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Motivation for Learning Science and Mathematics: TIMSS Study in Serbia[2]

Extended summary

Student motivation is one of the affective components that plays a key role in the process of conceptual changes in learning science, developing critical thinking and improving scientific skills. Motivation affects students' attitude towards science and their achievement. Research shows that highly motivated students express more positive attitudes towards science and they are more successful compared to other students. Students' perception of their own learning abilities impacts their attitudes toward science. In developed countries, there is a trend of a declining student interest in science and technology. Mathematics is an integral part of most scientific disciplines and it is considered that mathematical knowledge is necessary for the future study of science. There are mutual influences between students' intrinsic valuing of science and mathematics. Motivation and positive attitudes towards learning contribute to the development of students' science literacy and permanent interest in science and are important for improving the learning process as well as student achievement.

The paper looks at the relationships between intrinsic motivation, self-concept, and achievement of the fourth-grade elementary school students in mathematics and science were studied. The results of the secondary analyses of the data obtained in Serbia by means of student questionnaires and knowledge tests in the last two cycles of the TIMSS research in 2015

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and 2019 are presented in the paper. The questionnaire contains two scales in which motivational variables were operationalized: students' attitude towards mathematics/science and their self-confidence in mathematics/science. The students' attitude is an indicator of intrinsic motivation, and self-confidence is an indicator of the self-concept.

The results indicate that students express a high motivation for learning mathematics and science and a high level of self-concept. The surveyed students report a slightly higher level of self-concept, compared to the level of intrinsic motivation for learning. In both cycles, intrinsic motivation and self-concept are relatively highly correlated. A higher level of self-concept is accompanied by a higher level of motivation for learning mathematics and science. In the period between the two investigated cycles, the number of students expressing extremely high values of self-concept and intrinsic motivation in mathematics and science decreased, while the number of students with lower values on both variables increased proportionally.

The individual characteristics of students have a greater influence on achievement, compared to the influence of schools and teachers. In both studied cycles, the individual characteristics of students, among which the mathematical/scientific self-concept and the attitudes towards mathematics/science stood out, make up a large part of the variance that impacts student achievement in these subjects. Students expressing a more positive attitude towards mathematics and science, and a higher level of self-concept in these areas, generally have a higher achievement. However, in science, students who express moderate intrinsic motivation and the highest level of self-efficacy demonstrate the highest achievement. The influence of the mathematical self-concept on achievement is particularly significant. Perceiving oneself as a good mathematician motivates students more and impacts their mathematical achievement to a greater extent than in science.

The obtained results are in accordance with the findings of earlier research indicating complex relationships among intrinsic motivation, self-concept and mathematical achievement, as well as that other constructs, including self-concept, can mediate the links between motivation and achievement. Intrinsic motivation is not directly related to academic achievement at younger elementary school age, but its importance may increase at higher levels of education. If students are trained in the teaching process to organize their own activities, this will contribute to their experience of autonomy and the development of competency beliefs, which in turn positively impacts their motivation for learning.

It is important that teachers take into consideration students' attitudes towards subjects. Given that students' motivational profiles can be different, teachers of mathematics and science should adjust their teaching approaches to incite the intrinsic motivation of students, their beliefs about their own competency beliefs for learning and the perceptions of the utility values of these subjects. In order to ensure continuity in improving the teaching of science and mathematics, it is important that future research includes a sample of older students. This would make it possible to determine whether there are changes in the structure of students' motivational profiles during their development and with the transition to subject teaching.

Keywords: TIMSS research, learning motivation, self-concept, mathematics, science

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