

## **REVIEW**

**from PhD Anna Vladova Stoynova, professor from Technical University of Sofia**

of a dissertation for obtaining the educational and scientific degree "**doctor**"

by: field of higher education 5. Technical sciences

professional dfield 5.3 Communication and computer technology

doctoral program „Automation of fields from the intangible sphere (medicine, education, science, administrative activity, etc.)“

**Author:** Tsvetelina Lachezarova Ivanova-Varadinova

**Topic:** A system of technology-based solutions in engineering education

**Scientific supervisor:** Assoc. Prof. PhD Nadezhda Miteva Kafadarova,

### **1. General description of the presented materials**

By order No. RD-21-719 dated 04/02/2024 of the Rector of Paisii Hilendarski University of Plovdiv (PU), I have been appointed as a member of the scientific jury to ensure a procedure for the defense of a dissertation on the topic "System of technology-based solutions in engineering education" for the acquisition of the educational and scientific degree "doctor" in the field of higher education 5. Technical sciences, professional direction 5.3 Communication and computer technology, doctoral program „Automation of areas from the non-material sphere (medicine, education, science , administrative activity, etc.)“. The author of the dissertation work is Tsvetelina Lachezarova Ivanova-Varadinova - a full-time PhD student at the Department of Electronics, Communications and Information Technologies, with scientific supervisor Assoc. Prof. PhD Nadezhda Miteva Kafadarova from Paisii Hilendarski University of Plovdiv.

The set of paper materials presented by Tsvetelina Ivanova-Varadinova is in accordance with Article 36 (1) of the Regulations for the Development of the Academic Staff of the PU and includes the following documents:

- a request to the Rector of the PU to disclose the procedure for the defense of a dissertation work;
- CV in European format;
- protocol from the departmental council related to reporting the readiness to open the procedure and preliminary discussion of the dissertation work;

- dissertation work;
- autoabstract;
- a list of scientific publications on the topic of the dissertation;
- copies of scientific publications;
- statement of originality and authenticity of the attached documents;

The PhD student has attached 8 (eight) publications.

## **2. Brief biographical data for the PhD student**

Tsvetelina Ivanova-Varadinova was born on 02.11.1993 and completed her secondary education at the Plovdiv Humanitarian High School "St. Cyril and Methodius" in 2012. In 2016 acquired the educational and qualification degree (EQD) Bachelor in "Information Physics and Communications", and in 2019 acquired the EQD Master's degree "Physics teacher" at PU. In 2016 - 2017 she works as a "computer operator" at Stib Control EOOD. From 2017 she worked at PU successively as an expert "organizational service" and from 2020 to the present as an assistant.

From March 2020 she is enrolled as a full-time PhD student in the Department of Electronics, Communications and Information Technologies (ECIT) of the PU with scientific supervisor Assoc. Prof. PhD. Nadezhda Kafadarova. In March 2023 she is written off with a right of defense. On 28.02.2024 a preliminary discussion of the presented dissertation work was held at the ECIT departmental council and a decision was made to disclose the procedure for the defense of the dissertation work of Tsvetelina Ivanova-Varadinova for the acquisition of the educational and scientific degree (ESD) "Doctor". The requirements under the law on the National Tax Service and the rules of the PU on the procedure for the acquisition of the ESD "Doctor" have been fulfilled in volume and on time.

## **3. Relevance of the topic and appropriateness of the set goals and tasks**

The relevance of the current dissertation work is determined by the growing requirements for the modernization of engineering education in universities, the increasingly widespread application of smart digital technologies with increasing the effectiveness of the provided engineering knowledge for the formation of digital competences and engineering-technological skills, while preserving the advantages of the traditional forms of training, not only in the training process, but also during the time of their professional realization, according to the requirements of the labor market, business and the expectations of the students.

This poses to the so-called traditional training models new challenges, such as updating and implementing relevant specificity of the models in face-to-face, remote and remote form of training, choosing optimal technology-based solutions in engineering training and forming an assessment of the effectiveness of developed systems. When combining traditional engineering training and mobile training, including various educational tools, it is necessary to search for clear criteria and characteristics for researching the effectiveness of the developed models.

In this aspect, the topic of the dissertation work is relevant, and the tasks set are expedient. Achieving the set goal leads to scientific and applied contributions related to the modernization of engineering education, through the integration of modern technologies in the educational process to improve the learning experience and develop key skills and competencies of students in universities.

The Faculty of Physics and Technology of the PU has many years of experience in the creation and implementation in education of various innovative training systems and technology-based methods. The topic of the current dissertation is a natural continuation and upgrade of the previous studies.

#### **4. Knowing the problem**

A well-structured and analytical literature review shows in-depth knowledge of the scientific issues and a free handling of the literature on the subject. 92 scientific sources are cited, of which 79 are in English. The citation of more than a dozen scientific works by Bulgarian authors makes a good impression. A thorough creative evaluation of the used literary material by the PhD student is evident. She competently defines the current problem areas in the subject and clearly substantiates the need to fulfill the goal set in the dissertation. With a good knowledge of the terminology, the distinguishing characteristics of technology-based learning methods in engineering education and Internet-based systems supporting the implementation of tasks (Internet Performance Support Systems /IPSS/) have been analyzed. Demonstrated in-depth knowledge of various technologies and software tools for embedding technology-based methods in the educational process.

A good knowledge of the previous experience and achievements of the PU team in the implementation of innovative training systems has been demonstrated. The issue of "self-efficacy" has been excellently analyzed as an important indicator of developing skills to deal with the problem and make the right decisions.

The conclusions drawn in the dissertation work are logical and justified.

## **5. Research methodology**

Interdisciplinary knowledge was used in the dissertation, from the fields of electronics, communications, computers, automation of engineering work, pedagogical sciences, etc. The PhD student demonstrates skills in working with the NI ELVIS III integrated platform, software environments, LabVIEW, Multisim, Measurements Live, various measuring devices to implement the laboratory exercises in the subject "Electronics".

The chosen research methodology allows achieving the set goal and obtaining an adequate answer to the tasks solved in the dissertation. Moreover, one of the stated contributions is related to the development and implementation of an author's experiment for making technology-based decisions in engineering education in the implementation of three learning models and has a direct relationship to the research methodology.

## **6. Characterization and evaluation of the dissertation work**

The dissertation has a total volume of 229 pages, which includes used abbreviations, an introduction, four chapters, contributions, cited literature and three appendices of 62 pages.

The introduction touches on the importance of smart digital transformation of engineering education. The set goal and tasks are clearly formulated and achievable.

The literature review includes a critical analysis of the main characteristics of modern technology-based solutions and learning methods in engineering education. It purposefully analyzes the role of the integrity of science - business - academic training and the issue of "I-effectiveness" in the methodology of technology-based decision-making in engineering education. Special attention is paid to the innovative educational models developed in the Faculty of Physics and Technology, which marks the dividing line of the building research by the PhD student.

In the second chapter, the choice of a model and system for the study of two main technology-based solutions (TBR) in the education of students from different professional fields in the general engineering discipline "Electronics" is justified. The research is aimed at evaluating the effectiveness of the application of these technological training methods, for which there is not enough comparative research. For this purpose, the methods for performing the exercises are presented. The methods for evaluating the attitude of students towards technology-based solutions have been selected. The three different learning methods selected are described: face-to-face, remote access and remote through simulations. The equipment, elements, tools, software and schematics of the experimental setups for conducting three exercises are presented.

In the third chapter, the selection and construction of a remote access system for conducting the laboratory exercises is justified. The built-in connectivity between the NI ELVIS III prototype test platform and the Measurements Live client application for conducting real-time measurements is commented.

The PhD student decided in the last fourth chapter to present the discussion on the obtained experimental results using modern methods. In formulating the conclusions, a distinction is made between technology-based problem solving and technology-based decision making. The author demonstrates knowledge and skills about the functionalities of various technologies, which is the prerequisite for creatively making technology-based decisions.

The paper concludes with a summary of the results and formulation of the research contributions, a list of publications, references, a declaration and three appendices.

## **7. Contributions and significance of the development for science and practice**

I accept the claims for the contributions in the dissertation work. In short, I can see them as the use of modern interdisciplinary means and approaches to create new models for technology-based solutions in engineering education and to obtain confirmatory facts about the needs of engineering students for new smart digitized learning technologies to increase the effectiveness of learning. in accordance with business expectations and the need for lifelong learning, as well as the development of an individual author's approach in the application of technology-based solutions in the development of laboratory exercises in engineering education and construction of a VPN using the WireGuard protocol for experiments with remote access to mock-ups for the study of constructed laboratory schemes.

The nature of the contributions is scientific-applied and applied. Significance can refer to concretizing and expanding the applications of existing technology-based learning methods, as well as to various technologies and software tools that are integrated into the educational process. An author's experiment on technology-based solutions in engineering education is proposed for three learning models: face-to-face, remote with simulations and distance learning. The main results of the dissertation research are presented in 8 (eight) publications in specialized publications in English and have been approved in the following projects: No. ΦΠ21-ΦΤΦ -005 "New trends in the education of "Electrical Engineering" in the conditions of a pandemic", "DIVERSASIA" , BG05M2OP001-2.011-0001 "Support for success", No. MUPD 23 BF 015.

## **8. Assessment of dissertation publications**

The results included in the dissertation have been published in 8 reports in English, in proceedings of international scientific conferences abroad. Two of the publications are independent (from ISEIC23, Prague and EDULEARN21, Palma). In five of the publications, the PhD student is the first co-author (2 in EDULEARN23, Palma, 2 in HTQE21, Riga, ECADE22, Porto) and in one publication she is the third co-author (ICRI21, online, Seville). The five co-authored publications are respectively: 2 with two co-authors, 3 with three co-authors and 1 with four co-authors. Regardless of the fact that six of the publications are co-authored, the participation and contribution of the PhD student can be clearly distinguished, moreover, the co-authorship is proof that the topic is interdisciplinary and the team from the ECIT Department of PU "Paisiy Hilendarski" has long-term interests in the development and application of innovative learning systems and technology-based methods in the engineering education it offers.

According to these data, the scientometric requirements for obtaining the educational and scientific degree "Doctor" are fully covered.

## **9. Personal participation of the PhD student**

The presented materials show scientifically-applied experimental work in which the PhD student participated personally or with the help of specialists in the relevant field. In the dissertation work, data on the conducted researches are accurately presented.

I have no doubt that the PhD student got acquainted with the theory, with the achievements of the team, was trained practically and acquired the necessary skills, such as the need to continue, deepen and further develop the achievements of the team in the field of the system technology-based solutions applied in the engineering training. The PhD student has been an assistant at the PU since 2020. and has two independent publications, which further supports my belief that the formulated contributions and scientific results are her personal merit.

## **10. Autoabstract**

The presented autoabstract has a volume of 32 pages. It was made according to the requirements and presents the content of the dissertation in a concise and informative form. The goals and tasks, the main results and their discussion, the conclusions of the achievements, as well as the list of publications and participation in scientific forums are reflected.

The autoabstract is very well structured, with excellently executed illustrations of figures, graphs and diagrams and clear formulations and research conclusions..

## **11. Critical remarks and recommendations**

On pp. 101÷104 p., 115-119 p., 142 p., etc. the term "item" is found, which can be replaced by a Bulgarian variant. In a few places there are spelling mistakes, most likely made during the typing of the text.

In my opinion, the dissertation work would benefit if each chapter ended with conclusions, contributions and an indication of publications made, reflecting the studies reflected in it. Of course, the approach chosen by the PhD student is also permissible, but it makes it difficult to evaluate the obtained results and their reflection in scientific publications.

I recommend the PhD student to continue in her work as a university teacher to develop and deepen her research on the topic of applying smart digital technologies to support the effectiveness of engineering education.

## **12. Personal impressions**

The PhD student gives the impression of a motivated, goal-oriented and dedicated young researcher who managed to successfully complete her dissertation work on time, regardless of the difficult conditions of the COVID-epidemic. I am convinced that he will continue to develop and apply his knowledge and experience in the development of systems for technology-based solutions in engineering education.

## **13. Recommendations for future use of dissertation contributions and results**

PhD student assistant professor Tsvetelina Ivanova-Varadinova has obviously mastered and successfully applied in her work the most modern technology-based solutions in engineering education. Due to the great potential of opportunities of technology-based methods, I would recommend that research in this area be continued and promoted in journals, preferably with an impact factor..

## **CONCLUSION**

The dissertation **contains scientific-applied and applied results, which represent an original contribution to science and meet all** the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), the Regulations for the Implementation of ZRASRB and the relevant Regulations of the Paisii Hilendarski University of Plovdiv.

The dissertation work shows that the PhD student Tsvetelina Lachezarova Ivanova-Varadinova **possesses** in-depth theoretical knowledge and professional skills in the scientific specialty "Automation of areas from the intangible sphere (medicine, education, science, administra-

tive activity, etc.)" **by demonstrating** qualities and skills for independent conduct of scientific research.

Due to the above, I confidently give my **positive** assessment of the conducted research, presented by the above-reviewed dissertation work, autoabstract, achieved results and contributions, and I **propose to the honorable scientific jury to award the educational and scientific degree "doctor"** to Tsvetelina Lachezarova Ivanova-Varadinova in field of higher education: 5 Technical sciences, professional direction: 5.3 Communication and computer technology, doctoral program: "Automation of areas from the intangible sphere (medicine, education, science, administrative activity, etc.)".

Sofia, 07.05. 2024 г.

Reviewer: .....

(prof. PhD Anna Stoynova)