REVIEW

under the procedure for acquisition of the educational and scientific degree "Doctor"

by candidate Dafinka Savova Miteva

of the PhD Thesis entitled: "Big Data Visualization"

In the Scientific field: **4. Natural Sciences, Mathematics and Informatics**

Professional field: **4.6. Informatics and Computer Sciences**

Doctoral program "Information Technologies (Information and Communication Technologies)",

Department „ Information Technologies",

Faculty of Mathematics and Informatics (FMI),

Sofia University "St. Kliment Ohridski" (SU),

The review has been prepared by: assoc. prof. Aleksandar Dimov, PhD, as a member of the scientific jury for the defense of this PhD thesis according to Order № РД-38-153/03.04.2023 y. of the Rector of the Sofia University.

1. General characteristics of the dissertation thesis and the presented materials

The dissertation submitted for review contains 125 pages and consists of an introduction, 7 chapters, a conclusion, an author's reference to the contributions of the dissertation and a list of cited literature, which includes 105 titles. The dissertation also has 6 appendices, which span into 22 pages.

The text of the dissertation is exhaustively illustrated with 102 figures and 9 tables. A glossary with explanations of the main terms and abbreviations is also included.

The text of the dissertation consequently presents the following:

- Thorough review of the problem area – types of learning analytics and their application in the field of education (chapter 1)
- Experiments are conducted that illustrate benefits to learning process of application of learning analytics and their visualization (Chapters 2 and 3)
- Development of a prototype of a learning analytics visualization system is described with the standard phases of the software development process i.e.,

requirements analysis, design, implementation and testing (Chapters 4, 5, 6, and 7, respectively).

According to the defence procedure, in addition to the text of the dissertation, the following materials are also provided:

- Abstract - in Bulgarian and English.
- Declaration of no plagiarism
- Reports from the automatic check system and statement from the academic supervisor for absence of plagiarism.
- Certificate of satisfaction of the minimum requirements for acquiring a PhD degree
- A list of the doctoral student's dissertation-related publications, which contains 6 titles.
- Texts of the publications related to the dissertation.
- Screenshots showing the indexing of the doctoral student's publications in Scopus and Web of science.
- Statements of co-authorship that indicate the equivalence of paper contributions in which the candidate is a co-author.
- List of scientific contributions of the doctoral student.
- Other administrative documents related to the defence procedure.

The dissertation is very well written and structured. Also, the thoroughness of the doctoral student in conducting the specific experiments, as well as her attention to details, makes a good impression. It should also be noted that the candidate diligently followed all administrative requirements for preparation of defence documents.

2. Short CV and personal impressions of the candidate

Dafinka Miteva graduated in 2003 with a master's degree in informatics from the Faculty of Mathematics and Informatics (FMI) at SU "St. Kliment Ohridski". After that, she acquired several professional qualification certificates in the field of information and communication technologies. Since 2014, she is a doctoral student at the Department of Information Technologies at FMI.

The candidate has extensive professional experience as an information systems administrator, teacher, and programmer. Since 2018, she has been the head of the "Distance and e-Learning" sector at the Information Service Laboratory at FMI.

I know Dafinka Miteva as a colleague in the faculty for a long time, as we have worked on various activities at the university. We have been team members of several

research and educational projects. In our work, I have been impressed by the thoroughness and precision of her work in the tasks she undertakes.

Also, we have had joint tasks in administrative and organizational activities at the university. As a member of the Laboratory of Information Services at FMI, Dafinka Miteva has left excellent impressions, also on other colleagues at the faculty. Following these duties, she has mastered and has an in-depth knowledge on a lot of software platforms and e-learning systems. This includes data that they provide, and also the teacher requirements for visualization and processing of such data. This, in turn, is an additional prerequisite for comprehensiveness and thoroughness of the research on the topic of the dissertation.

In conclusion, it can be summarized that my personal impressions of the candidate are that she is an exceptional professional, who undertakes her tasks precisely, responsibly and thoroughly.

3. Content analysis of the scientific and applied achievements of the candidate, contained in the presented PhD thesis and the publications to it, included in the procedure

The goal of the dissertation thesis, as stated in the text of the dissertation, is: "*to design a learning analytics system in which, through modern visualization methods, ways to increase the effectiveness of e-learning can be outlined and to support learners, teachers and managers of educational institutions in making the right decisions at the right time*". The object and subject of the study are respectively "*learning analytics and their visualizations used in learning management systems*" and "*the types of reports that a learning management system can provide in the learning analytics section and data visualization methods used for easier and proper data understanding*".

The defined in this way aims of the thesis are in the field of data processing systems. In particular, the aim is to solve specific problems with the so-called learning analytics and their visualization and increasing their accessibility, and hence the possibilities for use by various professionals in the learning process.

Given the rapid development and use of training systems, both in traditional and innovative educational institutions, the chosen area and problems to be solved are very relevant. This follows from the opportunity to collect learning data from various sources that should help to improve the approaches to learning new material by individual learners.

The motivation to conduct the research and, the creation of a prototype to facilitate the activities in all processes of a given educational institution is very well justified in the thesis.

Main results of the dissertation are related to application and study of applicability of learning analytics into the learning process. This includes:

- Detailed analysis of the current state of the problem area. The concept of "virtual dashboard" is pointed out as the most suitable tool for use in an integrated learning analytics system.
- Results of experiments on application and visualization of learning analytics in educational technologies are shown and analysed.
- Experiments and analysis of different platforms for dashboard creation
- Requirements are defined and a prototype of an integrated software system for learning analytics is designed and implemented.

I consider that, the declared in the dissertation 10 contributions are significant and original, and I would classify them as follows: contributions 1-7 are application-scientific oriented, and contributions 8-10 are application oriented.

Applicability of the contributions thus obtained can be found in various other fields of science and practice, in particular, the work with data visualization can be extended and find application, for example, in medicine, economics, etc.

4. Approbation of the results

The results presented in the dissertation have been published in a total of 6 publications. Five of them are co-authored with the doctoral student's supervisor, and one of them in a team with two co-authors. The PhD student is listed as first author on all publications. The contribution of all co-authors in the publications is equal.

Five of the publications are in English and one is in Bulgarian. Three of them are indexed Scopus, and two of them – in Web of science. One of the articles (number three from the list of publications connected with the thesis) also has citations in these databases. All these facts also indicate the significance of the PhD student's work and her contributions.

There is no proven evidence for plagiarism in the dissertation and the scientific works under this procedure.

I consider that the works presented in this way fully cover and even exceed the legislation requirements for acquiring the PhD in Bulgaria.

5. Qualities of the abstract

The abstract is presented in two versions - one in Bulgarian and one in English. The version in Bulgarian has a volume of 36 pages, and the one in English - 33 pages. The content of both these versions correspond to the relevant chapters in the dissertation.

The abstract meets the requirements and correctly presents the content and results of the dissertation.

6. Critical notes and recommendations

I had the opportunity to get acquainted with the preliminary version of the thesis that was submitted for the pre-defence procedure. As an internal reviewer, I have made several comments and remarks on the content, the structure and layout of the dissertation. All of them have been taken into account by the doctoral student candidate and corrected in the final version of the thesis.

I have no other comments or recommendations.

7. Conclusion

After reviewing the PhD thesis presented at the procedure and the accompanying scientific papers and on the basis of the analysis of their importance and the scientific and applied contributions contained therein, **I confirm** that the presented PhD thesis and the scientific publications to it, as well as the quality and originality of the results and achievements presented in them, meet the requirements of the ADASRB*, the Rules for its Implementation and the corresponding Rules at the Sofia University "St. Kliment Ohridski" (FMI-SU) for acquisition by the candidate of educational and scientific degree "Doctor" in the Scientific field *4. Natural Sciences, Mathematics and Informatics*, Professional field: *4.6. Informatics and Computer Sciences*. In particular, the candidate meets the minimal national requirements in the professional field and no plagiarism has been detected in the scientific papers submitted for the competition.

Based on what has been stated above, **I strongly recommend** the scientific jury to award Dafinka Miteva, the educational and scientific degree "Doctor" in the Scientific field 4. Natural Sciences, Mathematics and Informatics, Professional field

4.6. Informatics and Computer Sciences, doctoral program "*Information Technologies (Information and Communication Technologies)*".

Date: 01.06.2023 Reviewer:.....

/Aleksandar Dimov, assoc. prof., PhD/

[*] *ADASRB - Act on Development of the Academic Staff in the Republic of Bulgaria*