

REVIEW

by **Corresponding Member Lyubka Atanasova Doukovska, DSc**
on the Thesis for awarding scientific degree “**Doctor of Sciences**”,
under the Professional Area 4.6. Informatics and Computer Sciences,
Author of the DSc Thesis: **Prof. Daniela Ananieva Orozova, PhD**

DSc Thesis Title:

“Application of data science in the virtual educational space”

In accordance with order No. 253/02.10.2023 of the Director of the Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences, I have been appointed as a member of the Scientific Jury regarding the DSc thesis titled: **“Application of data science in the virtual educational space”**, with author **Prof. Daniela Ananieva Orozova, PhD** for awarding the scientific degree “**Doctor of Sciences**” (DSc) in the Scientific Field 4. Natural Sciences, Mathematics and Informatics, the Professional Area 4.6. Informatics and Computer Sciences.

As a member of the scientific jury, I received a DSc thesis, an abstract to it and the accompanying administrative documentation.

In order to form the final evaluation of the dissertation, the requirements of the *Development of Academic Staff Act in the Republic of Bulgaria* are implemented the specific requirements in the Act’s Institutional Regulation shall be taken into consideration, where the respective norms are:

Art. 12. (announced as anti-constitutional by a Decision of the Constitutional Court No. 11 of 2010 – SG 81/10; new – SG 101/10) (1) (Suppl. - SG 30/18, in force from 04.05.2018) The scientific degree of Doctor of Science shall be awarded to a person with

an educational and scientific degree of a Doctor who meets the minimum national requirements under Art. 2b, Para. 2 and 3.

(2) For awarding of the scientific degree of a Doctor of Sciences the person referred to in Para. 1 must defend a dissertation paper subject to the terms and conditions and following the procedure of this act.

(3) (New - SG 30/18, in force from 04.05.2018) Admitted to defend their dissertation shall be persons who meet the minimum national requirements under Art. 2b, Para. 2 and 3.

(4) (Previous Art. 3 - SG 30/18, in force from 04.05.2018) The dissertation paper under Para. 2 must contain theoretical conclusions and solutions of major scientific and applies scientific problems, which correspond to the up-to-date achievements and can be regarded as a considerable and original contribution to science.

(5) (Previous Art. 4 - SG 30/18, in force from 04.05.2018) The dissertation paper referred to in Para. 2 shall be prepared independently and may not repeat literally the topic and a considerable part of the content of the paper presented for awarding of the educational and scientific degree of Doctor of Philosophy.

I accept that the requirement of Art. 12, Para. 1 of the *Development of Academic Staff Act in the Republic of Bulgaria* is met, as Prof. Daniela Ananieva Orozova has an educational and scientific PhD degree, according to a decision of the Presidium of the Higher Attestation Commission at the Council of Ministers of the Republic of Bulgaria, with diploma No. 27403 from 16.07.2001.

According to the presented reference, Prof. Daniela Ananieva Orozova fulfills the minimum national requirements under Art. 2b, Para. 2 and 3, I accept that the requirement of Art. 12, Para. 3 of the *Development of Academic Staff Act in the Republic of Bulgaria* is met.

I accept that that the requirement of Art. 12, Para. 5 of the *Development of Academic Staff Act in the Republic of Bulgaria* is met, because publications on this DSc thesis do not coincide with the publications for the educational and scientific PhD degree, also the

reviewed dissertation does not literally repeat the topic and a significant part of the content of the dissertation for the educational and scientific PhD degree.

The goal of the research is theoretical summaries of the processes of observation and analysis of the data from the dynamic interaction of objects in a learning environment and creation of methods and models for solving scientific or applied scientific problems in the virtual educational space.

In order to achieve the goal, the following four scientific tasks have been formulated:

1. Analysis of the application of tools for extracting knowledge from data in learning spaces and search for solutions for personalization of electronic and distance learning.

2. Creation of methods for evaluating and predicting the knowledge, skills and competences of learners in the virtual educational space.

3. Creation of models as a result of theoretical summaries of the processes of observation and analysis of the activities of learners related to Big Data Analytics, Data Mining, Web Metrics, Generalized Networks, Machine Learning and Fuzzy Logic.

4. Introduction of basic modules and tools of data science for solutions of applied scientific problems in education.

The dissertation is in volume of 189 pages. The work is structured in an introduction, five chapters, a conclusion, contributions of the dissertation work, declaration of originality of the results, a list of scientific publications on the subject of the dissertation work and a bibliography. The list of used literature includes 220 literary sources.

The introduction provides an overview of the main concepts and concepts of the researched area. The purpose of the dissertation work and the tasks related to its achievement are defined. The first chapter examines the field of virtual educational space, the main characteristics and possibilities of this type of infrastructure and the motivation for the conducted research work. In the second chapter, the state, proposed solutions, general characteristics and opportunities for integration of means and tools to the virtual educational space are presented. In the third chapter, methods and techniques are proposed for modeling the processes in the educational space, with the application of tools for

extracting data in an educational context (Educational Data Mining). The fourth chapter examines work processes in the virtual educational space and their formal models through the apparatus of generalized networks. In the fifth chapter, practices and trends in the entry of data science (Data Science) into higher education are presented. The conclusion summarizes the results and gives directions for further research on the topic of the dissertation work.

The cited sources in the DSc thesis are sufficiently diverse and are mostly written by foreign authors. The presence of Bulgarian authors in the used literature makes a good impression.

I accept that such defined DSc thesis's contributions can be defined as enriching the existing scientific field with new knowledge.

The publications on the dissertation work are forty-two, including one textbook, three publications in journals with an impact factor, ten publications in journals with an impact rank, two publications in refereed journals and twenty-six publications in proceedings of international conferences referred to in Scopus and/or WoS.

A list of sixty-six citations of works by Prof. Daniela Ananieva Orozova is presented. I accept that this issue is until the submission of the documents for the competition and does not include new citations.

The presented data give me reason to conclude that the results of the DSc thesis are provided with the necessary publicity.

The DSc abstract has a volume of 60 pages. It faithfully reflects the essence and content of the DSc thesis, including the purpose, subject, object and tasks of DSc thesis research and the ways of their realization.

In order to form the final evaluation of the dissertation, the requirements of the *Development of Academic Staff Act in the Republic of Bulgaria* and its Implementation Rules are to be taken into account, according to which I have the following remarks and recommendations:

1. The purpose of the dissertation is not clearly defined.

2. The contributions of the dissertation work are not convincingly formulated so as to contain theoretical summaries that correspond to modern achievements and represent a significant and original contribution to science.

I accept that the requirements of the *Development of Academic Staff Act in the Republic of Bulgaria*, the specific requirements in the Act's Institutional Regulation and the Rules for the specific conditions for acquisition of academic degrees and occupation of academic positions in the Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences are fulfilled. After an assessment of the DSc thesis and its publications, an analysis of their significance and the contributions they make, I give my positive assessment and I recommend to the Honorable Jury to award the scientific degree DSc to **Prof. Daniela Ananieva Orozova, PhD** in the Professional Area 4.6. Informatics and Computer Sciences, the Scientific Field 4. Natural Sciences, Mathematics and Informatics.

23.10.2023

Sofia

Signa

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Ljiljanka Doukovska/

НА ОСНОВАНИЕ
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