

OPINION

by **Prof. Maria Petkova Hristova, PhD**

on the Thesis for the acquisition of an educational and scientific degree "doctor"

Scientific Field: 4. Natural Sciences, Mathematics and Informatics;

Professional **direction**: 4.6. Informatics and computer science;

Doctoral program: Informatics

Author of the PhD Thesis: **IVAYLO ZHIVKOV BLAGOEV**

Thesis Title: **DEVELOPMENT AND DELIVERY OF PERSONALIZED E-LEARNING
CONTENT**

1. General description of the submitted materials and the PhD student

The opinion is prepared according to the order № 326 / 20.12.2024 of the Director of the Institute of Information and Communication Technologies (IICT) at BAS, by which I was appointed as a member of the scientific jury in connection with the procedure for the defense of the dissertation of the PhD student Ivaylo Zhivkov Blagoev on the topic "Development and delivery of personalized e-learning content" for the acquisition of the educational and scientific degree "Doctor" in the professional field. 4.6 Computer Science and Informatics.

Ivaylo Blagoev is a Master of Telecommunications Management and Bachelor - Systems Engineer at New Bulgarian University. He is Managing Director of PARADOX INTERACTIVE Ltd. and CEO of CONTIPSO Ltd. He has implemented a number of projects for the development and implementation of e-learning systems, construction, management, delivery and reporting of online multimedia e-distance courses, both in educational and training organizations and in leading business companies. Since 2017 he has been a PhD student in Computer Science at the Institute of Information and Communication Technologies at BAS.

The set of materials presented by the PhD student is in accordance with Article 8 of the Regulations on Specific Conditions for Acquisition of Scientific Degrees and for Holding Academic Positions at IICT-BAS.

2. Actuality, aim and tasks of the dissertation work

The dissertation is devoted to an undeniably topical area - e-learning with a focus on the development and presentation of personalized e-learning. Undoubtedly, the topic of the dissertation is relevant in computer science today and will remain so in the future, in view of the increasing key role of e-learning in education and the modern work environment. The relevance of the subject matter is also driven by the fact that the technological environment is changing rapidly, and by the need to continuously update training programs and tools. The pandemic of COVID-19 launched in 2020 has accelerated the digitalization of education and established e-learning as a core component of the modern education system. The personalized approach in e-learning requires the development of interactive and adaptive learning content that responds to the individual needs and skills of learners.

The aim of the dissertation is formulated as: *to propose a system and tools for the development and delivery of interactive personalized e-learning based on learners' prior knowledge*. The objective thus stated has the potential of a doctoral dissertation. To achieve it, 6 tasks are defined.

3. Knowledge of the problem

The clearly defined aim of the dissertation, the well motivated and concretely formulated main tasks for achieving the aim, the good and logically consistent structuring and the content-rich presentation of the dissertation text testify to the doctoral candidate's excellent knowledge in theoretical and applied aspect of the contemporary achievements in the problem area, the subject of the research. From the dissertation and its bibliography, containing 125 literature and internet sources (all correctly cited in the text), it can be concluded that the doctoral candidate has thoroughly and carefully studied the state of research in the area under consideration.

Besides, Ivaylo Blagoev's professional development and experience is entirely in the field of research. His entire nearly 15-year professional career has been related to the provision of e-learning processes in different types of organizations. He works what he researches in his work and what he writes about.

4. Research methodology

The research methodology used to realize the aim of the dissertation is adequate, appropriately motivated and chosen. Scientific methods suitable for development with applied orientation are applied: research, comparative analysis, synthesis, generalization, realization, experimental and innovative approaches. They contribute to the achievement of the main goal and the fulfillment of the set tasks of the research, which is proved by the presented results.

5. General characteristics of the dissertation and its contributions

The dissertation consists of 202 pages, 53 figures and 13 tables. It is structured in an introduction, 4 chapters, a conclusion and a summary of the results obtained, a graph of the dissertation, guidelines for future research, publications on the topic of the dissertation, noted citations, a statement of originality of the results, a bibliography, a list of figures and tables, a glossary of terms and abbreviations used in the dissertation. An opinion can be expressed that structurally and in terms of content the dissertation of Ivaylo Blagoev has been developed purposefully and appropriately in accordance with the defined main research thesis, and meets the requirements of Article 27(2) of the Regulations for the Implementation of the Law on the Development of Academic Staff in the Republic of Bulgaria.

A detailed review and analysis of the state of the art is provided in Chapter One of the study. The relevance of the topic and the need for creating and implementing new models for personalizing the learning process in the online environment are justified. The goal and the tasks for its achievement are defined. Chapter two is devoted to models and technologies for the development and delivery of personalized e-learning content. It presents: a method for generating training content using generative AI, a methodology for evaluating the functional capabilities of systems for creating and delivering e-learning, and an approach for developing content for e-learning courses.

Chapter three describes the process of designing the architecture of a web-based platform for developing and delivering interactive learning content. A model for personalized e-learning based on the learner's competency profile and a model for creating personalized e-learning content, including its main components and tools, are presented. Chapter four addresses the task of developing an innovative, multi-component web-based platform - a functioning prototype system for developing and delivering interactive e-learning content. The four Contipso modules form a complete solution for knowledge and learning management in organizations, providing flexibility, interactivity and the possibility of personalization of the

educational process. The prototype has been validated in an operational environment and is being used for the purposes of the CYBERsecurity 4 All STAKEholdeRs project funded by the Digital Europe Programme of the European Commission and the Research, Innovation and Digitalization for Smart Transformation Programme.

The main results obtained in the thesis are reported and summarized in the conclusion. The PhD student has pointed out some possibilities for future development of the considered problem in different directions: implementation of an AI model for generating text and multimedia training; training of an AI model to take the role of a training designer; development of a model for transforming generated content into structured content; development of an architecture for automatic creation of interactive multimedia training with the possibility of editing and validation by a human. I believe these directions for future work are correctly presented and achievable.

The finalization of the individual chapters, where main conclusions, generalizations and analyses are synthesized, as well as the thesis graph showing the relationship between the structure of the thesis, the tasks, the results and the publications made, are very good.

I would like to note the precision with which the thesis is laid out. The rules of good language and scientific style of writing research papers have been observed. The text of the thesis is clear, precise and analytical.

No plagiarism is found in the work.

The results achieved in the dissertation are original and in accordance with the stated aim and objectives.

I accept the 6 main contributions summarized by the PhD student at the end of the dissertation, which in my judgment can be systematized as scientific and applied. The contributions can be defined as enrichment of an existing scientific field with new knowledge and applied aspects.

I consider that the aim of the PhD has been achieved.

6. Assessment of the dissertation publications and personal contribution of the PhD student

The doctoral candidate has submitted a total of 7 author publications on the topic of the dissertation, made in refereed and indexed journals. One of them is in International Journal of Education and Information Technologies, North Atlantic University Union, a Web of Science indexed publication with IF. One publication is in the journal Cybernetics and Information Technologies, IICT of Bulgarian Academy of Sciences, a Scopus IF publication. Three are conference papers at IEEE Xplore.

All the papers are in English, one is independent, and in 5 of them the Ph.D student is the first author.

I believe that the results of the dissertation are very well presented to the scientific community. I have no doubts that the thesis and the results obtained are the personal work of the PhD student.

A total of 21 citations of the doctoral student's seven publications in reputable journals have been noted.

7. Fulfillment of the minimum requirements of the IICT for the PhD in PN 4.6.

According to the attached by the PhD student reference for fulfillment of the minimum requirements of the IICT at the required 30 points for group "D" (Scientific publications in publications that are refereed and indexed in world-known databases with scientific

information (Web of Science, Scopus, Zentralblatt, MathSciNet, ACM Digital Library, IEEE Xplore and AIS eLibrary) the PhD student collected 76 points from 5 submitted publications, which exceeds the requirement.

8. Abstract

The author's abstract corresponds in volume and content to the requirements of ZRASRB and the Regulations for specific conditions for acquiring scientific degrees and for holding academic positions in IICT.

9. Critical comments and recommendations

I have no significant critical comments. I noticed in the thesis (p. 119) and in the abstract (p. 17) in formulas 2 and 3 that the indices of the variables are in Cyrillic and Latin, but this is an error of a technical nature and does not detract from the positive impression of the thesis.

I recommend the doctoral student to continue the research started, as the topic is highly applicable and has broad prospects for development.

CONCLUSION

My assessment of the dissertation work, the abstract and scientific publications on the dissertation of Ivaylo Blagoev is entirely positive. The PhD student demonstrates a thorough theoretical knowledge of the specialty of the PhD program "Informatics " and high level of proficiency in the terminology of the subject of the thesis and proven ability for independent research.

Considering the scientific and applied contributions, which represent an original contribution to science, I think that the dissertation fully meets the requirements of the Law on the Development of the Academic Staff in Republic of Bulgaria, the Regulations for its implementation, as well as the Regulations for the specific conditions for acquisition of scientific degrees and for holding academic positions in IICT. This gives me confidence to recommend to the esteemed members of the scientific jury **to award to Ivaylo Zhivkov Blagoev the educational and scientific degree "Doctor" in the professional field: 4.6. Informatics and Computer Science, doctoral programme Informatics.**

28.01.2025

