etc.), but also dynamic geometry software, CAS and graphical tools. It's GeoGebra a program that has the properties of a dynamic geometry program (animated scrolling geometric objects), but also the possibility of CAS (display in symbolic and graphic form). In addition, GeoGebra belongs to the group of free open-source programs, it is very available for download and has the property that for online work we do not need to have GeoGebra installed on the computer.

Experimental work can be used to examine the properties of functions through changes various parameters, observing changes in the graph of the function and drawing conclusions. That's right characteristics such as monotonicity of functions, then symmetry, characteristic can be explored points, etc. Also, the experiment can be conducted through various repetitions of calculations or steps constructions so that the student can notice the required properties at his own pace and number of repetitions. The student can discover various mathematical rules and procedures, examples, rules of differentiation and integration, comma calculation rules, etc.

When using experiment in teaching mathematics, every teacher as a leader should pay attention to two things. First, it may happen that students after experimentally determine certain properties or ideas, do not need real mathematical proof because they believe that it is an experiment that provided sufficient evidence to generalize the observed rule. Therefore, the teacher, according to the age of the student, he should have carefully pointed out the need for mathematical proof, i.e. on the fact that heuristic ideas are not exactly tested. Secondly, it should be mentioned that the fact that parts of the teaching take place according to heuristic methods, no means that these classes are not systematically organized. On the contrary, the teacher needs to be well organized such a lesson, knowing the appropriate methods and capabilities of the computer. The teacher should also assess whether a particular material is suitable for experimental work or more suitable for one another method or teaching form.

6. Conclusions

Motivation affects the processes and outcomes of learning and teaching, while at the same time each new experience from the teaching process affects the motivation that the student has in the context of a subject and in school in general. Emotions and motivation are shown to have a significant place and role in learning and teaching mathematics. Therefore, the educational work of teachers must be mediated by positive experiences focused on experiences of success, in communication that respects the personality, interests and abilities of students, and encourages students to express opinions and suggestions to fully realize the concept of teaching in which the student center of the teaching process. To achieve this in teaching, it is not enough to ask questions, whether heuristic or problematic, but must provide a stimulating atmosphere permeated with success, praise, empathy, advice and support to encourage students to components of intrinsic and extrinsic motivation. In this way, we can encourage students to put more effort into learning, learn with understanding, be more persistent, and use different methods in learning and problem solving. In order for students to be motivated to learn mathematics, the quality of teaching is necessary, but it is not always enough. The process of learning mathematics requires students' interest and motivation towards the subject,

concentration, knowledge of learning itself, perseverance, and a range of cognitive skills and beliefs about learning mathematics. We must be aware of the limitations and how every learning requires motivation, a positive attitude towards learning and education in general, and a number of favorable factors from the school, family and social environment.

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