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Dragana D. Stanojević[1],
Elizabeta. M. Karalić
Institute for Education Quality and Evaluation of the Republic of Serbia, Belgrade, Serbia

Branislav M. Ranđelović
University of Priština, Teacher Training Faculty, Prizren – Leposavić, Serbia

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Functionality, Selectivity, and Psychometric Characteristics of Items Used on Entrance Exam for Students with Special Abilities for Computer Science[2]

Extended summary

The treatment of giftedness in the educational process is an important pedagogical issue because gifted individuals are the most important resource of a society and a pillar of its progress. Educational support for gifted and talented students and encouraging students' creativity appeared for the first time in the Serbian education system in the 1970s (Robinson & Clinkenbeard, 2008). Special forms of educational work were introduced at that time: additional work with advanced students, extracurricular and out-of-school activities, as well as the possibility of skipping grades in school and earlier enrollment in the next level of education. One of the systemic ways to encourage the development of gifted students is the formation of specialized classes and schools in which gifted students have the opportunity to progress in accordance with their abilities.

In 1966, the first specialized school for gifted students in the field of mathematics was opened, and in 1991, the Philological High School was founded as well. Special curricula regulate the contents studied by gifted students in specialized schools and departments. Since 2017, there have been specialized classes for students with special abilities in informatics and com-

1 branislav.randjelovic@ceo.gov.rs

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puter science in Serbia, and special curricula for these students have been created. For enrollment in such classes, a candidate takes the entrance exam in mathematics which is based on educational standards of achievement for the end of primary education (*Educational standards for the End of Compulsory Education, 2010*).

The aim of the research is to determine the quality of the items and the whole test, based on metric characteristics, especially in terms of their functionality and selectivity. The research relies on the scaling tradition. The paper starts from the item response theory that is widely used in education, particularly for the purposes of development and improvement of testing (Baker, 2001). The item response theory method was used to determine the complexity and discriminatory elements of the tasks.

The subject of the research was the investigation of the metric characteristics of the test which students had at the entrance exam for informatics classes in 2019. The ultimate aim of the research was to improve, based on the research conclusions, the quality of the entrance exam test for students with special abilities for informatics and computer science, and, consequently, to enable a more successful selection of the candidates.

The sample consisted of all the candidates (1926) who took the entrance exam in 2019. The research instrument was a test with 12 mathematics questions/tasks distributed to students at the entrance exam for the specialized class of students with special abilities for informatics and computer science.

Data analysis showed that the mathematics test generally had good psychometric characteristics and it enabled a relatively reliable assessment of student achievement. However, two items were not discriminatory and they should be removed from the test. In addition, the test contains several very easy tasks which do not provide enough information about students. The results of this research can be used to prevent the shortcomings in the task design or the entire tests. The test should contain the tasks that will provide more information about student achievement. The writers of the tasks can use the analysis of the tasks in this test to prevent errors in future tests and thus improve their quality. This research and other ones (Wu & Adams, 2006) show that the theory of item response is a possible tool for obtaining the relevant information from a limited group of data. The discriminatory factor in the tests should also be stricter, particularly in tasks for the advanced level.

Quality is a primary developmental goal in Serbian education, while apart from economic goals and social progress, the development of individual potential through the principle of equality and availability of education to all is a special aspect of the quality of education (*Education development strategy in Serbia until 2020*, 2012). Educational standards provide for a more efficient and better quality educational work, while the evaluation of the results is more objective and reliable.

Informatics education should focus on the acquisition of competencies for a modern approach to problem solving where using technology that enables different methods and approaches is a prerequisite. Such education is a good common foundation not only for those who will develop informatics solutions as a profession because they will be able to understand its application better, but also for non-professionals who use technology on a daily basis (Ožegović, 2019).

Keywords: functionality of items, selectivity of items, metric characteristics, entrance exam, mathematics

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