

STATEMENT

**by Assoc. Prof. Gabriela Georgieva Kiryakova, PhD
Trakia University – Stara Zagora**

on the Ph.D. thesis for awarding the educational and scientific degree “Doctor”

Area of higher education: 4. Natural Sciences, Mathematics and Informatics

Professional field: 4.6. Informatics and Computer Science

Ph.D. program: Informatics

Author: Maria Metodieva Gorgorova

Title: Intelligent Components in E-Learning Environments

Supervisors: Prof. Stanka Hadzhikoleva, PhD and Assoc. Prof. Silvia Gaftandzhieva, PhD

1. General presentation of the procedure and the PhD student

By Order No. ПД 22-1412 of 17.07.2026 issued by the Rector of Plovdiv University “Paisii Hilendarski”, I was appointed as a member of the scientific jury in the procedure for the defense of a Ph.D. thesis titled “Intelligent Components in E-Learning Environments” for obtaining the educational and scientific degree “Doctor” in the area of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.6. Informatics and Computer Science, Ph.D. program “Informatics”.

The author of the Ph.D. thesis is Maria Metodieva Gorgorova – a full-time Ph.D. student in the Department of Computer Informatics at the Faculty of Mathematics and Informatics of Plovdiv University “Paisii Hilendarski”, supervised by Prof. Stanka Hadzhikoleva, PhD and Assoc. Prof. Silvia Gaftandzhieva, PhD.

Maria Metodieva Gorgorova holds a Bachelor’s degree in “Software Technologies and Design” and a Master’s degree in “Business Informatics with English” from Plovdiv University “Paisii Hilendarski”. At present, she works as a coordinator at the Union of Scientists in Bulgaria, branch Plovdiv, and as a part-time assistant lecturer at the Academy of Music, Dance and Fine Arts “Prof. Asen Diamandiev” and Plovdiv University “Paisii Hilendarski”, teaching courses “Databases”, “Software Technologies 2”, “Software Project Management”, “Internet Programming with PHP and MySQL” and “Interactive Design”.

The submitted materials for the procedure comply with the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for the Development of the Academic Staff of Plovdiv University “Paisii Hilendarski”.

2. Relevance of the topic

Contemporary learners have high expectations for educational content. To increase their motivation and engagement – factors that directly influence the quality of learning outcomes – the content must undergo substantial transformation. It should be dynamic, interactive, and gamified to meet the needs of the digital generation and stimulate active participation in the learning process.

Designing and developing intelligent, gamified educational resources requires significant effort from educators, including pedagogical, technological, and methodological preparation. Artificial intelligence can greatly support and facilitate the creation, adaptation, and personalization of content, as well as automate the provision of intelligent feedback.

The effective application of artificial intelligence tools presupposes the development of clear conceptual models and a methodology for creating educational resources that ensure pedagogical appropriateness and quality. In this context, the Ph.D. thesis topic is significant and relevant, as it aligns with contemporary trends in the digital transformation of education and offers solutions to improve learning effectiveness through intelligent, adaptive, and gamified resources.

3. Knowledge of the problem

The list of references includes 169 sources. Maria Gorgorova's literature review demonstrates in-depth knowledge of contemporary trends in the digital transformation of education, gamification, and the application of artificial intelligence, as well as the existing problems. She outlines the potential of integrating artificial intelligence as a possible solution capable of overcoming current challenges.

4. Research methodology

The research methodology used by Maria Gorgorova is appropriately chosen and allows achieving the stated goal and fulfilling the formulated tasks. The developed conceptual models, methodology, and software solutions show good logical coherence between the theoretical and methodological parts of the research, and the practical implementation confirms the applicability of the proposed models.

5. Characteristics and evaluation of the research and contributions

In the Ph.D. thesis introduction, Maria Gorgorova outlines the goal, tasks, and justification for the choice of topic.

In **Chapter 1, “Innovative Approaches and Trends in Contemporary Education”**, the Ph.D. student presents a systematic review and analysis of contemporary scientific literature on the digital transformation of education, gamification, and the application of artificial intelligence in learning. Special attention is given to the role of artificial intelligence in education. Maria Gorgorova studies and systematizes attitudes toward its use in educational institutions based on various publications, including results from an empirical study of student attitudes in which she participated. She analyzes the integration of artificial intelligence in modern educational software solutions. The Ph.D. student examines good practices for gamifying courses and the applicability of educational games across disciplines, as well as existing games for teaching and learning SQL.

The findings outline a research gap: the lack of architectural models and software components for integrating intelligent components into popular e-learning environments, which justifies the Ph.D. thesis goal and tasks.

In **Chapter 2, “Conceptual Models for the Development and Integration of Intelligent Game Components in E-Learning Environments”**, Maria Gorgorova presents the research methodology. She derives criteria for selecting and integrating intelligent tools in e-learning environments, considering both pedagogical goals and the technological characteristics of the educational environment. The Ph.D. student proposes a methodology for creating educational mini-games using generative tools, based on an iterative, multi-stage model. The methodology is designed to support educators without advanced programming knowledge while enabling personalization and rapid prototyping.

Maria Gorgorova proposes a conceptual model of the game “SQL Escape Room”, aimed at defining a framework for gamification that supports the acquisition of knowledge and practical skills in working with relational databases and SQL, as well as a conceptual model of the gamified learning

environment “Temple of Data”. Based on a comparative analysis of architectural approaches, she justifies and develops a conceptual model for integrating educational games into e-learning systems.

In **Chapter 3, “Development and Integration of Intelligent Game Components in an E-Learning Environment”**, the Ph.D. student presents the practical implementation of the proposed conceptual models. She develops various types of educational mini-games for the course “Databases”, focused on training specific cognitive skills from Bloom’s taxonomy, and creates them with the help of generative artificial intelligence, following the proposed methodology.

Maria Gorgorova implements two complex applications: “SQL Escape Room” – a web-based application implementing the proposed conceptual model, and “Temple of Data” – a web-based gamified educational environment for learning SQL.

A significant contribution is the developed module for integrating educational games into Moodle – “AI Games”, which enables adding interactive educational games as activities in electronic courses. The proposed solution provides a standardized, extensible mechanism for including external game applications in e-learning systems without changing their core functionality.

In **Chapter 4, “Experimental Study and Evaluation”**, Maria Gorgorova analyzes the experimental studies conducted, which are primarily exploratory and evaluative and are not aimed at proving statistically significant dependencies or generalizing results. This methodological characteristic is correctly stated by the Ph. D. student, and the results are positioned realistically – as indicative and as a basis for future studies with larger samples and controlled conditions. Despite these limitations, the results confirm the potential of gamification as an effective approach in teaching “Databases” by creating a motivating learning environment that supports knowledge acquisition and logical thinking. At the same time, the results highlight the need for a careful balance between game mechanics and educational goals so that entertainment aspects do not overshadow the game's educational function.

I accept the formulated contributions of the research, among which the following stand out:

- a developed conceptual model and methodology for designing and developing intelligent and gamified educational resources that integrate pedagogical approaches, game mechanics, and artificial intelligence technologies within a unified conceptual framework supporting learning and the creation of interactive educational applications;
- a developed set of intelligent and gamified educational resources implementing the proposed conceptual models and intended for teaching the course “Databases”;
- a developed module for integrating educational games into Moodle;
- implemented software prototypes of intelligent and gamified educational resources for teaching students in the course “Databases”, which have been experimentally tested.

6. Evaluation of the publications and the Ph.D. student’s personal contribution

Maria Gorgorova has presented 8 publications: 2 in journals and 6 in conference proceedings. Three of the publications are indexed in Scopus and Web of Science. The ideas discussed in them directly correspond to the topic of the Ph. D. thesis. The research results have been presented at international and national conferences and seminars. Maria Gorgorova's research activity and results are recognizable, as evidenced by 9 citations for 4 of the publications.

I do not doubt the Ph.D. student’s contribution to the submitted publications.

7. Abstract

The abstract is 32 pages long and sufficiently reflects the content of the Ph.D. thesis, the research results obtained, and the contributions formulated.

8. Recommendations for future use of the Ph.D. thesis contributions and results

My recommendations to Maria Gorgorova are to continue building on the developed conceptual models and intelligent educational resources, which aligns with her development perspectives. Conducting experimental studies to validate the proposed models is necessary to prove their effectiveness and enable subsequent application through adaptation in various academic disciplines. Another possible direction for development is creating a methodology for designing AI-based educational resources to support educators.

Conclusion

The PhD thesis contains scientific, scientific-applied and applied results, which are sufficient for acquiring the educational and scientific degree "Doctor". The research meets the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, its implementing regulations, and the corresponding Regulations of Plovdiv University "Paisii Hilendarski".

The Ph.D. thesis shows that Maria Gorgorova possesses in-depth theoretical knowledge in the scientific specialty "Informatics" and demonstrates the qualities and skills to conduct scientific research independently.

In view of the above, I give my **positive assessment** of the research conducted and propose that the honorable Scientific Jury **award the educational and scientific degree "doctor" to Maria Metodieva Gorgorova** in the area of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.6. Informatics and Computer Science, doctoral program "Informatics".

26.08.2026

Member of the Scientific Jury:

Assoc. Prof. Gabriela Kiryakova, Ph.D.