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Research Insights
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SOCIAL-EMOTIONAL IMPACT OF MATHEMATICS TEACHERS ON STUDENTS' MOTIVATION

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Abstract. In the present study, social-emotional factors in mathematics teaching are examined through the prism of motivational theory of self-determination. Various concepts of the influence of teachers' emotional support on students' motivation and their achievement in mathematics have been examined. The research found that social and emotional support from mathematics teachers is one of the significant factors positively influencing students' internal motivation and confidence in solving tasks. Our research found out that social and emotional support from teachers in mathematics is one of the significant factors positively affecting students' internal motivation and confidence in solving tasks. The study was conducted among first-year students at FMI Plovdiv, Bulgaria. The basis for this was to analyze their attitude on several motivational issues, one of which was the influence of teachers and their support for learning mathematics. The results showed that the teacher and his motivation directly influence the students. A highly motivated and well-prepared methodically and professionally teacher is the basis for a highly motivated student.

Keywords: motivation; mathematics education; social-emotional; teaching

1. Timeliness of the problem

Positive relationships between teacher and student are among the factors of greatest importance on student motivation and performance in mathematics. The emotional support of the teacher plays a significant role in the achievement of students in mathematics, both at the elementary, junior and high school levels of education. Some studies have found that various factors, such as gender stereotypes, emotions and attitudes, influence students' mathematics achievement (Staribratov 2018; Moè 2018; Yang et al. 2021). For example, one study found that girls are reported as being less able in mathematics than boys (Fredericks & Eccles 2002; Moè 2018) and less self-identified with mathematics than boys (Cvencek et al. 2011). In our research we found that attitudes are different in different age groups. This may also be due to the age of puberty. In addition, teachers (Li 1999) and parents (Tomasetto et al. 2011) believe that boys are more skilled than girls in mathematics.

These negative stereotypes about mathematics can undermine girls' self-esteem and lead them to engage less in mathematics.

To deal with this problem, researchers who work on the theory of self-determination (Deci & Ryan 2000) prove the importance of teacher support (Yang et al. 2021), the ability to communicate, to be reflective, to be well professionally prepared methodically and in terms of teaching material. As here, other factors are not excluded - family environment, personal abilities, social environment, mathematical talent.

Some research has found that teachers' emotional support declines in adolescence and young adulthood (Wu & Hughes 2015). Namely, in adolescence, it is the emotional support of teachers that helps build self-acceptance, confidence in one's own abilities, and motivation to learn and engagement in students' mathematics classes (Gregory et al. 2016). High school students who report receiving warm emotional relationships with their teachers report better adjustment to the learning environment and positive learning emotions. The results of the study by (Kashy-Rosenbaum et al. 2018) show that teachers' emotional support has a positive impact on students' academic achievement and their motivation to learn.

2. Emotional support in mathematics teaching

Based on self-determination theory, a teacher's perceived emotional support refers to the student feeling an emotional connection with the teacher in the classroom and the teacher being interested and sensitive to their needs and responding positively and enthusiastically to them (Pianta et al. 2008). Students have a sense of safety in the classroom, which allows them to explore new things and expand their experiences. Such emotional connections can promote motivation to learn (Downer et al. 2010; Staribratov & Babakova 2019). Many other studies have found a strong relationship between social support (teacher support, peer support, and parental support) and academic achievement among high school students (Rosenfeld et al. 2000). It would be difficult for students to succeed academically when they are emotionally unsatisfied. So, researching the relationship between teacher emotional support and mathematics performance of middle school and high school students can improve the understanding of the teacher-student relationship, help them adapt better to school life, and thus to lay a certain foundation for their social adaptation in adulthood (Yang et al. 2021).

The emotional support of mathematics teachers is important for students and for developing a sense of competence. Some studies have found that in middle school, the sense of competence and intrinsic motivation for mathematics is stronger in boys than in girls; the opposite is true for language learning (Skaalvik & Skaalvik 2004).

In self-determination theory, increasing one's sense of competence for a certain task helps to enhance intrinsic motivation for that task (Ryan & Deci 2000). Recent interest studies have been used to determine the impact of feedback on intrinsic mo-

tivation of students (Katz et al. 2006). Thus, a student (girl or boy) who has a strong interest in a given discipline and is confident that he will master it will develop an intrinsic motivation higher than those whose interest or confidence is average or low. What's more, studies show that students who attribute their success to effort perform better and cope better with adversity because they feel they have control over their success. Other researchers have found that attributing success to internal and controllable causes leads to higher math performance. In turn, students' anxiety and lack of confidence in success due to a lack of emotional support from teachers also affects math results – low self-perception of competence and control over success often results in poor math performance (Staribratov & Babakova 2019).

A significant body of research has found that emotional support and a positive environment are important for overall motivation to learn. For example, in a study Yang et al. (2021) found a positive relationship between teacher emotional support and mathematics performance in a sample of Chinese students. Academic self-efficacy and mathematical behavioral engagement are also important in the relationship between teacher emotional support and students' mathematics performance. In the study by Luo et al. (2024) found that students who experience supportive and positive relationships with their teachers tend to experience less math anxiety, while those who do not report emotional support and a positive educational environment at school tend to have higher math anxiety. Moreover, students who report high emotional support from their teachers not only have positive attitudes toward mathematics and high intrinsic motivation to learn, but conversely, students with positive attitudes toward mathematics are also more likely to interact with their teachers, such as thus, they receive even more teacher support (Luo et al. 2024).

In the conducted research, we focused on the subject of mathematics due to the fact that it is the subject that is the most difficult for students and in recent years there are fewer and fewer who apply for majors related to this subject. And a significant number of teachers somehow do not appreciate the strong emotional support is important for overcoming the psychological barrier in front of students and their motivation to learn mathematics.

3. Researching

The purpose of the present study is to determine how some socio-emotional factors in mathematics teaching affect students' motivation and their academic performance.

Research participants. 156 first-year students from PU Paisii Hilendarski participated in the study. The average age of the subjects was 20.35 years. The choice of first-year students was due to the fact that they will respond from the position of graduates and can assess how and who provides the most favorable support for learning mathematics. Priority is given to those from majors preparing them to become leading mathematics teachers.

Methodology

In order to diagnose and determine the level of intrinsic and extrinsic motivation, a "Mathematics Motivation Scale" was developed, which measures amotivation, extrinsic regulation, intrinsic regulation, identified regulation and intrinsic motivation. It consists of 32 statements. The subjects are asked to evaluate on a 7-point scale the various options for answering the question "Why do you study mathematics?". The methodology is standardized and validated for Bulgarian conditions (Staribratov & Babakova 2019) and contains five scales: "Introjected Regulation" (α = 0.853), "External Regulation" (α = .854), "Amotivation" (A) (α = 0.779), Internal Motivation (α= 0.942) and "Internal Motivation for Expertise" (α= 0.828).

Confidence in math success was measured with the question "How confident are you about your success in math this school year" on a 7-point scale (1 – I will not do well at all; 7 – I will do very well). To assess learned helplessness/optimism, research participants were asked to rate one of the following two statements: "If I put my mind to it and want to, I can handle even the most difficult math problems" and "Although I do my best, mathematics is a very difficult subject". These two items have high reliability (α=0.90) and a high Pearson correlation coefficient (P=0.788). Since in the study we gave many scales to assess different aspects of behavior and learning in mathematics, we judged that with these two items the subjects would give more reliable answers than if we offered them a scale to measure learned helplessness, which consists of of more items.

With the help of several questions we ask the students from whom the greatest support is expected and received when learning mathematics – are these the parents, teachers or classmates.99% of the expectations were in favor of professional and emotional support from teachers. Perhaps if a study were conducted in the younger classgroups 1st to 4th the results would be different because in these classes parents still provide help and support.

Procedure

Study participants completed the test during a geometry workshop. They were also given three geometry problems to solve while completing the test procedures. They were informed that the purpose of the instrument was to ascertain the reasons why they learn mathematics. The questionnaire was completed anonymously and the participants were assured that its results would in no way affect their mathematics results at university.

Results

ANOVA showed that students who reported their confidence in their success and in coping with the most difficult tasks during the study showed that they were intrinsically motivated to learn mathematics (on the scale "intrinsic motivation" – $F(773.865) = 4.879$; $p = 0.030$). In Fig. 1 graphically depicts this result.

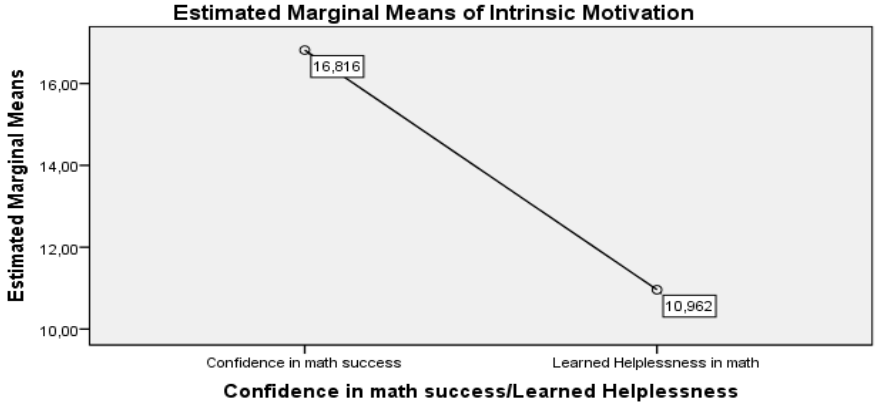

Figure 1. ANOVA on the Intrinsic Motivation scale and the Learned Helplessness factor

Students who are confident about their success in mathematics show high levels of intrinsic motivation. They feel that they received a lot of support from their teachers in secondary school.

Those showing learned helplessness showed high values on the "amotivation" scale – $F(173,108) = 4.827$; $p = 0.031$. In Fig. 2 graphically depicts this result.

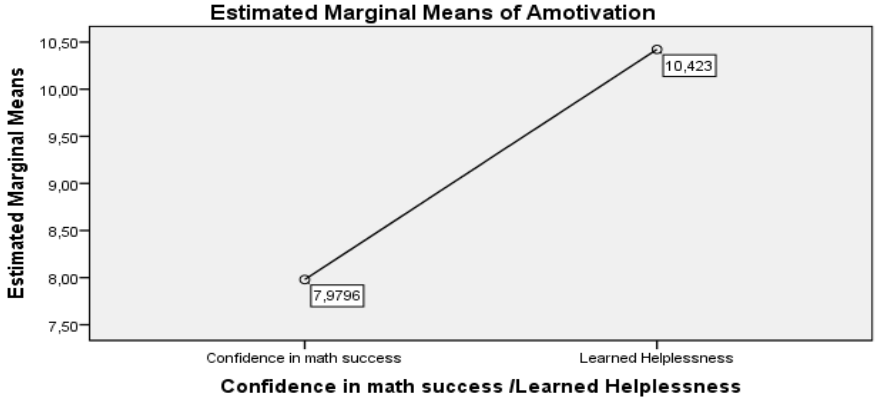

Figure 2. ANOVA on the Amotivation scale and the Learned Helplessness factor

These results suggest a higher commitment by mathematics teachers to students who display high levels of helplessness, as they are at the greatest risk of failure and dropping out of the educational system. The emotional support and strong

commitment of teachers towards such learners can become a buffer against such a threat. Low self-perceptions of competence and control over success often result in poor performance in mathematics, and therefore social support and belonging in the classroom may be one of the most important factors involved in student motivation and engagement.

Similarly, Connell and Welborn (1991) found that the sense of acceptance by teachers experienced by students at school was strongly related to their cognitive, behavioral, and emotional engagement in the classroom. Similarly, in a longitudinal study of seventh grade students, Kaplan and colleagues (1997) used a causal model to describe the relationship between academic failure and dropout behavior. The results highlight the importance of the school context, as negative academic experiences and lack of motivation have a significant impact on students' academic self-confidence and feelings of not being well accepted in the school environment. Students who leave school early are more likely to feel alienated from the school context.

Furthermore, after conducting a correlational analysis, it was found that students who showed high values on both scales measuring intrinsic motivation reported that they were confident in their success in mathematics during the academic year (r = 0.351; p = 0.01 and r = 0.360; p = 0.01), for those who are externally motivated, no correlation dependence is observed (r = 0.035; p = 0.771), for students who reported high levels of amotivation, there is a lack of confidence in success in mathematics during the school year (r = – 0.303; p = 0.01).

Student perceptions of teacher support are associated with high achievement motivation, well-being, and academic success. In high school, student-teacher relationships become increasingly important as adolescents seek support from non-parental authority figures. Research shows that students who feel their teachers support them are more engaged in learning and more successful academically (Becker & Luthar 2002).

The researchers believe that such positive achievement results are a consequence of students' perceptions of teacher support, which creates so-called self-fulfilling prophecies that support and encourage student achievement in line with these expectations. Seventh graders' perceptions of their teachers' grades and support were the most consistent and significant predictors of student achievement outcomes. Moreover, perceived teacher support and warmth explained more than one-third of the variance in students' expectations for success (Becker & Luthar 2002).

4. Conclusion

Both in the present study and in many other studies, the importance of mathematics teachers' social and emotional support for high motivation to learn mathematics has been found, and in relation to this, some researchers have developed policies and

recommendations to strengthen school organizational culture and climate through education reform. Becker, B. and Luthar, S. (2002) give the example of the Carnegie Council on Adolescent Development, which proposes that all secondary schools be restructured to be more "person-centered". Schools should foster a "sense of closeness" between students and teachers to enhance the development of intellectual progress in mathematics, academic achievement, and emotional and social maturity. Poor academic performance is the result of a process of detachment that began when the child first crossed the school threshold.

In recent years, efforts have been made to introduce Project-based and problem-based learning, where the proximity of teacher and student is significant. But in addition to the feeling of closeness and support in developing the study material, it is good to have a personalized approach. With the active entry of AI into life and education, these opportunities will increase.

The present study also has a number of limitations: it would be good to examine the relationship emotional support from the teacher – self-confidence/learned helplessness in mathematics - intrinsic motivation in a sample of teachers and students and to compare it with a sample of students. Thus, we will gain a better perspective on the role of emotional support on intrinsic motivation to learn mathematics in school education and in higher education.

Another limitation of the study is that it does not cover all the factors that influence the relationship between emotional support and intrinsic motivation to learn. For example, it would be good to investigate the mediating effect of anxiety experienced by students during solving tasks in Olympiads, competitions, self-efficacy in mathematics classes, other types of support that students receive to learn mathematics

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