REVIEW

by Associate Professor Gabriela Georgieva Kiryakova, Ph.D.
Trakia University – Stara Zagora
on the Ph.D. thesis for acquiring the educational and scientific degree "Doctor"

Area of higher education: 4. Natural sciences, Mathematics and Informatics
Professional field: 4.6. Informatics and Computer Science
Doctoral program: Informatics

Ph.D. Student: **Vladimir Hariev Tsvetkov**
Topic: **Adaptivity in an e-learning system based on pedagogical patterns**
Scientific Supervisor: **Assoc. Prof. Stanka Hadzhikoleva, PhD**

1. General description of the submitted materials

By order No. РД-21-653 / 21.03.2024 by the Rector of the University of Plovdiv "Paisii Hilendarski" I have been appointed as a member of a scientific jury to ensure a procedure for the defense of a Ph.D. thesis work on the topic "Adaptivity in an e-learning system based on pedagogical patterns" in the procedure for acquiring 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, doctoral program " Informatics".

The author of the Ph.D. thesis is Vladimir Hariev Tsvetkov - a full-time Ph.D. student at the Department of Computer informatics at the Faculty of Mathematics and Informatics, the University of Plovdiv "Paisii Hilendarski" supervised by Assoc. Prof. Stanka Hadzhikoleva, Ph.D.

The set of materials presented by Vladimir Tsvetkov follows the requirements of the Law for the development of the academic staff in the Republic of Bulgaria and the Regulations for the development of the academic staff of the University of Plovdiv "Paisii Hilendarski" and includes the following documents:
 – an application to the Rector of the University of Plovdiv "Paisii Hilendarski" for starting a procedure for acquiring the educational and scientific degree "doctor";
 – CV in European format;
 – protocol of preliminary discussion in the department;
 – abstract of the Ph.D. thesis;
 – declaration of originality and authenticity of the attached documents;
 – certificate of fulfillment of the minimum national requirements;
 – list of scientific publications on the topic of the Ph.D. thesis;
 – Ph.D. thesis;
 – copies of scientific publications on the topic of the dissertation.

2. Brief biographical data for the Ph.D. student

Vladimir Tsvetkov has graduated from the University of Plovdiv "Paisii Hilendarski" with a Master's degree in Informatics. Since 2020, he has been a full-time Ph.D. student at the Department of Computer Informatics at the Faculty of Mathematics and Informatics.

Since 2019, he has been involved in the development of automated business processes, holding the position of a software engineer in various companies.

3. Relevance of the topic and appropriateness of the goals and tasks

The use of patterns in the field of pedagogy is an opportunity to share successful practices in solving problems related to the educational process. Pedagogical patterns affect different aspects and problems in teaching and learning. They offer a set of actions and strategies for problems solution based on the good practices that have proven their effectiveness in different contexts.

The rapid and comprehensive penetration of digital technologies in education leads to changes in teaching, learning, organization and implementation of the educational process. The use of different software products as learning management systems requires the integration of pedagogical patterns via appropriate software solutions.

In this context, Ph.D. thesis topic is relevant. The goal of the Ph.D. student is to explore the possibilities of using pedagogical patterns in e-learning by developing new models and tools integrating pedagogical patterns to optimize the learning process. To achieve the goal, specific tasks are formulated in a logical sequence.

4. Knowledge of the problem

Vladimir Tsvetkov demonstrates knowledge in the field of the subject under consideration by presenting his vision of the existing problems and their solutions.

The PhD student makes a theoretical analysis of the scientific literature on the issues related to pedagogical patterns and examines various software tools and applications using pedagogical patterns. The list of references includes 139 sources (126 in Latin and 13 in Cyrillic). It can be concluded that the Ph.D. student has studied the researches in the subject area under consideration. Based on the studies, Vladimir Tsvetkov formulates an existing problem – the lack of software products for maintaining and using pedagogical patterns in e-learning systems and offers a suitable solution.

The in-depth analyzes combined with the proposed conceptual framework of an e-learning system based on pedagogical patterns and the developed software prototype are proof of knowledge of the research problem at theoretical and applied levels.

5. Research methodology

The research methodology used by the Ph.D. student is appropriately chosen and allows the achievement of the formulated goal and supporting tasks. The results achieved during the research – the developed conceptual model and the corresponding software prototype for creating pedagogical patterns in an e-learning environment are the proof of the appropriately selected methodology.

6. A characteristic and evaluation of the research work

The Ph.D. thesis is structured in the following parts: an introduction, four chapters and a conclusion. There is a list of scientific contributions and prospects for future development, as well as a list of literature sources.

In the **Introduction**, Vladimir Tsvetkov substantiates his motivation for choosing the research problem and the grounds for the conducted research. He outlines the purpose of the PhD thesis – to explore the possibilities of using pedagogical patterns in e-learning and to develop new models and tools with pedagogical patterns to optimize the learning process, facilitate teachers' work, and support learners in acquiring new knowledge and skills (p. 7). In order to achieve the main goal, the author formulates specific tasks connected in a logical sequence.

In **Chapter One Pedagogical Patterns**, Vladimir Tsvetkov provides an in-depth review of the literature and research related to pedagogical patterns, which are the basis for sharing good practices and imparting pedagogical experience. He examines the essence of patterns and systematizes the benefits of their application in the learning process. The PhD student discusses existing pattern languages as a set of pedagogical patterns applicable in one specific field and described in the same format. As a natural extension and connection to the topic of the PhD thesis is the examination of various software tools and applications using pedagogical patterns.

An important place is devoted to the concept of adaptivity in education and the accompanying methods and techniques for implementing and integrating adaptivity into learning management software tools and systems. The Ph.D. student discusses the various authors' theories regarding the learners' behavior, determining their learning styles, which directly corresponds to the realization of adaptivity of learning in an electronic environment. In logical sequence, theoretical reviews focus on available solutions for e-learning personalization based on real-time user behavior, identifying different approaches to adaptivity.

The chapter ends with a summary of the results of the research and a formulation of the existing problem. Vladimir Tsvetkov defines the main goal of the Ph.D. research and corresponding tasks. He proposes a methodology for its implementation.

In **Chapter Two Learning Models Based on Pedagogical Patterns**, the Ph.D. student presents a conceptual framework of an e-learning system with an opportunity to integrate pedagogical patterns. He discusses the architecture of the application, its main modules and functionalities.

The conceptual model proposed by Vladimir Tsvetkov has a three-layered architecture, with the individual layers described at a high abstract level. He consistently defines and explains the notions he operates with – an instance, a lesson, aspects of an instance of a pedagogical pattern. Taking into account the abstract description of problem solutions through pedagogical patterns, he defines a new concept – an instance of a pedagogical pattern as a concrete use of a pattern in learning with aspects necessary for its application in an electronic learning environment. The proposed model of an instance of a pedagogical pattern is complex and integrates multiple resources for conducting a learning process.

The Ph.D. student presents, visualizes and discusses the main activities of different groups of users when using the instance of a pedagogical pattern, as well as the processes and related activities in an e-learning system with opportunities to integrate patterns.

The chapter ends with a systematization of the main results of the activities carried out to fulfill the formulated tasks.

In Chapter 3 Implementation, Vladimir Tsvetkov presents the development process of a software plugin for Moodle e-learning environment and describes the main functionalities of the software prototype. The Ph.D. student investigates the requirements for the development of a plugin for creating pedagogical patterns and illustrates the main use cases for users with the role of administrator and teacher.

The implemented plugin uses the standard Moodle roles, learning activities and resources. From the user's point of view, the main functional modules of the repository include: Module for creating patterns, through which a user with the "administrator" role can model pedagogical patterns as a set of learning activities and resources arranged in a certain sequence and Module for instantiating a pattern, through which a user with the "teacher" role can select a pattern model, include it in a course, and make configuration by adding specific course content.

For the software implementation of the prototype, Vladimir Tsvetkov has extended the Moodle database and developed the necessary plugin components. He has described in detail the files of his plug-in and their organization.

The main functionalities of the plugin are illustrated by a specific example of using the "Early Warning" pattern. A positive functionality of the plugin is the ability for teachers to change the order of the activities and resources to match the specific situations and learners, which helps them plan and prepare the learning process.

In Chapter 4 Practical application of pedagogical patterns in e-learning, Vladimir Tsvetkov presents ideas for modeling in Moodle of 6 pedagogical patterns from Burgin's collection. For each pattern, he describes in detail its essence, existing problem and possible solutions through its application. The modeling of the patterns is presented both from a pedagogical point of view (educational goals, implementation of feedback, evaluation and other aspects) and from a technological one (the implementation in Moodle – what learning resources and activities are included in the pattern and the configuration of an instance of a pattern).

The Ph.D. student has verified his ideas in the course "Modeling courses in Moodle", studied by students at the University of Plovdiv "Paisiy Hilendarski". The results of a survey conducted among students aiming to establish the applicability of pedagogical patterns and their opinion on patterns importance in e-learning are presented. The study includes two surveys of students – before starting the course and after its completion.

The results of the survey are presented and described in text, without any diagrams, frequency tables and other forms of presentation typical for statistical data from surveys, which makes it difficult to perceive them. The survey questions could be more closely related to the PhD topic so the responses could reflect the students' attitudes about the applicability of the pedagogical patterns in e-learning.

In the **Conclusion**, a summary of the work on the specific tasks of the PhD thesis is made.

7. Contributions

I accept the contributions formulated by Vladimir Tsvetkov, which are sufficient for acquiring the educational and scientific degree "doctor":

- *scientific contributions*, expressed in a conceptual framework of a learning system based on pedagogical patterns;

- *scientific-applied contributions*, expressed in a pattern model that describes a problem and its solution in an abstract way, which allows multiple use in different situations and a pedagogical pattern instance model suitable for software implementation;
- *applied contributions*, including a plugin for pedagogical patterns for Moodle system, which expands the functionality of the environment and practical examples of using pedagogical patterns through Moodle standard learning activities and resources.

8. Assessment of the publications related to the Ph.D. thesis

Vladimir Tsvetkov has presented 7 publications, 2 of them are in journals indexed in Web of Science (with IF) and Scopus. 7 citations of 3 of the publications have been noted. The ideas presented in them directly correspond to the PhD thesis topic. The results of the research have been reported at 3 scientific conferences and 2 workshops and are available to the general audience. The presented publications satisfy the minimum national requirements for acquiring the educational and scientific degree "doctor" in professional field 4.6 Informatics and Computer Sciences.

9. Personal participation of the PhD student

I have no doubt about Vladimir Tsvetkov's personal contribution to the presented publications and Ph.D. thesis.

10. Abstract

The abstract is 32 pages long and sufficiently reflects the essence and the content of the Ph.D. thesis and the main results achieved in the research.

11. Critical remarks and recommendations

I have the following remarks and recommendations, which do not reduce the quality of the conducted research and are aimed at its refinement and improvement:
- Some of the figures are numbered incorrectly.
- The plugin files could be separated as an appendix to make the Ph.D. thesis more compact.

My recommendation to the Ph.D. student is to continue his work and research on the topic of the Ph.D. thesis and to develop a system of criteria for evaluating the effectiveness of pedagogical patterns in an e-learning environment. After such an assessment he will be able to prove the formulated research hypothesis.

I have the following question: Does he intend to distribute the plugin of pedagogical patterns among the Moodle community?

CONCLUSION

The research topic of the Ph.D. thesis of Vladimir Tsvetkov is relevant, the goals and objectives have been achieved. The PhD thesis contains scientific, scientific-applied and applied results, which are sufficient for acquiring the educational and scientific degree "Doctor".

There are proves that the Ph.D. student possesses theoretical knowledge and professional skills in the field of Informatics and demonstrates qualities and proficiency for conducting scientific research independently.

The Ph.D. thesis meets the requirements of the Law for the development of the academic staff in the Republic of Bulgaria, the Regulations for its implementation, and the

Regulations for the development of the academic staff of the University of Plovdiv "Paisii Hilendarski".

Considering all the above-mentioned, I give my **positive assessment** of the conducted research and **propose to the honorable Scientific Jury to award the educational and scientific degree "doctor" to Vladimir Hariev Tsvetkov** in the area of higher education: 4. Natural sciences, mathematics and informatics, professional field 4.6. Informatics and Computer Science, doctoral program Informatics.

20.04.2024   Member of the Scientific Jury:
                                                      Assoc. Prof. Gabriela Kiryakova, Ph.D.