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## **Mathematical Education and Developing the Emotional and Social Competencies of the Child in Pre-primary and Primary Education in Slovakia**

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### **Introduction**

It is a typical feature of the contemporary school that it focuses primarily on the acquisition of knowledge and information despite the two decades of declarations on humanistic trends in education, and the generally perceived need to devote more time to influence the social and emotional development of children. A common cause of this condition is, according to the representatives of teachers, the highly demanding content of subjects' curricula in the last years; these curricula have been filled with a large amount of knowledge (curriculum from 1996), and educational attainments have been verified through cognitive tests. The reduction in the content of the curriculum currently in force (since 2008) provides space for pursuing the personal development of children and for planning activities that develop the affective side of a child's personality. However, teachers lack the available tools for detecting the efficiency of the process and to verify the results attained in a given area. What is important here is the collaboration of educationalist and other experts from the field in order to obtain the relevant results. Some alternative schools in Slovakia have also participated in this process.

Mathematics is considered to be a subject which primarily develops the cognitive area of children and pupils aged from 3 to 10 years. This is also documented in the content standards and the performance standards of the mathematical-logical sub-area of the *State Programme of*

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*Education ISCED 0 - pre-primary education, 2008 (hereinafter SVP-ISCED0).* The standards are formulated within the thematic area *People*. Similarly, the content and performance standards of the *State Programme of Education for the 1st stage of primary education in the Slovak Republic ISCED 1 - primary education, 2011 (hereinafter SVP-ISCED 1)* state the requirements for pupils' knowledge and skill in mathematics. Measuring pupils' achievement in mathematics or children's readiness for school education in the mathematical content area is, in Slovakia, aimed at verifying the cognitive knowledge of children and pupils through cognitive tests, largely based on lower-order thinking skills. Developing cognition and stimulating cognitive skills in mathematics is naturally a priority, but, in practice, cognitive education cannot be deprived of developing the non-cognitive abilities of children and pupils.

### **The Emotional and Social Aspects in Developing a Child's Personality**

Emotion (feeling) is according to Košč (1994, p. 45) a conscious experience of man's relationship to things, to himself, to his own conduct and to other people. The author states that there is either a positive or negative interaction between emotions and cognitive processes. Interest in the subject may invoke feelings like excitement, surprise and disappointment, or conversely, feelings may trigger a loss of interest in logical connections, reasoning and argumentations. Emotions play an important role in human life, since they are a part of its motivation structure. The education of humans is associated with cultivating their emotional area which includes also fostering intellectual emotions that are part of learning, studying the unknown and discovering. The concept of emotional intelligence is gradually coming to the attention of psychologists. Goleman (1997) argues that emotional intelligence is the ability to:

- motivate oneself, not to give up in front of obstacles,
- control oneself - motivations, moods,

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- influence the quality of thinking,
  - empathize with the situation of others.

Goleman also points out that the development of emotional education improves learning and school performance of children.

According to Shapiro (2004), emotional intelligence is a part of social intelligence. It is the ability to monitor our own feelings and emotions as well as those of the others and use them in one's own thinking and behaviour. Emotional and intellectual skills are complementary in the real world. Developing problem-solving skills is an example of such interrelatedness. Even a pupil in the first year of primary school solves a simple maths task to add ( $4 + 3$ ) in several ways - the sum can be determined by counting one by one, by adding the smaller number to that of the larger, or by drawing. The pupil him/herself decides on the process of finding solutions in the context of the given task.

In interpersonal relationships, however, a short-circuit between logical and emotional judgment can occur. Emotional logic (which underlies intuition) helps to solve the problem. But, when emotions are too strong, the solution to the problem requires the application solely of logical procedure. Children of all ages learn how to solve problems, which in effect leads to developing the ability to overcome obstacles. The concept of social education in our view means specifically and systematically targeted development of a child's personality within the social environment of both classroom and school (Šikulová, 2003). It usually concerns creating such conditions, in the process of teaching and school life, which stimulate developing in children the ability to integrate into the group, work in groups to solve real-life problems, and interact with other members of the group. The situations in the school environment serve as a model, but the issues being addressed are related to real life. Komárková et al. (2001) consider social interaction as the basis for the socialization of humans. It is crucial for self-awareness, self-esteem, thinking and language, social sensitivity, transmitting communication signals, conflict resolution and the like. The social skills of children also include asking questions, information sharing, expressing interest in and acceptance of the others.

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The child's ability to get on with others and communicate with them contributes significantly to their feeling of success and gratification in life. A child needs to distinguish between different social situations, respond appropriately to them and harmonise their own expectations with the needs of the others.

Social learning ensures socialisation of the child. Forms of social learning include: learning under guidance (a child is being taught – direct guidance is provided, for example how to buy a bus ticket), learning by imitation (a child imitates a teacher in the process of work, but also in relations with others), learning by identification (a child behaves identically in certain situations as another person before), learning by being instructed (we provide reasoning to a child why s/he should do something the given way).

Baduríková (1999/2000) uses the term emotional literacy, by which she means:

- emotional self-awareness – the ability to recognize and name the emotions
- control of emotions
- communication (about emotions and feelings)
- personal decision making
- empathy
- managing the relationships.

One of the main goals of early childhood education should be a contribution to the emotional and social development and adjustment of the child – a positive self-concept, self-reliance, self-expression, ability to address common social situations and the development of interpersonal relationships. The child's entry into school represents a significant milestone in his emotional and social development. It is necessary that the child has reached the desired level of socialization in order to take up his new role – to be a schoolchild. Adequate social maturity means that a child is able to communicate with teachers and classmates adequately; s/he is able to differentiate between the position and authority of a teacher and that of

his or her classmates. If a child is socially immature, it may happen that s/he behaves impulsively and egocentrically. The emotional symptoms of a schoolchild differ from those at the pre-school age. Emotional lability, impulsivity and childhood egocentrism disappear. Gradually, the child will acquire the ability to control his behaviour in accordance with the norms; s/he wants to conform to teachers's and parents' expectations. The school is one of the determining factors of the socialization of the child. It is the environment which affects the development of social self-perception and the reflection of behaviour (Kolláriková - Pupala, 2001).

### **Social and Emotional Competencies in the Pre-primary and Primary Curriculum within the Context of Mathematical Education in Slovakia**

*SVP-ISCEDO* (2008) defines the educational aims for preschool age. They include striving to achieve the optimum level of emotional and social operation of the child as the basis for his/her future life in society. The aims related to our pursuit can be identified among the partial aims of the programme:

- to meet the child's need for social contact with peers,
- to develop the social, emotional and moral aspects of the child's personality through purposeful and systematic work in creative atmosphere.

In addition, the authors of *SVP-ISCEDO* (2008) highlighted the need to carry out educational processes in kindergarten through play and the child's positive emotional experience. In order to ensure that the national curriculum aims are adequately met, the pre-primary graduate profile was drafted in the form of a set of competencies and both content and performance standards. For the areas of social and emotional development of the child's personality the program contains the formulations of *personal, social and communicative competences* in the *socio-emotional*

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thematic area. *SVP-ISCED0* (2008, p. 8–9) identifies the following specific competences:

1. *Personal Competences – essentials of self-awareness:*

- is aware of his/her own identity
- manifests a relationship to self and to others in behaviour
- expresses his/her own feelings and assesses current emotional state
- estimates own capabilities and competences
- behaves with confidence in various situations
- is aware of the consequences of his/her own behaviour with respect to other people.

2. *Personal Competences – essentials of commitment:*

- asserts oneself respecting him/herself and others
- defends him/herself and others
- is interested in what is happening in the family, kindergarten and the immediate surroundings.

3. *Social Competences:*

- behaves emphatically to his/her surroundings
- behaves in accordance with the social rules and norms when in a group
- plays and works in pairs, in a group and in a team
- plans, organizes and assesses the activities
- continues playing and other activities, and completes the activity
- takes joint responsibility for his/her activities and for the activity of the group
- resolves conflicts with the assistance of adults or independently
- helps others with the assistance of an adult or alone
- accepts and respects multicultural diversities of people.

4. *Communicative Competences:*

- leads a monologue and begins dialogue

- listens actively and comprehends ideas and information from the media
- expresses and communicates his/her own ideas and opinions
- reproduces texts and announcements
- communicates acquired knowledge
- manifests pre-reader's literacy.

Pre-school education is predominantly focused on attaining basic competences. The role of a teacher is to manage education in accordance with the development of preferred competences by appropriate activities, keeping them interactive and experiential for a child.

The content of *SVP-ISCEDO (2008)* is divided into four thematic areas, each subdivided into three learning areas. The abovementioned *socio-emotional area* is one of them. By analysis of content and performance standards we have identified the themes and specific aims which, in our view, can be listed in the area of social and emotional development of the child's personality, but at the same time have an intrinsic link with mathematical and logical sub-areas.

**Table 1.** Thematic Area **I am**, *socio-emotional area*:

Content Standard	Performance Standard / <i>mathematical context</i>
Defending Own Position in the Conflict	Peacefully defends own opinion. / <i>Defends the proposal of own algorithm in solving mathematical problem.</i>
Self-regulation	Demonstrates self-regulation in games and other activities. / <i>Controls own behaviour in a mathematical game and when learning.</i>
Decision Making	Decision-making during an activity. / <i>Taking the correct decision on procedure for solving mathematical tasks, choosing the activity corresponding to the instruction.</i>
Self-assessment	Assesses his/her own skills in various activities. / <i>Selects mathematical tasks and activities following assessment of own abilities.</i>
Basic Rules of Cultural Behaviour	Applies and respects the habits of cultural behaviour. / <i>Follows the rules of conduct in a mathematical game and educational activity.</i>

**Table 2.** Thematic Area **People**, socio-emotional area:

Content Standard	Performance Standard / <i>mathematical context</i>
Sharing, Support, Gifting	Shares, gives a present to someone, helps someone. / <i>Divides a whole into halves, quarters.</i>
Acceptance of Different Opinions	Accepts difference of opinion in discussion. / <i>Accepts other views on solving the mathematical task or problem.</i>

**Table 3.** Thematic Area **Nature**, socio-emotional area:

Content Standard	Performance Standard / <i>mathematical context</i>
Evaluation of Natural Environment	Evaluates the natural environment. / <i>Creates tasks and mathematical situations in the context of the evaluation of natural phenomena.</i>
Conservationist Attitudes to Nature	Shows a positive attitude to nature and its conservation. / <i>Creates tasks and mathematical situations in the context of nature conservation.</i> Discusses feelings, experiences and impressions resulting from nature conservation and displays them. / <i>Suggests games, solves tasks in worksheets, describes and solves mathematical problems drawn from children's experiences.</i>

**Table 4.** Thematic Area **Culture**, socio-emotional area:

Content Standard	Performance Standard / <i>mathematical context</i>
Emotionality in Play	Expresses the joy of playing. / <i>Experiences mathematical game joyfully.</i>
Sociability in Play	Is engaged in group play and co-operates. / <i>Co-operates in mathematical group game.</i>
Planning, Implementation and Evaluation of Play	Initiates, develops and completes game. / <i>Plans mathematical game, completes the game.</i> Plans, implements and evaluates game. / <i>Evaluates the course of mathematical game or activity.</i>
Drawing, Painting, Modelling	Draws, paints and models from imagination and ideas on given a subject or theme. / <i>Draws and models geometric figures or groups of elements.</i> Modelling by different techniques. / <i>Builds models from construction kits and other materials, creates images from cut-out pieces and jigsaws.</i>
Books, Letters, Numbers	Shows an interest in books, letters and numbers necessary to navigate the books. / <i>Distinguishes numbers and uses them in mathematical situations, when browsing through children's books.</i>



Among the aims for the Slovak school, the document *SVP-ISCED 1* (2011) includes the following (p. 7):

- to develop a balanced pupils' capacity to communicate and understand each other, to evaluate (choose and decide) and to act proactively on the basis of self-conduct and self-reflection,
- to support the development of intrapersonal and interpersonal skills, in particular the ability to openly enter into social relationships, to collaborate effectively, to develop a social responsiveness and sensitivity to classmates, teachers, parents and other people of the community in his/her wider cultural and natural surroundings,
- to lead pupils to tolerance and to accept other people and their spiritual and cultural values,
- to teach students to exercise their rights and also to fulfil their duties, to take responsibility for their own health and to protect and strengthen it actively.

The pupil after completing the primary stage of education should have acquired *inter alia* the following core competencies (p. 8–9):

**competence to apply basic mathematical thinking and possession of basic exploratory skills in science and technology**

- to apply basic mathematical thinking to solve practical problems in everyday situations and to be able to (at different levels) use mathematical models of logical and spatial thinking and presentation (formulas, models),
- to be prepared to continue to develop the ability to explore, ask questions and find answers, which leads to the systematic storing of knowledge;

**personal, social and civic competences**

- to possess the basis that will allow for the development of a positive self-image and self-confidence,
- to be aware of his/her own needs and creatively exploit his/her own abilities,

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- to be able to assess his/her own strengths and weaknesses as well as his/her own opportunities for development,
  - to recognize the importance of protecting his/her own health and to be aware of its relatedness to appropriate, active leisure time activities,
  - to be able to demonstrate age-appropriate estimation of the consequences of his/her own decisions and actions,
  - to be aware of his/her own rights and duties,
  - to have acquired the basis for effective cooperation in group,
  - to be able to accept new ideas or come up with new ideas and procedures when working in a group,
  - to be aware of the socio-emotional climate in the classroom and by his/her own actions contribute to good interpersonal relations.

Finding intersections between competence to apply basic mathematical thinking on the one hand, and social and emotional competencies on the other, is one of the fundamental objectives of mathematical education.

The *State Programme of Education Mathematics (Educational Area: Mathematics and Working with Information) Annex ISCED 1, 2009 (hereinafter SVP-ISCED 1-Mathematics)* states the further aims and general requirements for the development of pupils' personality (p. 4):

- to promote and strengthen positive moral and volitional qualities of students, for example autonomy, determination, endurance, tenacity, self-criticism, criticality, purposeful self-education, confidence in their own abilities and capacity, systematic addressing of problems in private and public contexts;
  - to create and develop a positive attitude of pupils towards common European values,
  - towards permanent learning of cultural values created by European countries and Slovakia;
  - to develop within mathematical education pupils' key competences in social and communication areas, in ICT, in personal and civic areas, in science, and to develop a competence of learning to learn.

The content of the mathematical curriculum at the primary stage is divided into five thematic areas:

**Numbers, Variables and Calculations with Numbers**  
**Sequences, Relations, Functions, Tables, Diagrams**  
**Geometry and Measurement**  
**Combinatorics, Probability, Statistics**  
**Logic, Reasoning, Proofs**

At each stage of education, not all of the above thematic areas may necessarily be explicitly listed in the curriculum. The mathematical education at the primary level should provide the pupil with certain competences relevant to mathematical content (cognitive competences), but at the same time s/he should achieve certain attitudes (non-cognitive competences) in terms of the following (p. 33–34):

**Numbers, Variables and Calculations with Numbers:**

S/he ceases to be “afraid” of numbers, quantifies the reality around him with more confidence, confidently makes comparisons of people, things and events by means of numbers, is satisfied with the numerical representation of the solution and, if necessary, can perform a check on the correctness of a calculation.

**Sequences, Relations, Functions, Tables, Diagrams:**

Observes, undertakes searches and discovers relationships between numbers and quantities, perceives the need for autonomy while exploring and verbally presenting a solution, perceives the need for the gradual establishment of reasonable views on the relationship between mathematics and real life, is interested in improving his/her own logical thinking and its constant expansion and deepening (classification, using elementary algorithms, etc.) through the elements of critical thinking, is positively motivated to build the foundations of his/her own personal development.

**Geometry and Measurement:**

Is not indifferent to his/her surroundings, is able to focus on exploring geometric shapes in the surroundings, tries to apply geometry in

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practical problems when appropriate, is ready to use measurement and calculation coherently, strives for accuracy in measurements and calculations, makes efforts to develop his/her own spatial imagination.

**Solving Application Tasks and Tasks Developing Specific Mathematical Thinking:**

Distinguishes and classifies the world around him/her according to the truth and falsity of phenomena, feels the need for quantification of phenomena in his/her surroundings, is aware of the importance of sorting the events and things, acquires a need to give reasoning to truth or falsity of statements and situations (pictorial or situational).

**Educational Methods in Mathematical Education and the Possibilities of Developing Social and Emotional Competencies of the Child/Pupil**

In order to effectively develop the competence of preschool and junior school age children it is necessary to approach to the choice of suitable **educational methods**. Podhájecká (2008) states that play is the primary means of personal development of preschool age child; however, play is also a major educational method in kindergarten. A similar view is shared by other experts in primary education. Skalková (1999) argues that in didactic games and games with rules, the pupil learns to comply with established rules, which leads to his socialization and self-control. The child learns to interact with others, learns the rules of conduct and practices self-control. Play or a didactic game may have a mathematical context. Nowadays, however, more attention is paid to the methods that motivate and activate pupils in the acquisition of knowledge and also develop their personalities in the social and emotional spheres. Pash et al. (1998) outline the *social forms* of learning in which students learn from each other. In this instance the teacher acts more as a mediator or facilitator, instead of providing information to pupils directly. The advantage of social forms of learning is in that we all live in a social world and children's play as well as their work take place

in a social environment too. Teaching in school often provides little room for such processes. The teaching methods which promote social learning include *simulation, staging and dramatization*. The *simulation method*, according to Skalkova (1999), introduces pupils to simulating a fragment of real life and offers them space to solve and analyse problems that may exist there (there is an overlapping of the issues pertaining to the cognitive and affective levels of education). Simulation games, used in the education of pupils, open possibilities for pupils to try out something which could provide them with new experience or something that they have not yet encountered in life. It usually takes the whole class to be involved in simulation and the space is created here for students with different abilities to participate. The difficulty level of the simulated situation depends on the age and experience of pupils; for example, at the first stage of primary school pupils can create a system of *postal service in our life* (the mathematical context being the road to the post office, i.e. orientation in space, finding the shortest path to the post office; numbers and calculations – payment at the post office...). The *staging method* consists of playing the roles of people involved in any situation that is to be demonstrated. In this case there is also a problem to be solved and the pupils enter into the role of someone else. For example, at *the municipal office*, the pupil plays the role of a citizen who wants to solve his/her problem (the mathematical context being numbers and calculations – to calculate and pay the fee for garbage collection depending on the number of persons in the household, to calculate and pay the fee for a pet...). S/he thus gains the new emotional experience and develops communication skills. (The staging of the phases of the teaching process – microteaching is also used in the training of future teachers). *Dramatization* is one of the methods of drama in education. Dramatization allows for specification of the curriculum, deeper understanding and experiencing the content, and develops pupil's personality – his creativity, organizational and communication skills (the mathematical context being numbers and calculations – shopping in the store...).

The following is an example of one of the methods of drama education – pantomime: Pupils draw one of the two-digit numbers (for example,

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11, 15, 24, 27, 30, 41, 48, 56, 59, 63, 74, 79, 85, 92, 97) from a hat. Everyone should think about how the number of tenths in his/her number could be represented by postures of body while standing or lying down. One by one, each pupil presents the ideas saying in advance what number is going to be shown. Other students may assess, introduce new ideas, or otherwise suggest how the number could be rendered. Everyone should defend his/her presentation. Given the complexity of some representations of numbers, it is possible to work in pairs. The pair initially agrees on the method of representing a number. After presenting all the numbers, pupils are ordered in line according to the drawn two-digit numbers and thus create structured numerical series. The teacher then nominates different intervals of numbers so as to produce three five-member groups of students (group 1 – numbers less than 41, group 2 – numbers greater than 45 and less than 70, group 3 – numbers greater than 72). The pupils are placed in the groups on a random basis. Each group finds its place in the classroom where they collaboratively invent the task of addition and subtraction of the two two-digit numbers in the range less than 100 (for example, 20-11, 11-10 and others). When presenting their tasks the numbers are shown by their own body and the mathematical operation is indicated by a body movement based on previous activities. Each member of the group must have its role in the presentation of a task and must coordinate his/her concepts of number representation or mathematical operation with the other members of the group. Others have to guess what formula was invented by their classmates and determine its solution.

The method of *discovering* new knowledge provides motivation for pupils. They perceive it as an activity carried out by them without external pressure. It thus allows them to get involved emotionally and enjoy success (the mathematical context being an inductive procedure in “discovering” the triangle inequality through manipulation with sticks of different length...).

From the aspect of educational forms, it is *co-operative learning* which we consider appropriate and effective for the social and emotional development of pupils. The pupils are in mixed groups and work on a common task. For example, a team of pupils solve the problem specified by

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a teacher, or they learn together, or they form a teaching team in which each team member is given instructions from the teacher on what to teach the rest of their group. Everyone is responsible for the performance of the group, but, at the same time, everyone is responsible for his/her own teaching. In cooperative learning, pupils learn to receive help and to provide assistance. It is a skill that will be needed later in their careers.

### **Undergraduate Teacher Training for Mathematical Education**

The undergraduate training of teachers for pre-primary and primary education has recently been determined by some new factors. In the past, the prospective applicants for this type of study had been recruited mainly from grammar schools or pedagogical and social academies. Most of them had strong motivation for being trained as teachers. Currently, the prospective applicants come from different types of secondary schools. Their level of mathematical abilities as well as the level of mathematical literacy varies significantly. Moreover, many of them have developed a negative attitude towards mathematics and mathematical education. The undergraduate training of students – that is, future teachers – has therefore three main objectives:

1. raise the standard of subject specific mathematical education,
2. shape the positive attitudes towards mathematical education,
3. develop the ability of didactic interpretation of mathematical content at the pre-primary and primary stages of education.

The second objective is especially important insofar as the non-cognitive dimension of mathematical education is concerned. In our opinion, only a teacher who is convinced of the meaningfulness of mathematical education can positively influence the minds of his/her students. In such case, teaching mathematics will not be carried out only to provide pupils with the maximum knowledge but the learning process will also contribute to the development of pupils' emotional and social competences.

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### Conclusion

Education and teaching are always interconnected. It has been argued that education is more important than mere teaching (Zelina, 2004). The cognitive field concerns learning and thinking, while in the non-cognitive field it is the manifestation of emotions, motivation, socialization and creativity that matters. The activities of non-cognitive areas are manifested in play, learning and interaction between people. Mathematical education in kindergarten and primary school cannot be based solely on the activities in the cognitive domain. A child needs to view mathematics as a school subject that is necessary for his life since it can be experienced in various forms almost every day. Mathematical knowledge in conjunction with emotional and social competencies acquired through education can help children to solve problems. Mutual interaction works both ways, since fully developed social and emotional intelligence supports changes of attitudes towards mathematics in a positive way.

All those who have ever worked in the field of mathematical training of educators would probably agree that the study of mathematics creates, develops and strengthens positive character and volitional and moral qualities such as: diligence, accuracy, fairness, thoroughness, critical self-awareness, responsibility, initiative, persistence and tenacity. Mathematics does not tolerate shallowness and a lack of systematic behaviour. The above qualities (among others) should also be fostered by pre-primary and primary education.

To conclude, we can only agree with the idea of H. Freudenthal: *"Never ask how much of mathematics a child can learn. Ask rather to what extent mathematical education can contribute to the human dignity of a child."*



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### Abstract

Mathematical education at the pre-primary stage sets out its aims which are predominantly focussed on the area of developing the cognitive side of the child's personality. This area becomes the focus of relevant curricular documents for mathematical education, on the one hand, and influences the actual teaching

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of mathematics in practice, on the other. Meaningful and effective cross-curricular mathematical education opens a new space for developing the emotional and social skills of the child. The above aspect of mathematical education has the potential to become a determining factor in creating a positive attitude towards mathematics.

**Keywords:** pre-primary and primary education, mathematical education, emotional and social competencies

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in the 1st stage of primary schools, monitoring of the needs of a newly inducted teacher as a determinant of undergraduate mathematical training of elementary teachers, cognitive aspects of mathematical education, comparison of primary mathematics in Slovakia and abroad.

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