STATEMENT

by Prof. Maria Petkova Hristova, PhD

of dissertation for scientific degree „**Doctor of Science**"
in field of higher education 4. Natural sciences, mathematics and informatics
professional direction 4.6 Informatics and Computer Sciences
Topic: Application of data science in the virtual educational space
Author: **Prof. Daniela Ananieva Orozova, PhD**

1. Data on the dissertation, abstract and publications

By order no. 253 of 02.10.2023 of the Director of IICT-BAS, on the basis of Art. 30, para. 2 of the Regulation on the Implementation of the Development of Academic Staff in the Republic of Bulgaria Act as well as the decision of the first meeting of the scientific jury under the procedure of 03.10.2023 and in accordance with the requirements of the Act of Development of the Academic Staff in the Republic of Bulgaria (ADASRB), the Rules for its Application (RIDASRBA), the Regulations for the specific conditions in IICT-BAS for the Implementation of the Law enforcement.

The dissertation work was presented at a meeting of the „Intelligent Systems" section of IICT-BAS on 11.09.2023, at which a decision was made on the readiness to defend the dissertation before a scientific jury.

The presented dissertation work on the topic „Application of data science in the virtual educational space" for the acquisition of the scientific degree „Doctor of Sciences" is in the volume of 190 pages and 49 figures, the bibliography includes 220 literary sources. The text is organized into an introduction, five chapters and a conclusion. The introduction reviews the main terms and concepts in the field and defines the purpose and objectives of the dissertation work. In the first chapter, current problems in the field of virtual educational space and the motivation for the conducted research work are considered. The second chapter presents the status, proposed solutions and opportunities for integration of tools and data science tools into a virtual educational space. In the third chapter, methods and techniques for process modeling are proposed, with the application of data mining tools in an educational context. The fourth chapter examines work processes and components of a virtual educational space and presents their formal models through the generalized net. The fifth chapter presents the results of applications of the research and analysis in an educational environment and trends in the entry of Data Science into higher education.

The conclusion summarizes the results and gives directions for further research in the field. References to dissertation contributions and publications on the topic of the dissertation work are attached.

Abstract (presented in Bulgarian and English) meets the requirements for accurate, complete and concise coverage of the dissertation in terms of volume and content.

The **scientific publications** on the topic of the dissertation work are **41**:

- 15 publications are in journal articles or series;
- 26 publications are from conference proceedings.
- 17 publications are in editions with SJR, 3 of them are in editions with IF. According to the rules of the IICT-BAS: "candidates for obtaining the scientific degree "Doctor of Sciences" must have at least 15 publications with IF/SJR.

All publications are in English and were issued after 2014, after the author took up the academic position of "Professor" in 2012.

One textbook "Knowledge Representation in Artificial Intelligence Systems" was published".

A list of 66 citations of 22 publications from the list on the topic of the dissertation, made in the scientific databases Web of Science and Scopus, is presented. According to the rules of the IICT-BAS: „candidates for obtaining the scientific degree „Doctor of Sciences" must have at least 50 citations in WoS/Scopus.

In the works of Prof. Daniela Orozova PhD there are original scientific and applied contributions that have received international recognition, as a representative part of them have been published in journals and scientific collections issued by international academic publishing houses.

According to the documents submitted by the author of the dissertation work, the minimum requirements of the regulations for the specific conditions at IICT-BAS for the scientific degree „Doctor of Sciences" in direction 4.6 Informatics and Computer Science have been met:

• 50 points by group A - protected dissertation work for awarding the educational and scientific degree "doctor" from 11.05.2001 on the topic „Intelligent databases and training systems", Diploma No. 27403/ 16.07.2001.

• 100 points by group B - dissertation work on the topic „Application of data science in the virtual educational space";

• 655 points by group D (min. requirement 100 points) – 41 publications, on the subject of the dissertation work, referenced and indexed in world-famous databases with scientific information (Web of Science and Scopus);

• 396 points by group D (min. requirement 100 points) – 66 citations in scientific publications, referenced and indexed in world-famous databases with scientific information (Web of Science and Scopus) of the publications, on the topic of the dissertation work.

According to the requirements of IICT-BAS, the candidates for obtaining the scientific degree „Doctor of Sciences" must have a total of at least 350 points, and according to the submitted documents, Prof. Daniela Orozova PhD collects 1201 points.

The scientific works presented by the candidate do not repeat those from previous procedures for acquiring a scientific title and academic position.

The analysis of the works of Prof. Daniela Orozova PhD categorically proves that the requirements of the Act of Development of the Academic Staff in the Republic of Bulgaria (ADASRB), the Regulations for its application and the Regulations for the specific conditions in IICT-BAS for awarding the scientific degree have been met „Doctor of Science".

2. Dissertation Contributions

I accept the author's reference for the contributions in the dissertation given on pages 168 and 169. The contributions have a scientific and scientific-applied nature and can be summarized in the two groups: enrichment of an existing scientific field with new knowledge and application of scientific achievements in practice:

***Scientific contributions* (enrichment of existing knowledge)**

Methods and models have been developed as a result of theoretical generalizations and are solutions to essential scientific and applied problems:

- Methods for evaluating and predicting the knowledge, skills and competencies of learners in the virtual educational space [6, 27, 32]; Fuzzy logic models of hierarchical multicomponent assessment of high- and low-order thinking skills [9, 13]; A method with web metrics and inductive fuzzy classification for evaluating the degree of use of web resources by learners [34]; Document type analysis method based on classification algorithms [30]; A method for building a model of the learner taking into account the change of knowledge, skills and competences and predicting for learners [15, 16].

- Generalizednet models: using different tools in e-learning environments and applying Data Mining tools: [2, 3, 20, 22, 24, 25, 26, 40]; in the processes of multicomponent assessment and formation of tests by defining meta-models [1, 6, 29]; in project-based learning and the gamification processes of an E-learning course [4, 33, 39].

- Weakly-centralized and highly-centralized model for quality assurance and accreditation in higher education, taking into account the hierarchical structure of the organization and allowing management and optimization of resources. A basic generalizednet model of information flows in data processing in self-assessment in Higher education. [14, 23, 31].

***Scientific-applied contributions* (application of scientific achievements in practice)**

Software tools were developed and experiments were conducted:

- A system was developed for monitoring and collecting data for learners, using the machine learning tools of the Orange Data Mining system [6, 16]. Software was created to analyze and compare the behavior of machine learning agents: Rule-Based System and Reinforcement Learning [21]. Software tools have been created to analyze sound frequencies and convert them into colors to assist hearing impaired users [41].

- Basic curriculum modules [18] and approaches to introducing basic modules and tools from Data Science in Higher Education have been proposed [5, 7, 19, 35, 36, 37, 38].

The publications related to the contributions are described, according to the numbering from the list of publications, by the topic of the dissertation.

3. Personal impressions of the candidate

I know Daniela Orozova from her participation in scientific forums and expert groups in procedures for program accreditation of higher education institutions in the country, as well as from her published materials. I have excellent personal impressions of the professionalism and thoroughness of Prof. Orozova's work as a teacher, researcher and organizer.

Conclusion

After getting acquainted with the presented materials and scientific works, analyzing their significance and the scientific and scientific-applied contributions contained in them, I give a convincing and categorically **positive conclusion** for awarding the scientific degree „Doctor of Sciences" to Daniela Ananieva Orozova.

I propose to the Scientific Jury to unanimously vote for Prof. Daniela Ananieva Orozova PhD the scientific degree „Doctor of Sciences" in the field of higher education: 4. Natural sciences, mathematics and informatics, professional direction: 4.6 Informatics and computer sciences.

30.10.2023

Member of a scientifi
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На основание
ЗЗЛД