

# Diagnosis and assessment of the motivation and mathematical competence of students majoring in systems programming

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**Abstract.** The article discusses the problem of motivation in teaching mathematics to students majoring in systems programming. Based on research, conclusions are made about the reasons for reducing motivation and ideas are offered to improve it.

In modern day schools there are many factors that impact on the success rate of the students but motivation is one of the most important. That implies to cognitive, emotional and behavioral results for the effort being made by the students in the course of study.

The Bulgarian educational system is too conservative and clumsy regarding the process of implementing new technology. Besides the noncreative and inefficient reforms that are being made since 2016 in the educational system we are witnessing a lack of desire most of the teachers for changing the didactic process.

In school the students are facing the everyday the challenge of processing a huge amount of information. Meanwhile most teachers are using a morally old type of class based course of study in which all students are being treated the same instead of trying to treat the students as personalities with different ability and interests that are a subject of a different pedagogic interaction. The teacher is usually using the same approach for educating all students in class. That usually leads to less positive results and sometimes even student that are feeling underrated and neglected.

As L. Dobson says: Anyone who ever had a chance to research student behavior knows that not all of them are interested in the subject the same way and may be that is the reason for the crisis in the education systems [2].

There is a necessity to overthinking the idea that all students at the same age are having the same mind set and study in the same way. We also must point the fact that traditional classroom atmosphere most of the time do not respond to the specific needs and abilities of the student. A simple reordering of the seating order might be able to motivate a student to be more active in class.

The successful students should not be treated as bright intellects and genius but as unique personalities who can be characterized with a combination physical, intellectual and emotional abilities. And on top of that those qualities come at the right moment. They usually manage to assimilate the material being thought.

The non-successful students should not be treated as stupid and not capable but as unique and valuable personalities that can be described with their own specific combination of individual abilities whose manifestation can be restrained because of the inadequate environment or personal student physical and psychological status.

For the Bulgarian educational system, we can summarize that the teacher is lead in his professional activities by the requirement of the government educational standard to be covered by all students [6]. That defines

the specific didactic technology that is used in class. Most teachers share the idea that if they approach the students in a different manner by giving them more complex material the ones that study harder will not be able to catch up. On the other side if the material is too easy the better students are getting easily bored and indifferent to the school process. Those facts provoke the teachers to choose such materials that will guarantee a success for the best students but also for the ones having satisfactory qualities and achievements. This is how instead of stimulating the development of the student with high intellectual potential we witness a stimulation and upgrading mediocrity.

Mathematics is a science that helps development of high psychological processes that distinguish the man from the animal and are in the base of his whole evolution of man as a reasonable social being. Math competence suggests specific knowledge and abilities, mathematical thinking, argumentation and presentation with the use of symbols and signs, specific actions made with them as well as specific mathematical language. Forming and developing mathematical competence is most effective if started in preschool.

The arising social and educational expectations of the educational system bring the need of a different approach in the field of system programming. The competence approach is more and more dominating and responsive to the modern day requirements for preparing the programmers. Now days the competence is based in the design of every educational degree, defining its profile and responsibility of achieving the role of education in society. That is in fact creation of competitive and flexible models with a clear philosophy of education with clearly defined competences.

Common factors demotivating the students are organizing the education process, unprofessional teacher behavior, personal issues, lack of abilities to learn.

As specific factors demotivating the student we can mention unsure and boring lecturing of the material without showing its practical importance (Math is known as boring class) the students are being put into passive position, as the material presentation style does not comply with the level of knowledge and uniqueness of the students. The surrounding atmosphere can also be unsporting as the well learning students are being pointed out as nerds.

Demotivation factors directly depending on the teacher are too fast teaching as well as subjective behaviour to a specific student. Unconvincing teaching and poor discipline are also possibility.

Demotivation factors directly depending on the student are definite gaps in the material knowledge not filling up the missing materials in time. We can also point out lack of confidence and desire to learn, the feeling of being underrated and unnoticed by the teacher as well as a feeling of being rejected by his classmates; the inability to organise his study time; lack of a suitable family environment; presence of a bad atmosphere in the dormitory, etc.

Knowing those factors can help the teacher to create a motivation conditions and not demotivation for his students.

One of the actual tasks in the teaching process is creating a link between motivation and the achievements of the students.

After long years of confronting the problem with motivation in Math classes of the future programmers and investigating many different situations in the teaching course and mental evolution of the students we decided to start a research experiment and try to find a solution to at least a part of the problems.

The research has been made with 100 students from Vocational School of Computer Technology Pravez whom we divided in two groups of 50 students each. For better objectiveness of the research they have been divided in a way that their starting knowledge in Math to be approximately the same.

In the first group containing two classes we have implemented the standard teaching course and in the second little by little we started changing in methodology and keeping the material of teaching at the same time.

First we would like to discuss the different reasons for lack of motivation in students. Z. Kostova [1] is dividing them in 8 groups summarized in:

- social environment;
- school environment;
- school documentation;

- family environment;
- student qualities;
- relationships in school;
- financial abilities of the student's family;
- health issues.

We agree with the above described grouping but by methods like observation, talking, polls and analysis in our high school and the students in the system programmer major we can classify demotivation factors as follows:

1. Family environment;
2. School environments;
3. Relationships in school;
4. Relationships in the hostel;

In the process of research and research found that we need to add relationships in the dormitory because there is a unique environment that significantly affects the motivation to learn students, as well as learning content, which for years with each change in the curriculum in mathematics it is growing in size, and teaching hours are even decreasing. Through numerous observations in different situations, we believe that all these factors can be considered not only demotivating, but in many situations applied in the right direction can be highly motivating.

Based on the research, taking into account the specifics of the subject of mathematics, we have identified four main ways to form a positive motivation in students:

- through teaching methods and technologies;
- through the internal evaluation system;
- through extracurricular activities;
- through the teacher's personality.

Over the years, students have become more economical and pragmatic in terms of the effort they put into learning, and at the same time, "They want everything now." Looking for methods and ways to increase their motivation to learn, we studied many literature sources and getting acquainted with various psychological theories and schools, we came to the conclusion that one of the most applicable theories to improve learning motivation is Victor Vroom's theory of expectation. This model is based on the understanding that a person's intention to perform a certain action depends on the results it will lead to, as well as on the usefulness and attractiveness of these results for the individual. Or is the motivation based on this person's decision "How much effort should I use to get what they want from me?" As well as how much the result of the efforts will contribute to obtaining the expected remuneration (evaluation, praise, etc.). It turns out that for older students in grades 11-12, commercial remuneration is leading (unfortunately).

It should be borne in mind that students must adopt and apply knowledge of mathematics in order to develop competencies in a field. This means being able to integrate the knowledge and skills acquired in math classes to be useful for interpreting situations and solving problems that have arisen in programming classes.

Continuous problem solving in a particular field builds relevant competence, which goes through three stages:

- ❖ cognitive - the basic facts (theorems, formulas and rules) are remembered.
- ❖ associative - simultaneously with the preliminary understanding of the problem, the connections between the different disciplines studied in the specialty of system programmer are constructed. [6]
- ❖ autonomous - achieves automation and speed of execution.

Increasing mathematical competence also increases motivation to learn.

Through the methods of observation and comparison in both groups of the research process we came to the conclusions:

- ✓ The methods of motivating students should not be applied in isolation, but in an appropriate combination.

- ✓ They are interconnected within one lesson and each teacher must consider which lesson and what the students in the class are.
- ✓ Conscious learning motivates students to a higher degree to participate in the learning process.
- ✓ Positive learning motivation and mathematical competence are directly related.

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