# REVIEW

**under the procedure for acquisition of the educational and scientific degree "Doctor" by** candidate **Iliana Ivanova Tsvetkova,**
**of the PhD Thesis entitled: "Extracurricular Activities in Mathematics in Primary and Junior High School - an Important Factor in Discovering and Developing Mathematical Talents",**
In the Scientific field: **1. Pedagogical Sciences**
Professional field: **1.3. Pedagogy of learning in …**
Doctoral program "Teaching methodology in mathematics and informatics",
Department „ Education in mathematics and informatics",
**Faculty of Mathematics and Informatics (FMI)**, **Sofia University "St. Kliment Ohridski" (SU),**

The review has been prepared by: **Prof. Borislav Yordanov Lazarov, PhD, Institute of Mathematics and Informatics, Bulgarian Academy of Sciences**,
as a member of the scientific jury for the defense of this PhD thesis according to Order № РД38-677/22.12.2023 г. of the Rector of the Sofia University.

## 1. General characteristics of the dissertation thesis and the presented materials

The dissertation thesis meets the requirements of Art. 27 of the Regulations for the Implementation of the Law on the Development of the Academic Staff in the Republic of Bulgaria. It consists of a body text of 69 computer typed pages, which correspond to about 98 standard typewritten pages. This text is structured in Introduction, 5 Chapters and Conclusion. In addition, 4 Appendices, a Statement of Originality and a page of the Similarity Report are included in a total of 12 pages.

The Bibliography includes 19 titles, as well as sources from 9 websites. There are 7 publications in didactics related to the dissertation, of which 4 are independent. In addition, a list of 14 titles of methodic type, including textbooks, is applied, of which 5 are independent. According to the submitted Report on the Implementation of the Minimal National Requirements of the Republic of Bulgaria legislation 65 points are covered, while the required minimum is 30 points.

## 2. Short CV and personal impressions of the candidate

Iliana Tsvetkova graduated from SU "Kliment Ohridski" majoring in mathematics. Subsequently, there are numerous qualifications in various fields of education, of which I would highlight "Models and mechanisms for researching student achievement in profiled and/or optional mathematics training" and "Competence approach in education".

Informal: I have known Iliana Tsvetkova for many years. She has been a long-time senior teacher at the Sofia Mathematical High School, where she has contributed significantly to the high authority of the school, both on national and international level. In addition, she held and holds important positions in the World Federation of National Mathematical Competitions. I have listened more than once to her presentations, which were always highly professional done.

I have repeatedly witnessed Iliana Tsvetkova's direct work with advanced students in mathematics at training camps - her pedagogical approach was impressively original and effective. Scientific contributions will be discussed later in the review. All this speaks undoubtedly that Iliana Ivanova Tsvetkova is a prominent expert in mathematics education.

**3. Content analysis of the scientific and applied achievements of the candidate, contained in the presented PhD thesis and the publications to it, included in the procedure**

Below we are going to follow the structure of the dissertation.

In the **Introduction**, the candidate motivates her attitude to the dissertation topic with the desire to share her own experience of organizing extracurricular activities with advanced (or as the author calls them, talented) mathematics students of age 8-14 years. There are formulated:

- the purpose of the dissertation, justifying why the topic stands on agenda;
- the hypothesis, the object, the subject of the research, as well as the tasks that are set to achieve the goal.

The citations and the candidate's text are in an acceptable proportion.

**Chapter 1** discusses "the role of extracurricular training and competitions in discovering and developing mathematical talent." It is divided into 6 sections.

In the section *Mathematical talent - what is it?* the term *outstanding student* is chosen, justifying why it is preferred over terms such as *talented, gifted,* etc. This is in close accordance with the legislation, where the term *prominent child* was adopted (Ordinance of the Council of Ministers No. 298 of 17.12.2003).

In the section *How to recognize (discover) the talent?* 20 indicators that are characteristic of gifted children are quoted. Here the range is set within which the family and the school can take responsibility for recognizing and supporting the gifted child. The role of mathematical competitions for the early detection of talented and gifted students is emphasized.

In the section *How to develop and retain talent?* the results of the three studies are connected - Csikszentmihai's model, the Brentwood experiment, Serebryakov and Langer's conclusions, on the one hand, and Bankov's recommendations in this direction, on the other hand. Here, the candidate demonstrates her skills in synthesizing other researchers' conclusions, and as result obtaining an own intellectual product.

In the section *How does talent find its expression?* Gladwell's research is related to good practices from the Sofia Mathematical Highschool (SMG).

In the section *The role of mathematical competitions for the manifestation of talent*, various competitions suitable for different types of gifted students are presented.

In the section *How do we practically discover and develop mathematical talents in SMG?* both the collective experience of the teachers from SMG and the personal methods of the candidate for working with talented students, aimed at developing their mathematical abilities, are presented.

In **Chapter 2**, a brief analysis of mathematics curricula at the elementary and junior high school stages is made. The content of topics included in extracurricular forms in SMG, which round out the obligatory school topics, is given.

**Chapter 3** is entitled *Pedagogical experiment of the research*. In essence, this chapter briefly describes a long-term extracurricular program with gifted students rather than a pedagogical experiment. It starts with quoting of a classification of research types, noting what type the

dissertation research is according to the author. An impressive list of students prepared for mathematical competitions by the candidate is presented, with data on their quite successful further careers. An inquiry was conducted, from which it can be concluded that the hypothesis of the dissertation, that the early detection and purposeful development of mathematical talent is a prerequisite for its successful realization, is confirmed by 82% of the respondents.

In **Chapter 4**, problem systems are given on two topics: rebuses and back-to-front problems. The topics are designed to be studied during several consecutive academic years. The chapter is essentially a continuation of Chapter 2. Both systems are taken from published math problem books in which the candidate is a co-author. As far as no declarations have been submitted by the co-authors, we assume that the authorship is equal.

In **Chapter 5**, a theoretical model for evaluating the individual achievements of a student within the framework of teamwork is proposed. In this model, the process of mutual evaluation is essential. A brief review of research related to this issue is done. The target group is high school students who are interested in mathematics, and in addition to the advanced students, in the team work some students with lesser achievements are also included. The model has been tested and validated.

In the **Conclusions**, the candidate indicates 8 "Specific contributions in the work". Of them, 5 are of a didactical type (2, 3, 4, 6, 7).

## 4. Approbation of the results

Some results of the candidate have been reported at international and national scientific forums. The "business card" submitted to the documentation does not mention the candidate's talks at the Congresses of the World Federation of National Mathematical Competitions (the reviewer attended two of such candidate's talks), as well as at the International Congresses on Mathematics Education (the reviewer attended one candidate's talk). Publications directly related to the dissertation have been published by Springer, NCMT, World Scientific. No list of the candidate's citations is attached. Generally:

a) the scientific works meet the minimum national requirements (under Art. 2b, para. 2 and 3 of ADASRB) and respectively to the additional requirements of Sofia University "St. Kliment Ohridski" for acquiring the educational and scientific degree "Doctor" in the scientific field and professional field of the procedure;
b) the results presented by the candidate in the dissertation work and scientific works to it do not repeat such from previous procedures for acquiring a scientific title and academic position;
c) there is no plagiarism proven in the legally established order in the submitted dissertation work and scientific papers under this procedure.

## 5. Qualities of the abstract

The abstract correctly presents the content of the dissertation thesis. It transcribes the list of references from the dissertation, although no more than a third of the sources are quoted in the text. It can be said that the abstract meets the requirements for writing an abstract.

## 6. Critical notes and recommendations

In our opinion, the imperatively stated "... the development of mathematical talent *must begin*..." (p. 2) should be softened as "... *could begin*...", since there are numerous examples of scientists who started a successful career in the field of mathematics, natural science and technology.

Another exaggerated statement is "The most suitable form of performance for such students is team competitions" (p.14). Technically: the book "Test Your Child's Intelligence" cited on p.6 should be accompanied by the usual reference.

In Chapter 1, there is a complete mess of terminology - in the first part the term *outstanding student* is chosen, then there is talk about *talented children*, *gifted children* and so on. There is no overview of the status quo in research related to the dissertation topic in our country, although the Bulgarian experience in this field is quite rich.

On p. 22, important conclusions are drawn without indicating the grounds for them - whether they are author's own observations and conducted research or are from external sources.

In Chapter 2 and Chapter 3 there is an imbalance between quoted and authored texts.

The degree of participation of the candidate in the anchoring of didactic materials with several co-authors (in some cases 10 in number) is not clearly indicated in the Conclusions.

Some sources from the literature are not referenced in the main text, for example (Ivanova-Nedelcheva, 2017). Other citations are inserted without sufficient justification, for example (Bloom, 1956), which citation does not appear in the bibliography.

Stylistic errors and inaccuracies occur.

**7. Conclusion**

Having become acquainted with the PhD thesis presented in the procedure and the accompanying scientific papers and on the basis of the analysis of their importance and the scientific and applied contributions contained therein, I confirm that the presented PhD thesis and the scientific publications to it, as well as the quality and originality of the results and achievements presented in them, meet the requirements of the ADAS in the Republic of Bulgaria, the Rules for its Implementation and the corresponding Rules at the Sofia University "St. Kliment Ohridski" (FMI-SU) for acquisition by the candidate of educational and scientific degree "Doctor" in the Scientific field 1. Pedagogical Sciences, Professional field 1.3. Pedagogy of learning in … . In particular, the candidate meets the minimal national requirements in the professional field and no plagiarism has been detected in the scientific papers submitted for the competition.

Based on the above, I strongly recommend the scientific jury to award Iliana Ivanova Tsvetkova, the educational and scientific degree "Doctor" in the Scientific field 1. Pedagogical Sciences, Professional field 1.3. Pedagogy of learning in …

Date: 3 March 2024 Reviewer:

/ **Prof. Borislav Yordanov Lazarov, PhD,** /

**ADASRB - Act on Development of the Academic Staff in the Republic of Bulgaria*