

REVIEW

by **Ivan Kolev Koychev**, professor at FMI at Sofia University "St. Kliment Ohridski",
for the competition for the academic position "Professor", for the needs of the Faculty of
Mathematics and Informatics of Sofia University "St. Kliment Ohridski", in professional
field 4.6 Informatics and Computer Science, specialty "Informatics (Information
Technologies)", announced in SG no. 48/26.05.2020.

The review was prepared in my capacity as a member of the scientific jury in the above competition according to order № RD 38-344/23.07.2020 of the Rector of Sofia University "St. Kliment Ohridski" (SU).

As announced in the contest, a "professor" for the needs of the Faculty of Mathematics and Informatics (FMI) at Sofia University "St. Kliment Ohridski", as the only candidate is **Assoc. Prof. Dr. Pavel Boychev** from the same faculty. The candidate has submitted a complete set of documents in accordance with the requirements of the "Regulations on the terms and conditions for obtaining scientific degrees and holding academic positions at Sofia University "St. Kliment Ohridski"", which are required from the candidates for participation in the competitions for the academic position "Professor".

Dr. Pavel Boychev graduated FMI at Sofia University "St. Kliment Ohridski", - **Master** of Informatics since 1995. He has been awarded the educational and scientific degree "**Doctor**" in scientific specialty - 01.01.12 "Informatics" by FMI at Sofia University "St. Kliment Ohridski", with a diploma issued by the Higher Attestation Commission (HAC). His dissertation is on "Language and system based on LOGO" defended on October 29, 2001. He was awarded the title of "**Associate Professor**" in scientific specialty - 01.01.12 "Informatics" by Sofia University "St. Kliment Ohridski", awarded on 14.12.2006, certified with a diploma issued by the HAC.

From the submitted documents it is evident **that the candidate meets the minimum requirements** for candidates for the academic position of "professor" according to Article Art. 29. (1) of ZRASRB, as follows:

1. He has obtained the educational and scientific degree "**Doctor**".
2. He occupies an academic position "**associate professor**" in the same scientific organization more than five years.
3. He has presented a **monograph and publications in specialized scientific journals**, which do not repeat those presented for obtaining the educational and scientific degree "Doctor" and for holding the academic position "Associate Professor".
4. He has presented other **original research publications**.
5. **He meets the minimum national requirements** under Art. 2b, para. 2 and 3, respectively to the requirements under Art. 2b, para. 5.
6. There is no legally proven plagiarism in scientific works.

The presented "Report on the implementation of minimum national requirements of art. 2b of the ZRASRB on scientific area 4. Natural Sciences, Mathematics and Informatics, Professional Field 4.6 Informatics and Computer Science (Information Technologies), by Assoc. Prof. Dr. Pavel Boychev - candidate for the academic position Professor" is correct. It shows that the candidate **fulfills the minimum requirements** for holding the academic position of "professor".

Assoc. Prof. Boychev is **a leading specialist internationally recognized** in the field of informatics, and with significant scientific and applied contributions in areas such as: *computer graphics, programming languages, educational software* and more. He is coauthor of **publications** in Bulgarian and international scientific journals and proceedings of prestigious conferences and many popular science articles. **He is also a co-author of two books and a textbook.** He actively participates with presentations in national and international forums - a total of over 80 reports, about 25 of which are for the last 10 years. Total number of **citations of his scientific papers**, according to provided reference, is 189 (without auto-citations) and according Google Scholar – 424.

In the publications submitted for the competition, the original scientific, scientific-applied and scientific-artistic **contributions** of Assoc. Prof. Dr. Pavel Boychev can be summarized in the following areas:

- **Educational software and training content**
 - **Developed methodology for designing, creating and using virtual learning environments** for specific, mostly university, disciplines or specific learning objectives that combine content with an appropriate presentation style. [1, 2 and 8]¹
 - **Several models of student assessment** for several disciplines have been developed, which encourage students' creative thinking and reduce the possibility of copying. A *model for evaluation through applied games* is also presented, and a new metric is proposed - *temporal average*, which is suitable for aggregation of evaluation results, which are generated in large volumes during the game. A *model* in the field of computer graphics has been developed, which is applicable for both student and task assessment. A *model of serious educational game* with a separate assessment layer has also been developed. The developed *assessment models* are embedded in disciplines taught at FMI, Sofia University. He analyzed their advantages and disadvantages, considering the views of the student and the teacher. He developed *ten component gaming evaluation*, embedded in the virtual environment Meiro, where the proposed *temporal average* measure is used to evaluate the plays' results. [1, 2, 6 and 7]
 - **The concept of "deconstructionism" has been introduced, described and classified** in the context of education. There is a traditionally neglected phase in the learning process that precedes the construction of new knowledge - this is the phase of deconstruction. The important role that this phase has and the lack of pedagogical and technological means to

¹ References are to the list of publications that candidate is submitted for participating in the competition.

support it are emphasized. It is considering the effect of deconstruction stage on the construction of knowledge and development of creative thinking. [1]

- In the monography it is described a **realization of a model of synergy between the three distinct elements - educational software, university courses and educational content**, each of which has so far taken individually and detached from others. The view is that the developed software is the basis for conducting the disciplines and creating their content; the disciplines are a platform for software application and an inspiration for its future development; and the learning content created through the software is realized during the courses. The monography presents outcomes of realization of this synergy that has developed for more than 10 years. It practically shows how through it the software, the disciplines and the educational content are maintained and developed mutually. [1]
- **Several specialized virtual environments have been created** that provide a programming or interactive interface, each oriented to a specific discipline. Such realized environments are *SUICA*, used in the discipline "Languages and learning environments"; *Mecho* used in "Geometry of Motion"; *FMI3D* and *Meiro* used in "Fundamentals of Computer Graphics". [1, 2, 6 and 9]
- **There are several interactive applications, that present virtual 3D scenes.** The *Virtual Classroom application*, which is used by students, is provided without documentation and the students' work includes research into the virtual environment itself. The set of *ten Elica - DALEST applications* is designed so that each of the applications, in addition to specific training sessions, can be used for research and artistic activities. Some of the developed applications use the author's programming language Elica. Some of the applications (for flight simulations, bridge structures, optics, thermodynamics and spectral analysis) were developed for the Stevens Institute of Technology and also use Elica. With Elica are built other applications which visualize mathematical concepts and properties. [1, 3, 8, 9, 10 and 11]
- **More than 10 university disciplines have been created**, in which both the illustration material and the interactive applications are generated through the author's educational software environments. The results of conducting five of the disciplines are described and the change of the students' success depending on specific decisions in updating the disciplines is analyzed. [1 and 7]
- **Ontologies, taxonomies and metadata**
 - **A model for expanding the ontology has been created**, which provides an opportunity to transform a monolingual or multilingual ontology into a multicultural one, which captures the similarities and differences between different cultures and allows their effective use. When searching with keywords from one culture in resources of another culture, the multicultural ontology allows the search to be performed in branches of the ontology of the other culture, which are inaccessible when using only a multilingual ontology. [1 and 5]
 - **Created tools for working with metadata and taxonomies.** A *meta-editor* has been implemented to create and manage metadata. With them, the editor constructs in real time standard editors for specific metadata, which are used to describe software components for application games. The innovative solutions in it are the management through semantic

extension of cascading CSS styles, the possibility to determine through statistical analysis how much text is entered in English and the verification of metadata. 90 verification rules are built-in. Several *applications for working with taxonomies* have been created. Possibilities for their incorporation in other applications or for independent use are included. [1, 4 and 5]

- **Programming languages and translators for them**

- **A *programming language model* has been created** with a limited number of reserved words and syntactic constructions, which expands the semantic expressiveness. **A *model of Natural OOP* has also been created**, which supports the standard capabilities of OOP, extended with conditional and multiple inheritance, without any additional language constructions. *This allows the same source code to be considered by the programmer as OOP code, as procedural code or as code in a functional programming language.* **A *model of a compiler*** is proposed, which incorporates into the generated compiled code, with which the user *executable file inherits the functionality of the compiler* and in turn becomes a compiler, but with advanced functions. [1]
- **Created and developed for more than 10 years is *the Elica programming language and the corresponding application development environment***, which practically implements the model of limited syntax and the model of Natural OOP. The software was used in the first versions of several of the disciplines in FMI, was used to create other educational applications and was used to create teaching and educational content. *The Lhogho compiler has been created*, which since its inception has been the **only working compiler in the Logo programming language**. The basic problem of how to compile a dynamic language is solved. A unique feature of the compiler is the ability to build into the compiled application, which in turn turns it into a compiler. The speed of execution of Logo programs increases from several tens to several hundred times. [1]
- **Data for over 300 versions and dialects of the Logo programming language have been collected and structured** through communication with developers and users, analyzing forums and reviewing archives published on this topic last 50 year. A *metric* has been proposed and demonstrated **to determine how close two dialects are, both at the level of language constructions and at the level of a translator**. The metric allows not only comparison, but also **translation from one Logo to another Logo**. The purpose of this metric is to be the basis for creating a language standard, if one is ever created. [1]

- **Scientific art contributions**

- **Developed *hundreds of scientific and popular videos*** on topics mainly of mathematics, but also in physics, mechanics, astronomy, chemistry, geology, engineering and other scientific topics. Many of them present multidisciplinary ideas and include elements of history, art, entertaining mathematics and social relationships. Many of these videos are used in established university disciplines as illustrative material or as a demonstration of techniques and algorithms. [1 and 9]
- When creating *educational applications and environments*, special attention is paid to the visualization element. On the one hand, this is due to the thematic focus of the disciplines on *computer graphics*, on the other hand, the *interest of students increases*. [1, 2, 8 and 9]

In its application the candidate also shared his **plans for future scientific work**, which includes "development of synergy between software and training content through the use of *virtual augmented and extended reality*". I would like to suggest to be explored the side effects of overuse of imaginary realities, namely the loss of connection with the real reality.

Assoc. Prof. Boychev has **an active teaching**. It has over 10 courses, most of which has been delivered at FMI of SU such as: Languages and learning environments, Computer Graphics, Computer Graphics with WebGL, Applied Computer Graphics with Elica, Applied Computer Graphics with C, Computer training systems, Algorithms and others. The annual number of students trained are more than 200. Assoc. Prof. Boychev was supervised 3 master student and **2 PhD students**, which successfully defended their theses.

Assoc. Prof. Boychev has experience in working with people from other countries, gained while **working in Germany, USA and Japan** and working on **international research projects** (5 for the last 10 years). Many of multimedia products he works on are created in collaboration with people from other countries. He also has managerial administrative experience, as **head of department** (re-elected for a second term) and as head of master's program. He is the leader of a team of Sofia University in 4 of the tasks under the national program ICTinSES and the leader of several internal university projects that have been successfully completed.

CONCLUSION

The documents and materials submitted by the candidate **meet all the requirements** of the Law for the Development of the Academic Staff in the Republic of Bulgaria (RASRB), the Regulations for implementation of the RASRB and the relevant regulations of Sofia University and FMI for the academic position of "professor". He is **a leading specialist with international recognition** in the field such as computer graphics, programming languages and educational software. His scientific and applied contributions are original and significant. Evidence for this are the **publications in respectful international journals and conference proceedings** with many **citations** and his participation in many international projects.

After getting acquainted with the materials and scientific works presented in the competition, analysis of their significance and contained in them scientific, scientific-applied and applied contributions, I give a **positive assessment** and propose to the Scientific Jury to prepare a report-proposal to the Faculty Council of FMI at Sofia University "St. Kliment Ohridski" **to select the candidate Associate Professor Pavel Boychev for the academic position of "professor"** in the professional field 4.6 Informatics and Computer Science, specialty "Informatics" (Information Technology), announced in the State Gazette. **48/26.05.2020**

16.09.2019

Sofia

Signature:

/Prof. Dr. Ivan Koychev/