

## OPINION

by Prof. DSc Veselin Totev Videv

head of the department "Informatics and Mathematics"

Trakia University - Stara Zagora

of dissertation for scientific degree "Doctor of Sciences"

in field of higher education 4. "Natural sciences, mathematics and informatics"

professional direction 4.6 "Informatics and computer sciences"

**Author:** Daniela Ananieva Orozova

**Topic:** "Application of data science in the virtual educational space"

**1. General presentation of the procedure and the dissertation.** 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 Republic of Bulgaria Act and by decision of Scientific Council of IICT (protocol No 9/ 28.08..2023) I have been designated as a member of the scientific jury for ensuring the procedure for the defense of a dissertation work on the topic "Application of data science in the virtual educational space", for the acquisition of 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", with author Prof. Dr. Daniela Ananieva Orozova. The presented set of materials is in accordance with the Regulation on the Implementation of the Development on Academic Staff in Republic of Bulgaria Act (RIDASRBA) and the Regulation on the specific conditions in the IICT for implementation of the law and includes the following documents: dissertation, abstract in Bulgarian, abstract in English, copy of the diploma for the educational and scientific degree "Doctor", list of scientific publications on the topic of the dissertation, copies of printed scientific publications on the topic of the dissertation, list of citations of publications on the topic of the dissertation work, general list of publications of the dissertation student, general list of citations, list of participation in scientific and research projects, CV, reference on the fulfillment of the requirements of IICT-BAS, order of the Director of IICT-BAS for the appointment of a scientific jury.

The dissertation student Daniela Ananieva Orozova graduated from higher education in 1990 at Kliment Ohridski University of Applied Sciences - Master of Informatics with a specialization in "Automated Learning Systems". In 2001, she defended a dissertation on "Intelligent databases and training systems" in the scientific specialty 01.01.12 "Informatics". From 04.11.2005 she was elected as "Assoc. professor" by the Higher Attestation Commission in professional direction 4.6 "Informatics and computer sciences", and from 27.04.2012 she held the academic position of "Professor" in professional direction 4.6 "Informatics and computer

sciences". From 28.04.2022 she holds the academic position of "Professor" at the Trakia University, Faculty of Economics, Department of "Informatics and Mathematics".

**2. Relevance of the topic.** The dissertation contains 190 pages, with 49 figures, a bibliography including 220 literary sources, and the dissertation consists of an introduction, 5 chapters and a conclusion. The dissertation examines current problems in the field of virtual educational space in the concept of the Internet of Things (IoT), in the concept of Big Data, in the concept of emerging technologies and risks associated with them. Possibilities for the application of means and tools for knowledge extraction in learning spaces are analyzed and solutions are sought for the integration of data science means for personalization and adaptation of electronic and distance learning environments. Techniques for modeling processes in an educational context are proposed. Important highlights in the dissertation are the presented formal models of processes and components of an educational space through the tools of generalized nets. Results of applications of the research and analysis in an educational environment and trends in the entry of data science into higher education are presented.

**3. Knowledge of the problem.** The dissertation student knows in detail the problems considered in the dissertation, in the resolution of which 220 literary sources were used, most of which are scientific publications in authoritative international journals with an impact factor or impact rank. This speaks to the insight of the author of the dissertation work into the modern scientific achievements related to the scientific field investigated in the dissertation, to which the author has made a significant contribution, both through the present dissertation and through his research in the last 10-15 years.

**4. Research methodology.** In the dissertation, methods and process models of the learners' activities related to Big Data Analytics, Data Mining, Web metrix, machine learning, fuzzy logic and others are proposed. A methodological approach was chosen for conducting the research, where the defined tasks correspond to the main goal set in the dissertation work and are a good guide for conducting the research. The significance of the obtained results is expressed in their applicability and the original approaches used to solve the tasks.

**5. Characteristics and evaluation of the dissertation and contributions.** In the dissertation are created:

- Methods and models, as a result of theoretical summaries of the processes of observation and analysis of the activities of learners, which can be used to evaluate and predict the knowledge, skills and competences of learners in the educational space, with the possibility of applying various computational models and dynamic evaluation criteria [6, 27, 32].

- Fuzzy logic models of hierarchical multicomponent assessment of various high- and low-order thinking skills [9, 13]. Methods for building a model of the learner, regarding knowledge, skills and competences and their prediction [15, 16]. Web metrics and inductive fuzzy classification methods for evaluating learner usage of web resources and document type analysis based on classification algorithms [30, 34].

- Generalized network models: for the integration of various tools in e-learning environments and the application of Data Mining tools [2, 3, 20, 22, 24, 25, 26, 40]; of the processes of multicomponent assessment and formation of tests by defining meta-models [1, 6, 29]; of the processes in project-based learning and the possibilities for gamification of an E-learning course [4, 33, 39]; for quality assurance and accreditation in higher education [14, 23, 31].

- The results of research and analysis of the main components and characteristics of the educational space presented in the publications [10, 11, 12, 27, 28, 34] are summarized. Software tools have been proposed and experiments have been conducted to collect and analyze learner data [6, 16]. Various techniques have been proposed for teaching students [5, 7, 19, 35, 36, 37, 38].

I especially want to emphasize the work of Prof. Daniela Orozova PhD on the project of Trakia University as a Research Higher School: "Development of scientific research and innovation at Trakia University in the service of health and sustainable well-being". Working in the scientific group "Digitalization, Innovation and Industry", software tools were created for the analysis of sound frequencies and their conversion into colors in the RGB model, to help hearing impaired users - an important scientific and applied contribution [41]. Contributions are linked to publication numbers, from the list of publications, on the topic of the dissertation.

**6. Assessment of the publications and contributions.** The results of the dissertation work are presented in 41 publications in the scientific databases Web of Science and Scopus, as 3 publications are with IF and 17 publications are with SJR, 15 publications are in journal articles or series, 26 publications are from reports of international scientific conferences. All publications are in the period 2014–2023 and are after the procedure for filling the academic position "Professor".

A list of 66 citations of 22 publications from the list on the subject of the dissertation work, in the scientific databases Web of Science and Scopus, is presented. Of these, 11 citations are in journals with IF, 48 in publications with SJR.

Prof. Daniela Orozova PhD has presented a complete list of her scientific production of 206 publications, in the period 1993–2023, 104 of which are after taking the academic position of "Professor" in 2012. She has publications in a number of prestigious publications and over 310 noticed citations to date.

The comparison of the minimum requirements from the regulations for the specific conditions in IICT -BAS for the scientific degree "Doctor of Sciences" in direction 4.6. "Informatics and Computer Sciences" and the materials presented by Prof. Dr. Daniela Orozova I place in the following table:

<b>Group</b>	<b>Minimal number points</b>	<b>Scientific indicator</b>	<b>Introduced points from the candidate</b>
<b>A</b>	<b>50 p.</b>	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)	<b>50 p.</b>
<b>B</b>	<b>100 p.</b>	Dissertation on "Application of data science in the virtual educational space"	<b>100 p.</b>
<b>C</b>	<b>100 p.</b> 15 publications with IF/SJR	41 publications, on the subject of the dissertation work, referenced and indexed in world-famous databases with scientific information (Web of Science and Scopus);	<b>655 p.</b> 17 publications with IF/SJR
<b>D</b>	<b>100 p.</b> 50 citations in WoS/Scopus	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.	<b>396 p.</b> 66 citations in WoS/Scopus
<b>Total</b>	<b>350 p.</b>		<b>1201 p.</b>

Therefore, Prof. Daniela Orozova PhD fulfills and significantly exceeds the conditions of ADASRB, RIDASRBA and the Regulations for the specific conditions in IICT-BAS in general and by individual groups indicators for obtaining the scientific degree "Doctor of Sciences".

**7. Teaching and learning activity.** As a teacher at the Trakia University, Prof. Daniela Orozova PhD has an active teaching activity, which is realized in leading lectures in the bachelor programs of the specialties "Software Engineering", "Information Technologies", "Information Technologies in Economics and Management", on the following compulsory subjects: "Java Programming", "Databases", "Analysis and Design of Databases", "Artificial Intelligence", "Development of Client-Server Applications" and many other elective and optional subjects, according to the approved curricula of the specified specialties. She has developed study programs for the disciplines she leads, actively participates in compiling and updating the study plans of the specialties in the professional areas 4.6. "Informatics and computer science" and 3.8. "Economics", as well as in the preparation of reports related to the periodic accreditation of Professional direction 4.6. "Informatics and Computer Science" at the Faculty of Economics. She is the head of the "Software Engineering" specialty at the Faculty of Economics. Conducts active teaching-methodical and scientific-research activities with the students of Thrace University. Prof. Daniela Orozova PhD is a member of the Union of Mathematicians, the Union of Scientists

in Bulgaria, the Society "Development of the Information Society" (RIO) and the Federation of Scientific and Technical Unions - Sofia.

**8. Abstract.** The abstract of the dissertation was written in Bulgarian and in English, according to the requirements of RIDASRBA. It consists of 60 pages, it gives a general description of the dissertation, reflects the main results of the dissertation and the list of publications on the topic of the dissertation work.

**CONCLUSION.** The dissertation *contains scientific results, which represent an original contribution to science* and meet all the requirements of the Act of Development of the Academic Staff in the Republic of Bulgaria (ADASRB), the Regulation on the Implementation of the Development on Academic Staff in Republic of Bulgaria Act (RIDASRBA). The presented materials and dissertation results fully correspond to the specific requirements of IICT-BAS. The dissertation work shows that the dissertation student Daniela Ananieva Orozova possesses in-depth theoretical knowledge and professional skills in direction 4.6 "Informatics and computer sciences", and in the present dissertation she obtained original and significant results that were cited and used by a number of scientific workers in our country and abroad. Due to the above, convinced and with the greatest pleasure, I give my *positive assessment* of the conducted research, based on the presented dissertation, abstract, scientific publications, citations, achieved results and contributions, and *I propose to the honorable scientific jury to award the scientific degree "Doctor of the sciences"* of Daniela Ananieva Orozova, in the field of higher education: 4. "Natural sciences, mathematics and informatics", professional direction "4.6. Informatics and Computer Science".

Date: 27. 10. 2023.

Opinion prepared by

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