R E V I E W

by Prof. Eugenia Kovatcheva, PhD

University of Library Studies and Information Technologies

for the acquisition of the educational and scientific degree "Philosophy Doctor"

in the professional direction "4.6 Informatics and computer sciences",

PhD program Informatics

order No. 168, 05.07.2023 of the Director of IIKT-BAS art. cor. St. Margenov

with a dissertation on:

TECHNOLOGICAL APPROACHES FOR PERSONALIZED LEARNING
USING EDUCATIONAL COMPUTER GAMES

by Eng. Valentina Todorova Terzieva-Bogoycheva,

PhD student at IIKT-BAS

with scientific supervisor Prof. Boyan Bonchev PhD, FMI-SU

and Assoc. Dr. Rumen Andreev, IIKT-BAS

Relevance of the topic

On the subject of personalized learning, various approaches have been sought in the last 10-15 years. It has gone from testing approaches, learning styles, data collecting and training with artificial intelligence, etc.

The approach that PhD student Terzieva-Bogoycheva presents is another approach to creating personalized learning resources. It analyzes the achievements so far and presents its solution with the current technological means.

Criteria and indicators for awarding scientific and doctoral degrees

The dissertation work and 4 publications on the topic presented by PhD student Eng. Valentina Todorova Terzieva-Bogoycheva (in total there are 8 articles presented, but only 4 are in relevant databases) cover the minimum national requirements and the requirements of IIKT-BAS for awarding educational and scientific doctorate degree.

The candidate's contributions are significant and, as mentioned above, the topicality of the topic is in line with the process of searching for effective methods in learning in the enriched digital environment.

General characteristics of the candidate's dissertation work

Doctoral student Eng. Valentina Bogojcheva presents a dissertation, spread over 144 pages, 5 appendices, 215 sources, 31 figures and 11 tables. The dissertation consists of five chapters with an introduction and a conclusion:

Chapter 1. **Overview and analysis of technology-based learning approaches** - a critical analysis of modern educational technologies and the main concepts, types and characteristics of educational computer games and their use in an educational context is made.

Chapter 2. **Application of games in education** is aimed at analyzing ICT means in educational games in Bulgarian schools. The benefits and obstacles in their implementation are presented and analyzed. As a conclusion, the need to create educational video games as electronic resources for target groups is motivated.

Chapter 3. **Modeling Personilized Educational Video Games** is devoted to the basic models needed when designing educational video games. The main aspect here is the developed combined learner model and its customization.

Chapter 4 **Personalized Enriched Maze Educational Video Games** presents a conceptual model of an enriched maze educational video game-the basis of the process of creating this type of game through the APOGEE platform using embedded mini-games.

Chapter 5. **Validation and Evaluation of a Personalized Enriched Maze Educational Video Game** presents the developed methodology for validation and evaluation of customized enriched maze educational video games. A methodology for conducting the experiments is proposed, including qualitative and quantitative evaluation characteristics. Results of the experimental evaluation were analyzed.

The PhD student has thoroughly and reasonably presented the theoretical foundations of serious learning games and the interdisciplinary approach of her research. The limitation she imposed on herself in the beginning was educational video games.

The PhDstudent's goal is to "analyze existing approaches to the design of educational games and develop a model and methodology for creating personalized educational video games to be validated through practical experiments," which it achieves with seven clear and specific tasks.

Valentina Terzieva-Bogoycheva presents 3 hypotheses

1. In Bulgaria, there are conditions for applying ICT in education - availability of technical means and motivation of teachers;
2. In pedagogical circles, there is an idea about the types of computer games that are most preferred for learning;
3. Personalized video games are more relevant and rated more highly by their intended learners than non-personalized ones.

In the conclusion on page 140 is written: The studies showed that in most Bulgarian schools there are good conditions for using ICT - availability of technical means and corresponding attitudes and motivation of the teachers. Among the teachers surveyed, there is already an understanding of the concept of educational games and an idea has been formed about the types of computer games that are most preferred and suitable for learning, but there are still some technological, administrative and organizational obstacles to the wider use of educational video games in the classroom. but did not explicitly note whether her hypotheses were confirmed or rejected.

Methodology used in scientific research

Eng. Valentina Bogojcheva uses scientific research approaches suitable for the researched area, literary analysis, modeling and empirical evaluation methods as well as practical experiments.

The PhD student is proficient in the terminology of educational resources and user experiences and aptly describes user-centered design and its characteristics.

Presenting games as a means of learning is increasingly tolerated in educational environments because it makes it easier to accept new things.

Contributions

The PhD student Eng. Valentina Bogojcheva presented 7 scientific, scientific-applied and applied results without differentiating them:

1. A conceptual composite learner model was created for use in customizing educational computer games.
2. A classification of the types of educational computer games is proposed.
3. A qualitative and quantitative assessment of the use of ICT and educational computer games in Bulgarian schools is presented.
4. A methodology for personalizing educational video games based on a combined model of the learner was created.
5. A methodology was created for the customization of an educational maze-type video game enriched with built-in didactic mini-games.
6. A methodology was developed to investigate, validate, and evaluate learning suitability, game impact, effectiveness, and attitudes when using a personalized maze-type educational video game.
7. A universal and personalized maze-type educational video game was created, enriched with built-in didactic mini-games dedicated to Bulgarian medieval history, which were successfully validated against the above methodology.

I would define 1-3 as scientific, 4-6 as scientific-applied and 7 as applied.

General characteristics of the applicant's publication activity

Doctoral student Eng. Terzieva presents 8 articles related to the topic of the dissertation, of which 1 is in Scopus with SJR 0.1 and 3 in Web of Science.

1. Dankov, Y., Antonova, A., Terzieva, V., Bontchev, B. (2021) Applying User-Centered Design for a Climate Resilience Video Game. International Journal of Differential Equations and Applications, 20, 2, Academic Publications, Ltd., ISSN:1311-2872 (Print); 1314-6084 (Online), pp. 147-156. SJR 0.1, Q4, Scopus
2. Terzieva, V. (2019). Personalization in Educational Games – A Case Study. Proceedings of the International Conference EDULEARN, pp. 7080-7090, IATED, ISSN:2340-1117 https://doi.org/10.21125/edulearn.2019.1694 WoS

3. Terzieva, V. (2018). The Potential of Educational Maze Games for Teaching in Primary Schools. Proceedings of the International Conference of Education, Research and Innovation ICERI2018, pp. 2480-2489, IATED, ISBN:978-84-09-05948-5, ISSN:2340-1095, https://doi.org/10.21125/iceri.2018.1542 WoS

4. Terzieva, V., Paunova-Hubenova, E., Dimitrov, S., Dobrinkova N. (2018). ICT in Bulgarian Schools – Changes in the Last Decade. Proceedings of the International Conference on Education and New Learning Technologies EDULEARN18, pp. 6801-6810, IATED, ISSN:2340-1117, https://doi.org/10.21125/edulearn.2018.1612, WoS

5. Bonchev, B., Terzieva, V., Dankov, Ya. (2021). Educational video games-mazes. Magazine Nauka, XXXI, 1, Union of Scientists in Bulgaria, 2603-3623 (electronic), pp. 25-33, available at: http://spisanie-nauka.bg/arhiv/1-2021.pdf

6. Terzieva, V. (2018). Video games for learning in school. Reports of the National Conference "Education and Research in the Information Society", ARIO and IMI-BAN, ISSN:1314-0752, pp. 84-93, available at: http://sci-gems. math.bas.bg:8080/jspui/bitstream/10525/2950/1/ERIS2018-book-p09.pdf

7. Todorova, K., Terzieva, V., Kademova-Katsarova, P. (2018). Educational games in school - research and analysis. Reports of the National Conference "Education and Research in the Information Society", ARIO and IMI-BAN, ISSN:1314-0752, 116-125, available at: http://sci-gems.math.bas.bg:8080/ jspui/ bitstream/10525/2954/1/ERIS2018-book-p13.pdf

8. Terzieva, V., Todorova, K., Kademova-Katsarova, P. (2016). Teaching through technology – the shared experience of Bulgarian teachers. Reports of the National Conference "Education and Research in the Information Society", ARIO and IMI-BAN, ISSN:1314-0752, 185-194 available at: http://sci-gems.math.bas.bg: 8080/jspui/bitstream /10525/2756/1/ERIS2016-book-p19.pdf

Evaluation of the short version of the thesis

The short presentation of the thesis fully reflects the dissertation work.

Scientific and scientific-applied activity

The presented glossary with used terms and abbreviations at the beginning of the thesis gives a good impression, as well as noting the citation of which chapters in which articles it appears.

The PhD student has approved her studies with her work on projects at National Scientific Fund, Center for Excellence and Erasmus+ as follows

1. Project "Analysis of training data for the integration of ICT resources in Bulgarian schools", financed by the "Scientific Research" fund of the Ministry of Education and Culture, Competition for funding research of young scientists under Contract No. DM02/1/2016. The project was successfully completed in 2019.
2. Project APOGEE - "Innovative platform for intelligent adaptive video games for learning", headed by Prof. Boyan Bonchev, financed by the "Scientific Research" fund of the Ministry of Education and Culture under Contract No. DN12/7/2017. The project was successfully completed in 2022 with the highest grade.
3. Project HERITAGE'BG - with the head of the task Prof. Boyan Bonchev. Procedure BG05M2OP001-1.001-0001 Construction and development of a Center of Excellence, 2020-2021.
4. Project e-Creha - "education for Climate Resilient European Architectural Heritage", 2020-2023, with the head of the Bulgarian team Prof. Boyan Bonchev, financed under the Erasmus + program, with number 2020-1-NL01-KA203-064610 .

A significant part of achieved results were presented by the PhD student in various national and international scientific conferences and other scientific and popular science events.

6 of her articles have been cited a total of 33 times, which is an extremely good result. One of her articles has 15 citations.

Critical notes

One section of PhD thesis is Bibliography with a list of the literature used, as mentioned above, they are 215 sources. In the footnotes there are listed and Internet addresses more than 11 more in number. It would be better to have one common list in the section Bibliography. Despite the numerous sources, there is a lack of citations of some Bulgarian

colleagues in the field of education and adaptive systems that have been published on behalf of SU, which would perhaps add flexibility in personalizing learning.

The term learning context is used - better is educational context. (In Bulgarian Language there are different terms).

Games in education is a hot topic. I would suggest to add more information what kind of skills the maze games develop.

Personal impressions and opinion

I have no personal impressions of Eng. Valentina Todorova Terzieva-Bogoycheva. I have become familiar with her research activities from the materials shared with me.

Questions

To what extent do you have a connection with Bulgarian education? How familiar is she with the learning process?

Reviewer's overall conclusion

From everything that has been said so far, I express my positive assessment and recommend to the esteemed committee to award the educational and scientific degree PhD in professional direction "4.6 Informatics and computer sciences", doctoral program Informatics to Eng. Valentina Todorova Terzieva-Bogoycheva.

На основание

ЗЗЛД