REVIEW

about the PhD thesis for acquisition of the scientific degree **"doctor"**

in the professional field **5.3. „Computer and communication technology" "**

Ph.D. program **"Computer Systems, Complexes and Networks"**

Author of the PhD thesis: **Ava Ahmed Chikurteva**

Title of the PhD thesis: **INFORMATION AND COMMUNICATION TECHNOLOGIES IN EDUCATION**

Ph.D. supervisor: prof. Ph.d. Dimitar Karastoyanov

Reviewer: Prof. D.Sc. Eng. Todor Atanasov Stoilov, Institute of information and communication technologies – Bulgarian Academy of Sciences (IICT-BAS), Sofia, Acad.G.Bontchev str., BL.2

General notes

The PhD thesis contains 134 pages. The Ph.D. thesis contains 4 chapters, conclusions, list of author's publications, list of references and two appendices. The reference list contains 129 literary sources, includingh three author's publications cited in the dissertation work.

1. Actuality of the problems in the PhD thesis

The contribution of the Ph.D. thesis refers to the development of solutions from the new concept in the education system called "Project-Based Learning". The peculiarity of this concept is in a new hierarchical arrangement of the two main criteria for evaluating learning outcomes. The classical formulation of education defines its results in the hierarchical dependence "knowledge and skills". In the new formulation of Project-Based Learning, this hierarchy has been rearranged by "skills and knowledge". The Ph.D. thesis implements this new concept by using the method of this concept "The Flipped Classroom". Using this method, lessons with included electronics and robotics simulations have been developed as experimental approaches. Decisions using information technology are made and evaluated also in the subjects "geography" and "economics".

The scientific-applied result of the dissertation work is expressed in developing and experimenting with a new form of training that applies a modern concept of educational policy.

The main method of the research is the definition of new solutions for conducting an educational process with preferential use of means based on information technologies.

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I positively assess the thematic orientation of the dissertation work. I believe that the researches described in the dissertation work have theoretical and applied, pragmatic and useful value, as they are addressed to necessary and important elements of problems of effective and useful education. I believe that the actuality and importance of the developed topic is easily understandable.

The reviewer assesses the research in the dissertation positively. The scientific and applied part of the dissertation research is easy to understand, which is illustrated with elements from lessons in simulation and systems engineering. I believe that the importance of dissertation research is evident, the results obtained are useful, as a result of increased success rate of the students in the presented subjects and give a positive certificate for the qualification of the candidate.

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

The dissertation makes a meaningful presentation of the problems that have a place in the use of information solutions and systems in the implementation of activities and stages in the educational process.

Chapter 1 analyzes the changes that are made in the applied teaching methods due to the application of information technologies as new tools in the teaching process. These information solutions directly affect the learning process as well as its administration, assessment and management.

The overview in Chapter 1 logically substantiates the need to change the concept of education, which is formally defined as Project-Based Learning. This concept allows to implement not only forms of distance learning, but also predominantly requires forms of independent work of the learners.

3. Correspondence between the chosen research methodology and the goals and problems targeted in the thesis

In the Ph.D. thesis, the aim was to develop methodological solutions for carrying out forms of educational process, where the primary criterion for the trainees is the "skill". In Chapter Two, a study of the application of various electronic and informational tools, which are applied in the implementation of Project-Based Learning, is made. Questions about the functionality of platforms supporting forms of electronic learning, the appropriateness and specificity of multimedia solutions are commented on. It has been analyzed to what extent electronic forms of training can be applied to implement an educational process based on the concept of Project-based training. In its final content, this chapter evaluates the appropriateness and field of application of Project-Based Learning, which uses electronic and informatic means.

Chapter three develops methodological solutions and application stages of Project Based Learning. Forms of determining the goals of an educational lesson, ways of using additional links and knowledge from other subject areas outside the main subject of the presented lesson, forms of assessment are defined. A potential information system through which Project Based Learning can be implemented is presented as a block structure. Example solutions of functionalities of such a system are presented.

In the fourth chapter, experimental developments of the dissertation work on the application of methods for Project-based learning are presented. The functionality and appropriateness of the developments for increasing the skills of the trainees were evaluated. Developments are related to the application of simulations in the management of a robot structure, simulations of the operation of an electronic circuit, the implementation of a zoo engineering lesson using the flipped classroom method. The effectiveness of an application of Project-based learning in two classes for two years in the subjects "geography" and "economy" was evaluated integrally. The comparison was made with classes in which these subjects were taught according to the classical teaching method without the application of electronic and informatic means.

The Ph.D. student demonstrates a good knowledge of the concepts applied in education, the methods of their application and the possibilities of comparing and evaluating the effectiveness of education. The knowledge has made it possible to make relevant lessons and simulations in subjects that apply and use electronic and informatic means. An illustration of part of the program implementations of these educational lessons was presented.

4. Scientific and/or scientific-applied contributions of the Ph.D. thesis

In the Ph.D. thesis, a modification of educational solutions is made in order to implement the new concept of education: Project-based learning. The latter puts as the main criterion for the effectiveness of education the "skill" of the educated to solve tasks from a defined problem area. In the dissertation work, elements of educational lessons are designed and programmatically implemented, which are included in new forms of teaching, applying in the new concept of Project-based learning. These solutions have been prepared for the thematic areas of simulations in robotic platform control, systems engineering and electronics, geography and economics.

I assess that the subject being developed has a scientific-applied nature in the part of developing new forms of training and education that achieve newly defined goals. This allows to evaluate the acquired skills of the trainees from a conducted educational process. As an applied contribution, I find the demonstrated programming environment in which simulations and skill assessment were done.

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

I consider these contributions to be sufficient for this dissertation work. They prove that the doctoral student can independently carry out research activities, develop thematic areas for the development of electronic and informatic training tools in the implementation of the new concept of Project-Based Learning.

When reading the dissertation, I find that the achieved results are mainly the personal work of the Ph.D. student.

5. Correspondence with the minimal national legislative requirements

The reviewer assesses that the presented author's publications correspond to the topic and content of the dissertation work. Six publications are presented. Two of them have been presented at international conferences that are indexed in SCOPUS.

These publications have a digital identification code DOI. The rest of the publications were presented at conferences in our country and were published by academic publishing houses.

I believe that the presented publications are representative, sufficient to defend the educational and scientific degree "doctor". No citation data available.

According to the National legislative requirements and these one insisted by the internal rules of IICT-BAS for obtaining the educational and research degree "Ph.D." in professional field 5.3. "Computer and communication technology" it is required to achieve at least 80 points according to Group indicators A and G. Following the documents of the Ph.D. procedure, such a reference is attached, and my personal verification of the submitted publications satisfies this requirement through criterion A: developed dissertation work, G7: scientific publications in publications that are referenced and indexed in world-renowned 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 Ph.D. thesis

The Ph.D. student Ava Chikurteva demonstrated skills in the analysis and evaluation of methodological and electronic means for conducting an educational process. The PhD student demonstrates a good knowledge of the processes and methods for implementing the Project Based Learning concept. The doctoral student demonstrates skills in developing and applying informatics tools in the learning process.

The reviewer finds that the dissertation research is useful and has led to potentially pragmatic results such as the creation and implementation of new solutions from the use and application of informatics solutions in an educational process.

The submitted documents do not contain data about the division of authors' contributions for the publications made.

7. Some recommendations and critical remarks

I positively assess the presented Ph.D. thesis. It is evident from its content that the doctoral student has conducted independently the research work.

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

I recommend that dissertation research in its future forms can be enriched with formal relations, which can support making predictions and future evaluations of qualities and success parameters of a learning process. Such quantitative evaluations can easily be assessed and the appropriate comparisons will give evidences for the usefulness and the potential for acquiring positive results in educational process.

As a form of indirect remark, is my question how much it was necessary to present in Chapter 4 code samples for the test environment being developed. Currently, a claim for educational contribution through the presented program code can hardly be substantiated. It was not demonstrated relation between the illustration of the program code with the results of learners from the educational process.

The reviewer assesses that the Ph.D. student Ava Chikurteva demonstrates experience and qualifications for conducting independent research in the field of development and application of training tools, realizing the new educational concept of Object-oriented learning.

8. Conclusions

I give positive assessment for the presented research and application results in the PhD thesis of Ava Ahmed Chikurteva. My estimation is that the legislative requirements of the Law for academic growth in Bulgaria, the Regulations for its application and the specific requirements of the IICT-BAS are satisfied. This gives me reasons to recommend to the honorable Scientific Jury **Ava Ahmed Chikurteva**to be awarded with the Educational and scientific degree "Ph.D." in the professional field in the professional field   **5.3. „Computer and communication technology"**, Ph.D. program "**Computer Systems, Complexes and Networks**"

16.02.2023

Revie *НА ОСНОВАНИЕ*

Prof. C *ЗЗЛД*