

REVIEW

by Prof. Borislav Yordanov Lazarov, PhD,
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under the procedure for occupying the academic position *Associate Professor*
for the needs of the Department *Education in mathematics and informatics*, IMI-BAS
announced in the State Gazette, issue 97 of 15.11.2024

in the Scientific field 1. *Pedagogical Sciences*; Professional field 1.3. *Pedagogy of learning in ...*, Scientific subject *Didactics of mathematics, informatics and information technologies* (Didactical models),

announced in the State Gazette, issue 97 of 15.11.2024
with the sole candidate Senior Assistant Professor Dr. Georgi Stamov Gachev

1. Subject of review

According to Order No. 4/ 14.01.2025 of the Director of IMI-BAS, I am included in the Scientific Jury for the procedure about occupying the academic position of "associate professor" in the field of higher education in the Scientific field 1. *Pedagogical Sciences*; Professional field 1.3. *Pedagogy of learning in ...*, Scientific subject *Didactic of teaching in mathematics, informatics and information technologies* (Didactical models), announced in the State Gazette, issue 97 of 15.11.2024 with the sole candidate, senior assistant professor Dr. Georgi Stamov Gachev. At the meeting of the Scientific Jury held on January 21, 2025, I was elected as a reviewer.

2. Brief presentation of the candidate Senior Assistant Professor Dr. Georgi Stamov Gachev

Georgi Stamov Gachev was born in 1968. He has a multifaceted qualification: master's degrees in mining of non-ferrous, rare and precious metals (Saint Petersburg Technical University - Russia), finance (Veliko Tarnovo University "St. St. Cyril and Methodius"); pedagogical - teacher of informatics (Veliko Tarnovo University "St. St. Cyril and Methodius"); engineering in technology of industrial chemical processes - processing of solid household waste (Chemical-Technological and Metallurgical University - Sofia). He defended his doctoral dissertation at Sofia University "St. Kliment Ohridski" in specialty 4.6. Informatics and computer science. He has competence in system and network administration with a Cisco Academy certificate at Sofia University. He is fluent in English and Russian. The Candidate meets the requirements of Art. 53/2/a of the Regulations for the Implementation of the Act on Development of the Academic Staff in the Republic of Bulgaria.

3. General description of the submitted materials

The review was prepared based on the following documents submitted for this procedure: Application from the candidate, Professional CV, PhD and MS diploms; Description of the scientific achievements for participation in the procedure, full texts as well as separately abstracts of the scientific works for participation in the procedure, Author's selfreference for the scientific

contributions of the Candidate, Reference for the citations in which the Candidate's publication is cited, Reference for fulfillment of the minimum requirements.

4. Publications and citations

For participation in the competition, Dr. Gachev has submitted a list of 23 publications. Of these: one monograph; 8 articles in publications referenced in Scopus and WoS, 3 of which are independent and 5 in co-authorship; 14 in peer-reviewed journals or in conference proceedings, 5 of which are independent and 9 in co-authorship. There are 10 publications in Bulgarian, 13 in English. No declarations have been submitted about the degree of participation in the joint publications, therefore we assume that the Candidate's participation in the joint publications is equal to the other co-authors. We **have not registered plagiarism** in the submitted publications.

There were noted 20 citations of the Candidate's works submitted for this procedure.

According to the submitted Reference for fulfillment of the minimum requirements, he fully (100%) covers the indicators in sections A and B. For the rest: in section D he covers 240.7 points (109%) with a required 220; in section E he covers 165 points (236%) with a required 70; in section E he covers 258 points (1290%) with a required 20.

5. Scientific and applied achievements

The main scientific and applied directions on the topic of the procedure, in which Senior Assistant Professor Dr. Georgi Gachev worked, could be divided into several thematic areas.

1. *Pedagogical research and didactical models.*

Results of research work in this direction:

1.1 Experimental study of a didactic model based on the integration of the constructivist learning approach and virtual collaborative learning. An e-learning infrastructure was implemented in which STEM education researchers, teachers and students work in an environment saturated with ICT resources. The results are presented in the three publications [2, 3, 4]¹.

1.2 Solving problems related to balancing chemical equations. An original method for balancing chemical equations has been developed, in which complex chemical equations are balanced without computing devices. The method is based on an algorithm for solving systems of linear homogeneous equations, combining the application of matrices and graphs. The balancing process is entertaining and resembles solving a rebus. The results are presented in the publications [1, 8, 9, 21].

1.3 Adaptation of educational content, typical for engineering universities, for teaching in secondary schools. Rules for working with dimensions are described, each rule being illustrated by an example. It is justified that the analysis of dimensions is a necessary condition for adequate practical application of mathematical models. The results are presented in the publication [19].

1.4 Development of educational content suitable for training in STEAM centers. Based on the analysis of the results of participants in mathematical competitions, the level of preparation in the target age groups for solving specific types of tasks was determined. The target group also includes future teachers oriented towards the application of the research approach in education. The results are presented in the publications [12, 14].

¹ Here and further on, we follow the numbering according to the *List of publications, inventions and other scientific and applied results presented in the documents for participation in the competition of Senior Assistant Professor Dr. Georgi Gachev.*

2. *Research and development of new technologies in education*

Results of research work in this area:

2.1 A study on the possibility of using a visual programming language via a tablet in computer science education. The characteristics of a visual language, its applicability in certain classes of algorithms, as well as the target groups to which such training could be directed in secondary schools are analyzed. The results are presented in the publication [5].

2.2 Development of innovative didactic ICT tools. The proposed technological innovations are operationalized through specific tasks. The results are presented in the publications [11, 15, 16, 20, 22].

3. *Applied Mathematics and Informatics.*

Results of research work in this area:

3.1 A model for determining the sensitivity and specificity of a clinical diagnostic test without using a reference test. The method provides an estimate of the prevalence of the disease for which the specific clinical test is intended. A computer simulation has been developed to validate the methodology. The results are presented in the publication [18].

3.2 A model for determining the impact of investments in control programs on the economic damage caused by cystic echinococcosis (canine tapeworm). The thesis is substantiated that the invested funds lead to a significant return on the national budget and on the individual health and life expectancy of the population. The results are presented in the publication [7].

3.3 Model for determining the genetic closeness of the peoples of individual European countries. The model is universal and can be applied to assess the genetic closeness of individual ethnic groups anywhere in the world. The results are presented in the publications [10, 13].

4. *Development of educational software products*

Results of research work in this area:

4.1 Online system for assessing knowledge in mathematics. Adequate presentation of the content of the questions and tasks is achieved, as well as automated assessment of the answers. The advantages are in assessing a large number of solved tasks in a short time. The results are presented in the publication [6].

4.2 Environment for managing and conducting online competitions. This system allows management for more than ten years of the *VIVA Mathematics with Computer* competition to be held. Thousands of students participated and over two thousand research tasks were included. The results are presented in the publications [5, 12, 14].

4.3 Establishing and development of the *Virtual Mathematics Laboratory*. Educational resources for mathematics education are provided with open access, through which students' mathematical and digital competence is developed simultaneously. On average, approximately 30,000 visits are registered per month. The results are presented in the publication [23].

4.4 Program implementation of the mathematical game Combination Nine. The game contributes to the development of cognitive brain functions and to the improvement of memory. It can be used in educational and recreational activities for all age groups. The results are presented in the publication [17].

6. Participation in scientific or educational projects

Senior Assistant Professor Dr. Georgi Gachev is a participant in an impressive number of international and national projects. He is the project manager for the *Online Competition "VIVA Mathematics with Computer"*, MES, program "Education with Science -3".

Among the international projects with his participation we will mention

- Scientix 4. Inquiry-based science education in Europe, European Commission (Horizon 2020 - Research and Innovation Framework Programme).
- Scientix 3. The community for Science Education in Europe 3, H2020-EU.5.a DE03-KA201-02, A&P: STEM-PD-Net, European, Erasmus+ MaSciL, Mathematics and science for life, SiS.2012.2.2.1-1.
- Scientix 2. The community for Science Education in Europe 2, FP7:SIS.

National projects with the participation of the Candidate:

- NP OsN, National Program "Education with Science", Ministry of Education and Science.
- Technologies for STEAM education, MES, program "Education with Science -3".
- Technologies for STEAM education, MES, program "Education with Science -2".
- Research approach in STEAM education, Program "Education with Science", MES.
- Qualification for professional development of pedagogical specialists, OP "Science and Education for Smart Growth".
- NNP "Information and Communication Technologies for a Single Digital Market in Science, Education and Security" (ICT in the National Education System).
- PMS No. 347, item 5 of 08.12.2016, Activity "Introduction of modern methods in education and work with young talents".

7. Other activities

Dr. Georgi Gachev actively participates in the work of the Department *Education in mathematics and informatics*, IMI-BAS. He gave talks at the *Didactic Modeling* seminar, participates in organizing committees of scientific and educational forums. Among them, we will note the key role he played in the successful holding of the *Ninth Congress of the World Federation of National Mathematical Competitions* (2022).

The Candidate has inventions registered with patents. A contribution to the fight against the spread of COVID-19, as well as other infectious diseases transmitted by airborne droplets, was made with the theoretical and practical development of a personal and collective air sterilizer. The development was registered with a utility model in 2021, as well as with a valid patent in 2024.

Conclusion

The documents and materials submitted by Senior Asst. Prof. Dr. Georgi Stamov Gachev meet the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria, the Rules for its Implementation and the corresponding Rules at the Institute of Mathematics and Informatics, Bulgarian Academy of Sciences. His works contain significant scientific and applied results in the field of education in mathematics, informatics and information technologies (Didactic models), which have received national and international recognition. His competence in educational and scientific activities have been repeatedly and comprehensively proven. Formally, the Candidate meets the minimum quantitative requirements

for acquiring the academic position of *associate professor*, and in some indicators he exceeds them many times, but what is more important is that in terms of quality, Georgi Gachev's work is of a particular height.

Based on the above, I **strongly recommend** to the scientific jury to vote for awarding the academic position of **associate professor** to Georgi Stamov Gachev in the field of higher education 1. *Pedagogical Sciences*; Professional field 1.3. *Pedagogy of learning in ...* .

Date: February 21, 2025

Reviewer:

/ Prof. Borislav Yordanov Lazarov, PhD, /