REVIEW

of the dissertation for awarding the educational and scientific degree **"Doctor"** by professional field **5.3. " Communications and computer engineering"** Doctoral Program **"Computer Systems, Complexes and Networks"** Author of the dissertation: **Ava Ahmed Chikurteva**
Topic: **INFORMATION AND COMMUNICATION TECHNOLOGIES IN EDUCATION**
Scientific supervisor: Prof. Dr. Dimitar Karastoyanov
Reviewer: Prof. Dr. Lyubomir Vankov Dimitrov, Technical University – Sofia

General part

The material presented to me for dissertation work is in a volume of 134 pages. The dissertation work is structured in 4 chapters, conclusion, list of publications, literature used, two appendices. The list of used literature includes 129 literary sources, of which three author's publications included in the dissertation.

1. **Topicality of the problem developed in the dissertation**

The dissertation explores problems related to the application of the project-based learning method in an electronic environment and with the help of information and communication technologies. The topic of digitization of training materials is addressed and methodologies for creating digital educational resources are presented. The presented studies and the results achieved are essential and can be used in current topics, both on problems at European level and in the country. The topic of the research is focused on digitalization, application of ICT in the process of education and improvement of teaching methods.

The contribution of the dissertation concerns the development of solutions for the application of an innovative method in the education system called "Project-based learning". This concept is based on the competence approach of training, which implies the building of competencies and skills based on the acquired knowledge. Training through projects is an active method that makes it possible to combine innovative training methods and information technologies. The peculiar thing about this method is that it evaluates problem-solving skills by applying knowledge. In the dissertation work is studied the application of the method in combination with another innovative method "Flipped Classroom" and the technology "Virtual Reality". By this method, lessons with electronics and robotics simulations included have been developed as experimental research. Decisions using information technology have been made and evaluated in the subjects of "geography" and "economics".

The main scientific contribution can be considered the presented model for the implementation of a project in o-based training. The model presents the stages in the creation of project-based lessons and methodology of work by the teacher. The method aims to develop a unified approach to creating project-based lessons based on modern ICT.

The thematic focus of the dissertation is in the field of education and more specifically solving modern educational problems through the application of information and communication technologies. I positively appreciate the thematic focus and categorize it as relevant and useful to society.

The presented research finds direct and key application in education and learning processes. I appreciate these studies positively. They are well described and understandable.

Parts of block diagrams, tables and application software are presented. My opinion is that the research is significant, the results obtained are useful and show improvement of the educational process and show that the candidate has potential and high qualifications.

2. **Degree of knowledge of the state of the problem and creative interpretation of literary material**

The dissertation work presents leading problems in the field of digitization of education, application and implementation of various digital technologies in the educational process, as well as problems in the use of innovative teaching methods with the help of ICT and digital resources.

In the introduction of Chapter 1 are presented current educational problems that are set as priorities and objectives in European and national documents. These problems relate to the use of digital resources, the application of innovative teaching methods and the use of technologies in the educational process. All these problems relate directly to the research and application of ICT in education.

The candidate follows in detail the development, role and place of information and communication technologies in education. An overview on the application and various solutions based on ICT in the process of learning and implementation of modern teaching methods is presented. Problem areas such as information technologies for management of the educational process, ICT in support of children with disabilities and SEN, ICT for the implementation of innovative teaching methods based on technologies are covered.

The review is consistent and analytical, clearly showing the current problems in the field of education and the need to conduct research related to ICT to improve all aspects of modern education.

3. **Compliance of the chosen methodology of research and the set goal and tasks of the dissertation with the achieved contributions**

The purpose of the dissertation is clearly defined. The work aims to develop new methods and approaches based on information and communication technologies to improve the application of innovative technology-based teaching methods.

Chapter 2 presents technologies used in educational processes that are applied in both distance and face-to-face learning. Technological platforms for e-teaching and management of the educational process are presented. The role and impact of eEducation in modern learning is explored. Special attention is paid to the project-based learning method. This method is presented as an active learning method with the potential to improve practical skills and reinforce the theoretical knowledge of learners. This method is set as a point of intersection between interdisciplinary, competence-oriented, practical and technological education of the future.

Chapter 3 presents a conceptual modular model for creating project-based lessons. The purpose of this model is to give a clear idea of the essence and application of the method of teachers. Information technologies for the application of project-based learning are studied. A model of a platform for PBL is developed and the application of ICT in the developed model is presented. Interactive features of the proposed platform are developed so that teachers can follow a methodology when creating new projects and tutorials. A content management system and software architecture have been developed. An assistant is presented to automate the process of creating a project-based tutorial in a web-based educational platform. This assistant has the task of assisting educators and improving the quality of future projects.

Chapter 4 presents the development and application of specialized digital educational resources. The role of e-educational resources for the digital transformation of education is great, they are the basis of successful and quality e-education. This determines the wide variety of software tools and applications for creating digital resources. The author presents software and

experiments from the processes of creation and validation of digital resources in the field of robotics and simulation applications in electronics. An example lesson on the method of project-based learning is presented in combination with an innovative method Flipped classroom and use of virtual reality. An experiment is made: Application of project-based learning in school education. The results achieved show a positive impact from the application of the innovative method in a real learning process.

The PhD student shows a good knowledge of the innovative methods applied in education and in particular project-based learning and flipped classroom. The candidate's ability to apply ICT to develop digital educational resources and technologies such as virtual reality becomes clear. The in-depth knowledge and competencies in pedagogy and ICT contribute to the successful development of relevant lessons and simulations in subjects, who apply and use electronic and informational means.

4. Scientific and/or scientific-applied contributions of the dissertation

The dissertation presents five scientific and applied contributions. In the opinion of the reviewer, these contributions are correctly formulated and describe well the importance of the conducted research and the results achieved. The contributions can be categorized into three categories.

A scientific contribution:

- A model for effective and consistent implementation of a methodology for creating and implementing project-based training is developed. This model contributes to a more effective and functional application of the method by teachers.

Two scientific-applied contributions:

- A methodology for creating a project-based lesson using an innovative method Flipped Classroom and Augmented Reality has been developed, which allows a numerical assessment of the skills of the learners;
- A model of an automated interactive assistant integrated into the project-based learning application system has been developed, which assists educators in creating project-based lessons.

Two applied contributions:

- Digital educational resources for simulation and control of a mobile robot have been developed, which are used in validation and testing of algorithms and robotics training. Resources can be used in the learning process in an electronic environment;
- An empirical comparison of learners' success with and without applying the developed model for project-based learning has been made. The results show an increase in learners' success in using the developed model.

I appreciate the results of the doctoral student's research. They have a useful formal character and potential for practical application by proving the usefulness and pragmatism of research in dissertation.

The results obtained show that research has wide application in different fields of education and science and can significantly contribute to the development of e-learning and teaching.

I appreciate these contributions as sufficient for this dissertation work. They prove that the PhD student can independently carry out research, explore thematic areas for the development of electronic and informational training tools in the implementation of an innovative method of project-based learning. The candidate successfully applies and combines different teaching methods in combination with innovative digital technologies such as virtual and augmented reality.

I believe that the contributions are the personal work of the candidate.

5. Assessment of compliance with the minimum national requirements and with the additional requirements under art. 1a, para. 2 of the RZRRB

In the dissertation are included 6 publications. Two of them are presented at international conferences, which are indexed in SCOPUS. These publications have a digital identification code DOI. Two other publications have been published in a journal in English by an academic publishing house in Bulgaria. The other two publications are presented at conferences in Bulgaria and are published by academic publishers.

The topics and content of the submitted publications are in accordance with the dissertation and are on problems related to the scientific field of research.

I believe that the submitted publications are representative, sufficient to protect the educational and scientific degree "Doctor". There is no indication of citations.

According to the RFASRB and the internal rules of IICT-BAS, for the fulfillment of the minimum national requirements for obtaining a PhD in the professional field 5.3 "Computer and communication equipment" requires the presence of at least 80 points under Group of indicators A and D. Such a reference is attached to the documents of the dissertation and my personal check of the submitted publications satisfies this requirement through criterion A: developed dissertation, G7: scientific publications in editions that are referenced and indexed in world-famous databases (Web of Science and SCOPUS) and G8: Scientific publication in non-refereed journals with scientific review.

6. Significance of the research and applied contributions of the dissertation

It is a good impression that a large part of the doctoral student's developments and contributions are directly focused on solving practical problems in the field of digital resources and ICT.

The developed educational resources have the potential for direct application, both in the process of research of various methods and algorithms, as well as for training in robotics, programming and other educational disciplines.

The developed platform for the application of the method of Project-based learning is based on modern information and communication technologies and has the potential to promote the dissemination of the method. It facilitates training in this method by providing the necessary environment and resources.

A general view of the research in the dissertation shows that it is useful and significant for society and science. In the process of work, various methods and technologies have been applied to achieve new and improved systems and resources.

In the submitted documents there is no data on the distribution of author's contributions in the submitted publications.

7. Some recommendations and critical remarks

I appreciate my thesis positively. From its content it is clear that the doctoral student has conducted independent research work and has the necessary skills and qualities to conduct independent research.

The reviewer has no comments regarding the content of the dissertation.

I recommend that future research examines methods and looks for dependencies to assess the effectiveness of different teaching methods. It is also advisable to study the degree of application of various technologies in the electronic environment and methods for the development and application of technology in the educational process.

The presented approaches to combining different teaching methods and high technologies show the great potential of modern information and communication technologies. I recommend continuing research in this direction – combining training methods with high technology.

The reviewer believes that the PhD student Ava Chikurteva shows good knowledge in the field of modern and innovative teaching methods and ICT. It is clear from the dissertation that she has the necessary experience and expertise to conduct independent future research and development.

CONCLUSION

I appreciate positively the scientific, applied and applied contributions of the dissertation of Ava Ahmed Chikurteva. I believe that the requirements of the Law on the Development of Academic Staff in Bulgaria and the Regulations for its implementation and the internal rules of IICT-BAS are fulfilled in the dissertation presented. The above gives me grounds to give a positive assessment of the dissertation and to recommend to the Scientific Jury to award to **Ava Ahmed Chikurteva** the educational and scientific degree "Doctor" in professional field 5.3. "Computer and Communication Engineering", doctoral program "Computer Systems, Complexes and Networks".

На основание
ЗЗЛД

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