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STUDENTS' MOTIVATION IN THE METHODOLOGY OF TEACHING MATHEMATICS COURSE

Abstract: People's behaviour is targeted to gain and satisfy certain needs, with a driving motivation behind them. The same stands for mathematics, which people encounter in many activities in daily life. The learning of mathematics is the result of human curiosity although it is becoming a less interesting and attractive activity as people age. And the introductory motivation is the key in all of this. The introductory motivation is mostly found only at the elementary school level, where the pupils are still playful, not knowing that introductory motivation is also an important incentive for curiosity for the students who will teach mathematics. Krajnc (1982) defines motivation as a process that triggers an individual's activity, directs it to certain objects, regulates behaviour, unifies it and connects it into the whole in an effort to achieve the objectives that the individual has set for themselves. One can claim that the state of cognitive and emotional arousal leads to a conscious decision for a particular behaviour and consequently persistence in this behaviour (Marentič Požarnik, 2003). The introductory motivation in didactics of mathematics must be directed by the professor into study tasks that are interesting, fun, logical and complex for students. This way, the students approach studying with the goal of acquiring knowledge and increasing learning competence. Learning and knowledge become a value for these students who will transfer it to future students.

Keywords: introductory motivation, motivational activities, mathematics, didactics of mathematics, teaching, game.

INTRODUCTION

A student as a future class teacher should first have the opportunity to understand and love the study of mathematics, and only then focus on the didactics of mathematics. Affect is symbiotically related to learning in mathematics education – students' beliefs, attitudes and emotions influence the learning process, and conversely, students develop mathematical beliefs, attitudes and emotions as they are engaging in the activities of the mathematics classroom (Grootenboer & Marshman, 2016). Many students have rooted beliefs about mathematics and learning that make it difficult for them to successfully teach mathematics (Beswick, 2005).

Concerns about the negative mathematical beliefs of prospective primary teachers have arisen from evidence that such beliefs detrimentally impact future teaching practices (Maasepp & Bobis, 2014). A rapidly evolving and changing society requires ongoing updating of study programmes that educate class teachers. Initial teacher education is concerned with developing proficiency with a number of different dimensions of teacher knowledge, from teachers' knowledge of mathematical content to teachers' knowledge of pedagogy and didactics (Liljedahl et al., 2009). It is important that future teachers are also aware of the importance of continuous professional development in order to constantly adapt to new knowledge and societal demands. This way, teachers will be able to direct pupils at the beginning of schooling into effectively building mathematical competence, one of the key competences needed for the full development of each child. With the right motivation and approaches, the teachers will be able to connect mathematics directly to real-life circumstances, and contribute to the constant increase in the level of mathematical literacy of children thanks to such well-designed lessons in mathematics. This raises the question of whether teachers of didactics of mathematics in the study programme of Class Teaching, also teach on the basis of theory or content they are passing on to students, and whether they motivate pre-service teachers for their own future teaching of mathematics. Most people know that motivation is the key to any learning or acting. Apart from knowledge, skills and habits, mainly motivation is needed for successful education (Bizjak, 2009).

MOTIVATION AND INTRODUCTORY MOTIVATION

In pedagogical practice, incentives, the primary purpose of which is to attract students' attention to their studies, are called introductory motivation, i. e. the key part of the didactic structure of the lesson. These incentives from the pedagogical-psychological side are understood in terms of promoting the situational interest: what students are attracted to now, at this moment. The introductory motivation ultimately leads to the development of individual interests and, consequently, to a longer duration of motivation for studying (Silvia, 2006).

Konečnik Kotnik (2003) found in research that the introductory motivation should contain the elements of surprise, mystery, excitement, that is everything that enthuses and gains their attention. Of course, the key is the professor's own motivation, focus and willingness to use it.

Introductory motivation is therefore a tendency to find academic activities that are sensible and worthwhile (Woolfolk, 2002). The professor will use it to enthuse the students and attract them to the study content, which is not always interesting in itself. The introductory motivation helps the students to discover

the new and the unknown, remember it faster and more permanently, have fun and achieve better results. Introductory motivation is, last but not least, the state of cognitive and emotional arousal leading to a conscious decision for a certain behaviour and, consequently, persistence in this behaviour (Marentič Požarnik, 2003). However, every student is motivated differently. It all depends on his past experience. Therefore, the professor should not expect to equally motivate all the students, but must realise that the students will enjoy attending lectures on the didactics of mathematics and they will enjoy learning if, thanks to introductory motivations, they see that mathematics is an important tool in the life of every human being. The need to learn mathematics in order to pass the exam must be overcome, and students must understand the importance of building up their mathematical competence so that they are able to gradually transfer it to their pupils. Learning and teaching in order to raise the level of mathematical literacy should be the learning and teaching of empirical mathematics based on the inductive method of acquiring knowledge. The pupils would first learn about the power of mathematics in certain cases from everyday life, in order to be able to understand the generalisation and abstraction procedures later (Packer, 2003). It is probably necessary to modernise the mathematics learning and teaching system to be effective enough and to cover the most important needs of a person in a modern society.

Elementary school teachers ask themselves every day how to motivate pupils to develop the joy of learning. However, the question arises how universities cover this matter, especially in didactic study subjects, where the importance of introductory motivation is emphasised for the teachers to direct pupils to the learning material and influences how much interest the students will devote to acquiring new knowledge. Some professors are not aware of the importance of motivation for success in learning. Ultimately, who finds themselves in a learning position has a learning motivation, that is students, too. And Pečjak (1986) says that there is no learning without motivating activities. Professors often stress that attendance at lectures is obligatory, but they do not think that they must do anything to secure the attendance of the students. The motivation for studying is truly primarily dependent on one's own interests, personal goals, curiosity, independence, but it also depends on the method of teaching, introducing and presenting the study material. When talking about the lack of motivation when students are forced to attend lectures, they do not participate in the lectures and avoid any duties. Student interest and initial curiosity are disappearing from one lecture to another, and their studies become an end in themselves. Students become demotivated to study, since the professor gives the same lectures every time, with no challenges with too demanding or insufficiently challenging goals. Marentič Požarnik (2000) says that the goal of learning in demotivated students is not knowledge and its practical application, but only a dull achievement of positive and avoiding

negative consequences. The attendance of lectures and, consequently, the study process becomes more difficult as students are uninterested and begin to avoid lectures. In such circumstances, teachers generally do not use introductory motivational activities to encourage the desire for new knowledge, but often by punishing and rewarding they achieve that at least a small part of the group attends lectures. Therefore, it is necessary that university professors also start using the introduction of motivation in lectures.

Introductory motivation, which is a psychological process (Weiner, 1992), in the form of various motivational activities energises the study process by activating it first, and then directing it until the completion of the study task. In doing so, the professor must understand that motivation is happening within the students, and that the students are the main source of motivational activities. A professor cannot give students motivation, as this is actually intrinsic. However, he or she can support it with various introductory motivational situations (Juriševič, 2006). Motivational activities cannot be carried out if the students do not have properly motivated behaviour that stimulates, directs and maintains behaviour (Woolfolk, 2002).

Psychologists believe that introductory motivation is an essential ingredient for studying (Biehler & Snowman, 2006). Fontana (1995) considers it unlikely that a study process would be conducted in the absence of sufficient introductory motivation. The influence of introductory motivation is very extensive. It can help a professor in guiding students' behaviour, which includes the level of the initiative to study, because it guides and determines intensity, perseverance, duration and quality. The introductory motivation also affects emotions and self-image of students, and as a process, the introductory motivation directs and regulates student activities to the goal, the latter is the source of motivation (Marentič Požarnik, 1988). Mayrhofer (in Brajša, 1995) states that the goal of introductory motivation is to manage and strengthen existing behaviour or to direct it towards a new, better-quality form. Meanwhile, Okoye (1985) states that introductory motivation is a manipulative activity used by the professor to attract the interest of students to the study situation, because the motivation is created while the person performs something with pleasure and satisfaction.

Introductory motivation is a significant strategy regarding students that the professors use in order to stimulate the interest of students or future teachers to study and, consequently, to maintain a positive interest in learning, which they are supposed to transfer into their classes. Introductorily motivated students are better able to understand and follow the study situation, they are more successful and achieve higher achievements than demotivated students. The good relationship and motivated students' interest in studying is even an incentive for the professor to change the way of teaching in a more attractive and interesting way, to use introductory stimuli. (Tella, 2007).

INTRODUCTORY MOTIVATION IN THE STUDY PROCESS

Students evaluate the study course according to the professor's ability to obtain and maintain the attention. Stipek (2002) thinks that it would be unreasonable to expect a professor to equally motivate all the students, but it is crucial to proactively try to stimulate as many students as possible to study.

Juriševič (2012) states that the importance of the pedagogical mission, both of professors at the university and future teachers, is understood in the sense of ancient Chinese wisdom, which states that people should be thrilled about the sea if they are to build boats, cross the ocean and discover new horizons. In a study process that can metaphorically be understood as an ocean of wisdom, the introductory motivation of students is a right and a duty of every professor.

Paterson (2000) lists the three main motivational activities that the professor uses in the study process to initially motivate students for further cooperation and studies, and which are continually intertwined throughout the entire study process:

1. Teaching – introducing learning material in terms of providing advice and guidance;
2. Playing – replaying and achieving effect with a role before the audience;
3. Fun – achieving relaxation and good mood.

Einstein said: "I am neither especially clever nor especially gifted. I am only very, very curious" (Juriševič, 2012). Introductory motivation is a key factor in the dynamics of the study process, as only motivated students continue their studies and persist until they achieve set goals, regardless of whether this is a successfully passed exam, the actual grade or a professor's praise. A unique type of learning takes place within the learning process, which is separated from the spontaneous daily learning by the intensity and content of the introductory motivation. In the study process, a student does not choose the course and study content, but nevertheless is required to have quality knowledge that can only be achieved if one is appropriately motivated for this learning, so that this motive attracts further learning (Marentič Požarnik, 2003). As people age, they find learning less and less appealing as an interesting and attractive activity. In doing so, progress in the study process increases the complexity of knowledge and study tasks, which are becoming more and more demanding and difficult (Hidi, 2000).

The introductory motivation must be directed by the professor into the studies or study tasks that are interesting, fun, logical and complex for students. This way, the students approach studying with the goal of acquiring knowledge and increasing learning competence. It is important how the students are motivated, and whether they are motivated.

As mentioned above, motivated students consequently achieve better results. This is of course true, but a lot of research (Pintrich & Schunk, 2002) shows that the introductory motivation is not as closely related to academic performance as the studying itself, but is mostly related to the storage of new information in the long-term memory. Therefore, the remembering of new information depends on whether the professor uses good introductory motivation to enable students to have better knowledge.

The influence of introductory motivation is reflected in the study at three levels (Rheinberg, Vollmeyer & Rollett, 2000):

1. At the level of time the student dedicates to studying;
2. At the level of the nature of the learning activity, which includes regulating the effort invested by the student in the studying;
3. At the level of student's functional mood, which refers to the optimal psychological state of a student during his studies (for example, commitment, positive emotions, concentration).

Using introductory motivation, the students will be satisfied, studying will be easier and more interesting, and the lectures will be more productive. In all of this, the professor will achieve the goal of making studying, or more precisely, learning and knowledge a value for students.

TYPES OF INTRODUCTORY MOTIVATION

There are four types of introductory motivation:

1. The primary motivation derives from already adopted study material. The professor uses the already acquired knowledge of the students for comparing new knowledge. Within the students, all of this raises the sense of importance of their knowledge, as certain knowledge has already been gained. Here, the professor can use the method of analysis, research, generalisation and logical deduction (Konečnik Kotnik, 2000).
2. Secondary motivation usually coincides with certain personal interests of the students in connection with their everyday life. It didactically, therefore, does not originate directly in the subject matter lectured by the professor. The use of this kind of motivation means greater introductory motivational power for the students, since it is linked to personal desires, needs and interests. It comes to the forefront when the students express a certain initiative, for example, ask a question about something (Zgonik, 1995).
3. Emotional spontaneous motivation is associated with emotional engagement of students (Zgonik, 1995).

4. Mental or cognitive motivation is linked to rational situations that enable the development of thinking by exercising observation, comparing, logical deduction, and generalisation. The best mental motivational situations are problematic, since they are the lever of the deepest thought mechanisms (Konečnik Kotnik, 2000).

In all types of introductory motivation, the professor can use a variety of motivational activities that direct the students' attention to the matter that needs to be studied. Introductory motivation activity should therefore be interesting, short and essential, in the form of surprise, productive repetition and problem-orientation, involving different types of perceptions, contributing to a better study experience, changing the known into the unknown and vice versa, etc.

INTRODUCTORY MOTIVATION IN THE DIDACTICS OF MATHEMATICS

In accordance with the latest scientific results in the field of didactics of mathematics and the expectations of modern society, it is necessary to upgrade the curriculum of courses in the Class Teaching study programme for the students to become familiar with the content of mathematics and didactics of mathematics. Future class teachers need to become acquainted with active learning approaches in order to be able to encourage pupils to engage in critical dialogue, research, and higher mental processes. They will lead their pupils through creative research and solving realistic problems, whereby students will develop mental skills and logical deduction. Here, however, the introductory motivation in the didactics of mathematics has an important place.

Using the introductory motivation, the professor achieves that students feel the curiosity and therefore incentive to gain new knowledge, whereby the learning and teaching of didactics of mathematics get the right meaning. With introductory motivation, the professor can once again present the didactics of mathematics to the students not only as concise and strict, but also as creative and playful.

Researchers have found that introductory motivation is of the utmost importance for the establishment of interest in the subject matter and interest in studying. Introductory motivational activities in the study subject of didactics of mathematics are now diverse. Their usual dry use is ineffective. The professor should always try to choose a new activity, which should contain elements of humour, surprise, secrets and exciting novelties, in order to stimulate the necessary attention for further studying.

In the introductory motivation of the university subject of didactics of mathematics, the professor can use various didactic tools, paintings, objects, photographs, sound recordings, videos, everyday life situations, logical problems, research work, authentic learning tasks, anecdotes from history, riddles, sayings, stories, social and didactic games, learning leaflets, role playing, etc. It is important to ensure students achieve self-confidence, which will enhance the desire for success and further work.

Introductory motivation examples in the didactics of mathematics

Every good start allows further progress; therefore, the professor should stimulate the mind of the students if they want the study to be successful (Poljak, 1974). The professor should always be guided by the question of how to increase the quality of the introductory interest of the students in a particular study subject.

The professor must arouse love for mathematics and teaching in students. For this purpose, he can use various motivational activities and tools for learning and teaching mathematics.

Introductory motivation with problem tasks

For the introductory motivation in didactics of mathematics, the most frequently mentioned activities involve motivational tasks with a mathematical-logical problem. These tasks are most often difficult to solve, because the professor uses them to raise the interest in solving them. The content of these tasks is related to everyday life issues, and the main objective of these tasks is to stimulate interest in dealing with new knowledge needed for solving the motivational task.

Students have to forget the need to learn mathematics in order to pass the exam, and feel the true meaning of building mathematical competence so they will be able to gradually transfer it to pupils on their professional path. Learning and teaching in order to raise the level of mathematical literacy should be the learning and teaching of empirical mathematics based on the inductive method of acquiring knowledge. The pupils would first learn about the power of mathematics in certain cases from everyday life, in order to be able to understand the generalisation and abstraction procedures later (Packer, 2003). The principle and central place in introductory motivation can be a mathematical problem and the realistic solving of it, and research related to it. The professor can offer his students a specific problem situation, which represents a wider context in which students must find, understand and form a problem in different ways, which, when solving, gets its meaning.

An example of the problem task:

Miha was baking baguettes in the Mišmaš bakery. He baked nine of them. All the baguettes seemed to be of the same shape and size. At a later weighing, he found one of the baguettes weighing 10 grams less than the others. How did Miha the baker find which baguette weighed less if it is known that weighed the baguettes only twice?

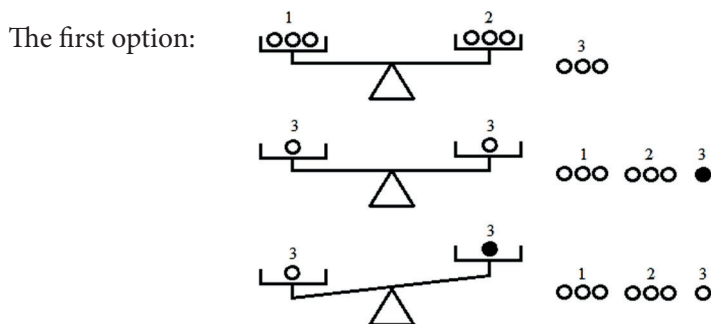


Figure 1. An example of a possible solution to a mathematical problem.

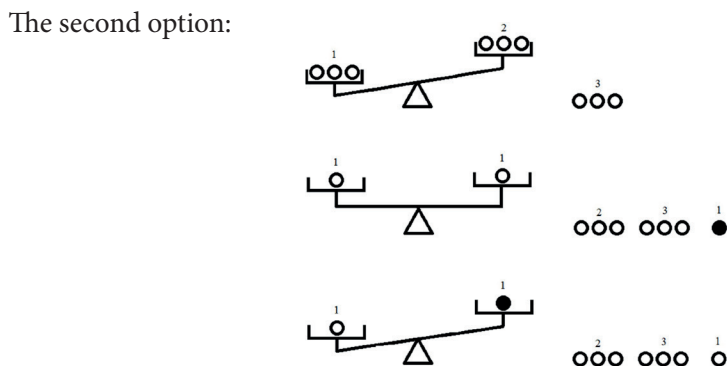


Figure 2. An example of a possible solution to a mathematical problem.

Teaching mathematics is a common experience for the professor and for the students, therefore the opportunities to increase joy and initiative in the lectures of the didactics of mathematics through a common dealing with mathematical problems.

Introductory motivation through the history of mathematics

Examples from the history of mathematics are also an interesting introductory motivation. In such cases, students deal with the origin of ancient discoveries

in mathematics, which were of key importance for the development of modern day mathematics, its teaching and learning, as well as the way of life in general.

An example from the history of mathematics

Historical development of numbers and counting are the predominant motivational mathematical activity. The future class teacher will teach the children about counting or numbers in the same way as man started to count in prehistoric times. So why should the professor not use the history of the development of the concept of numbers as an introductory motivation for students? In doing so, the professor can reach into history, which is definitely interesting for every student, as many do not know the historical development of numbers and counting.

The introductory motivation can begin with a simple explanation of the historical development of writing down numbers: “The word number means a group of characters used for writing down the number. A single character is called a digit. People have been writing down numbers since long before the invention of writing. The first level of writing were simple images that represented things or concepts. They were called hieroglyphs. Later on, the signs of syllables or signs for voices were developed from hieroglyphs; different alphabets were created, such as Phoenician, Jewish, Greek, Cyrillic, Roman, Arabic and so on. The numbers were initially also hieroglyphs. In ancient Egypt, hieroglyphs were also used to record numbers.” (Justinek & Domicelj, 2011).

The professor can then present to the students some of the ancient Egyptians' numbers (Justinek & Domicelj, 2011).

- | – A finger on a hand, which means 1:
- ∩ – There are several explanations, one of them is “both hands”, which means 10:
- ☉ – A measuring rope with a length of one hundred units, which means 100:
- ☼ – A lotus flower, which means 1000, as thousands of lotus flowers grew on the banks of the Nile river.

$$\begin{aligned}
 1 &= |, \quad 2 = ||, \quad 3 = |||, \quad \dots, \quad 8 = \begin{array}{c} |||| \\ |||| \end{array}, \quad 9 = \begin{array}{c} ||| \\ ||| \\ ||| \end{array}, \quad 10 = \cap, \\
 11 &= | \cap \text{ ali } \cap | \quad \dots \quad 20 = \cap \cap \quad \dots \quad 24 = \cap \cap |||| \text{ ali } \begin{array}{c} \cap \cap \\ ||| \end{array} \quad \dots \quad 30 = \cap \cap \cap, \\
 99 &= \begin{array}{c} \cap \cap \cap \\ \cap \cap \cap \\ \cap \cap \cap \end{array} |||, \quad 100 = \text{☉} \quad \text{itd.}
 \end{aligned}$$

Figure 3. An example of the Egyptian way of writing down numbers (Justinek & Domicelj, 2011, pp. 10).

In observing the way ancient Egyptians wrote down numbers, the professor can explain an interesting fact to the students that the places of individual digits are not important, only the number of individual digits is important, for example the number $|n||n|$ means 24. The professor encourages them to write down some more examples.

Introductory motivation through role playing

Introductory motivation in the form of role playing has an imaginary meaning. It takes a lot of engagement for the professor, and the use of imagination for the students. In this type of motivation, changing roles between the professor and the students often takes place. The professor exchanges roles with the students; therefore the students take the role of teacher and help acquire new knowledge or explain the study material. The students can be motivated to help the professor find the appropriate didactic-introductory motivation in introducing a new learning material.

The example of introductory motivation in the didactics of mathematics is when the professor introduces a teaching set of Geometry and Measurement – the mass:

The professor can initially motivate the students by entering the classroom and placing two equal bags and a clothes hanger on his desk. Then, invite them to share ideas, on which theme they would introduce using these three objects. After the final determination that these subjects would be used to introduce weighing under the curriculum of measuring for the 3rd grade of elementary school, the professor invites students to help him formulate an introductory motivation for introducing the concept of weighing, using only the objects brought into the classroom.

Role-playing example:

The teacher in the classroom puts two bags on his desk. One contains 1kg of sugar (numbered as 1), and in the other 500dag of pasta (numbered as 2). The pupils cannot see the contents of these two bags.

The teacher asks the pupils:

- “What do you think, which bag weighs more, which less?”
- “About how much does bag 1 weigh and how much does bag 2 weigh?”
- “What makes you think so?”

The teacher hangs the hanger on the blackboard and asks the students:

- “What will the hanger help us find out?”

The teacher places the bags on the hanger and then asks his pupils:

- “Do you still have the same opinion about how much each bag weighs?

Why?”

- “What makes you think the bags' weights are not the same?”
- “What would be the hanger's position if the bags' weights were the same?”
- “What do you think the bags contain?”

Teacher loosens the bags and shows the contents.

Using this kind of introductory motivation, the professor encourages intellectual efforts of the students in order to achieve the goal he set for the students.

CONCLUSION

Every professor wants their students to be motivated to study. Their role is to create study conditions in which the students will work in a high-quality manner and develop confidence in their own abilities. And the students will enjoy studying only when the professors raise their interest and curiosity for gaining new knowledge.

Mathematics is an important, useful, exciting and creative area of teaching. Most students believe that mathematics is a large collection of rules and formulas, and therefore form negative impressions when it comes to mathematics. However, one of the global goals of teaching mathematics is experiencing mathematics as a pleasant matter. Students should therefore form a positive attitude towards mathematics as a subject they will be teaching after completing their studies. A professor can contribute to formation of positive attitudes towards mathematics, and while teaching the subject of didactics of mathematics, can show that mathematics is something fun and interesting, something people come across every day, and not only when mathematics is on the study schedule. But the main condition for successful teaching of mathematics is the interest of students in this subject, which the professors acquire to a large extent through the introductory motivation.

Through introductory motivation, the professor can offer motivational activities for raising interest in students, thus giving them the opportunity to achieve a feeling of enthusiasm about themselves after their effort, work and mathematical-logical thinking, thereby creating a lasting joy towards mathematics.

Classroom developments and the effect of the teacher or teaching are crucial to improving learning results, where teaching is a key factor in raising the quality of learning (UNESCO, 2004). The teacher's mathematics-related beliefs, which pertain to their subjective knowledge, act in mathematics classroom as a

hidden factor regulating the quality of mathematics teaching and learning (Perkilä, 2003). Education and training of teachers should be a central theme of researchers in the field of education who would introduce the latest findings into school practice. Recently, the teacher was treated as a trained worker who did not make responsible decisions about work but followed the recipes, the precise scenarios and a rigorous teaching process. Professional development is built with special instructions from “experts” within the relevant workshops (Schon & McDonald, 1998). Such an approach is completely wrong, all the more so in modern times, when we give preference to the constructivist approach and the principles of active learning. The teacher must become a thinking practitioner who uses active learning approaches in the classroom and encourages students to engage in a critical dialogue, research, and higher thinking processes in problem lessons (Boyle, While, & Boyle, 2003; Leu, Hays, LeCzel & O’Grady, 2005). The teacher must be an expert who is capable of constant reflection on the school and class situation, and to quickly make appropriate sovereign decisions (Boyle et al., 2003). A class teacher must be trained to teach all curricular areas, and must be aware that the process of learning and teaching each area are interwoven and that teaching is not merely a “mechanical” transfer of knowledge to the learner. Lately, the field of mathematics teaching has received considerable attention; society does not expect the learner to get “armed” with a dry mathematical knowledge, but that the learner will be mathematically literate on all levels or mathematically competent at the end of schooling, therefore motivation in their education plays an important role. The study of mathematics is an exercise in reasoning. Beyond acquiring procedural mathematical skills with their clear methods and boundaries, students need to master the more subjective skills of reading, interpreting, representing and “mathematicizing” a problem (Stumbo & Follett Lusi, 2005). The European Commission (2007) defines competences as a combination of knowledge, skills and attitudes that correspond to the circumstances. The key competences, including the mathematical one, are those that all people need for personal fulfilment and development, for active citizenship, social inclusion and employment.

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