REVIEW

by Prof. Desislava Ivanova Paneva-Marinova, PhD
Institute of Mathematics and Informatics, Bulgarian Academy of Sciences

on the Dissertation for awarding educational and scientific degree "**doctor**" (PhD),

in the Area of Higher Education 4. Natural Sciences, Mathematics and Informatics,

Professional Field 4.6. Informatics and Computer Sciences

PhD Program „Informatics"

Author: Valentina Todorova Terzieva-Bogoycheva

Topic: Technological Approaches for Personalized Learning Using Educational Computer Games

Scientific supervisors: Prof. Boyan Bontchev, PhD, Faculty of Mathematics and Informatics, Sofia University and Assoc. Prof. Rumen Andreev, PhD, Institute of Information and Communication Technologies, Bulgarian Academy of Sciences.

1. General presentation of the procedure and the PhD student

In accordance with Order № 168/05.07.2023 of the Director of Institute of Information and Communication Technologies, Bulgarian Academy of Sciences (IICT-BAS) I have been appointed as a member of the Scientific Jury to provide the procedure for the defense of a dissertation titled "Technological Approaches for Personalized Learning Using Educational Computer Games" of Valentina Todorova Terzieva-Bogoycheva for awarding the educational and scientific degree "doctor" in the Area of Higher Education 4. Natural Sciences, Mathematics and Informatics, the Professional Field 4.6. Informatics and Computer Sciences of the PhD Program "Informatics". The author Valentina Todorova Terzieva-Bogoycheva is a self-study PhD student at the Institute of Information and Communication Technologies, Bulgarian Academy of Sciences, with scientific supervisors Prof. Boyan Bontchev, PhD, Faculty of Mathematics and Informatics, Sofia University and Assoc. Prof. Rumen Andreev, PhD, Institute of Information and Communication Technologies, Bulgarian Academy of Sciences.

The presented Opinion is made in accordance with the Act for the Development of the Academic Staff in the Republic of Bulgaria, the Rules for its implementation and the Rules for the conditions and the order for acquiring scientific degrees and for occupying academic positions in IICT-BAS.

The set of materials by Valentina Todorova Terzieva-Bogoycheva is in accordance with Article 6 (8) of the Rules for the conditions and the order for acquiring scientific degrees and for occupying academic positions in IICT-BAS.

2. Relevance of the topic

The dissertation presents the results of research on approaches for personalized learning using educational computer games, a recent development of great scientific and practical interest.

3. Knowledge of the problem

The realization of the dissertation goal requires in-depth theoretical knowledge and practical skills. It is evident from the dissertation and the materials presented that the PhD student has a solid theoretical background and extensive insight into modern educational technologies required to achieve the research objectives. Valentina Terzieva-Bogoycheva demonstrates good knowledge of the research object. He formulates clearly and performs the tasks leading to specific results.

4. Research methodology

I consider the methodology used by the PhD student to achieve the formulated objectives and corresponding tasks to be appropriate, well-motivated and suitable for the successful implementation of the research, which is evident from the results obtained.

5. Characteristics and evaluation of the dissertation and contributions

The dissertation of Valentina Terzieva-Bogoycheva contains 172 pages, presented by a table of contents, an introduction, five chapters, a conclusion, main results (contributions) of the dissertation (in the conclusion), a bibliography of 214 literature sources in English and Bulgarian, five appendices, a glossary of terms and abbreviations used, a list of figures, a list of tables, a list of author's publications on the topic of the dissertation (in the conclusion), an approbation of results (in the conclusion), and a declaration of originality of the results and contributions.

The object, subject, goal and objectives of the dissertation as well as the methodology used are presented in the **Introduction**.

Chapter 1 presents technology-based approaches to learning with a focus on personalized learning and the use of educational computer games. An evaluation is made of the application of technology-based learning methods and in particular of game-based learning.

Chapter 2 analyses the use of ICT tools and educational games in Bulgarian schools, taking into account benefits and constraints in their implementation and requirements and preferences of users (teachers and learners).

In **Chapter 3** basic models for designing educational video games are described. The paper presents the developed *combined user model of a personalized educational computer game*, a *metamodel of the learning content in an educational video game*, and *a conceptual model for personalizing an educational video game.*

Chapter 4 describes a conceptual model of an enriched maze type educational video game used in the APOGEE platform. A methodology for customising an enriched maze type educational video game using embedded mini-games is also presented. A concrete realization of a customized educational video game of the enriched maze type in the APOGEE platform is presented - the educational video game "Asenevtsi".

Chapter 5 proposes a methodology for validating and evaluating personalization in enriched maze educational video games and its application.

In the **Conclusion**, relevant summaries are made on the obtained results and main contributions. Opportunities and directions for further research on the topic are outlined. A list of scientific publications on the topic and citations is given.

Significant results (contributions) achieved in the dissertation research:

- A conceptual student model aimed at the personalization of educational computer games, was created
- A methodology for personalizing educational video games, based on a model of the learner and enriched with built-in didactic mini-games, was created.
- A methodology for customizing a maze-type educational video game enriched with embedded didactic mini-games was created.
- A methodology was developed to investigate, validate, and evaluate the learnability, game impact, effectiveness, and attitudes of using a personalized maze-type educational video game.
- A personalized maze-type educational video game, enriched with embedded didactic mini-games dedicated to Bulgarian medieval history, was created and successfully validated against the above methodology.

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

The author's list of publications on the subject of the dissertation includes 8 titles, 4 of which are indexed in Scopus or Web of Science. One publication is in a scientific journal with SJR (*International Journal of Differential Equations and Applications*). Two publications are in international refereed scientific journals and six publications are in proceedings of international and national conferences. Four of the publications are in English and four are in Bulgarian. In five publications Valentina Terzieva-Bogoycheva is the first author. In three publications Valentina Terzieva-Bogoycheva is the only author, the others are co-authored. The PhD student has presented results at six scientific conferences. 33 citations were noted.

Having read the dissertation and the submitted materials, I believe that the formulated contributions and the obtained results are the personal work of the PhD student.

7. Abstract

The abstract is 51 pages long and correctly reflects the structure of the dissertation, the results obtained and the conclusions drawn from the study. The requirements of the Act for the Development of the Academic Staff in the Republic of Bulgaria, the Rules for its implementation and the Rules for the conditions and the order for acquiring scientific degrees and for occupying academic positions in IICT-BAS have been met.

8. Critical remarks, questions and recommendations

I have no critical remarks. I have a few questions:

1. The sections of Chapter 2 and Chapter 5 comment on the results of several different surveys that served as the basis for the dissertation research. Because of this, no clear distinction is made between the different surveys to give specific information - period, target groups, questionnaires and principal. In addition, the author to comment on how relevant their results are at the present time.

2. How was the International Journal of Differential Equations and Applications, whose subject matter is mainly in the field of Differential Equations, chosen for publication?

CONCLUSIONS

The dissertation **contains *scientific, and applied results, which represent an original contribution to science*** and ***meet all the requirements*** of the Law for the Development of Academic Staff in the Republic of Bulgaria, the Rules for its Implementation and the Rules for the conditions and the order for acquiring scientific degrees and for occupying academic positions in IICT-BAS.

The dissertation shows that the PhD student Valentina Todorova Terzieva-Bogoycheva **possesses** in-depth theoretical knowledge and professional skills in the scientific specialty "Informatics", **demonstrating** qualities and skills for independent scientific research.

Due to the above, I confidently give my ***positive evaluation*** for the conducted research, presented in the dissertation, abstract, achieved results and contributions, and ***I propose the honorable scientific jury to award educational and scientific degree "doctor"*** to Valentina Todorova Terzieva-Bogoycheva in the Area of Higher Education 4. Natural Sciences, Mathematics and Informatics, Professional Field 4.6. Informatics and Computer Sciences, PhD Program "Informatics".

23.08.2023

На основание
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