Peer Review

of the scientific works submitted for participation in the competition for occupying the academic position of "Professor", announced by the University of Plovdiv "Paisii Hilendarski" in area in higher education: 4. Natural Sciences, Mathematics and Informatics of professional field: 4.6 Informatics and Computer Science (Informatics)

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In the competition for „Professor", announced in the Newspaper of State, issue 99 of 20.11.2020, and on the website of the University of Plovdiv "Paisii Hilendarski", for the needs of the Department of Computer Science at the Faculty of Mathematics and Informatics, Associate Professor Elena Petrova Somova, PhD from the University of Plovdiv „Paisii Hilendarski" participates as a candidate.

1. General description of the procedure

By order № P33-74 / 12.01.2021 of the Rector of the University of Plovdiv „Paisii Hilendarski", I was appointed a member of the Scientific Jury of the competition for the occupation of the academic position of „Professor" at the University of Plovdiv in the field of higher education: 4. Natural Sciences, Mathematics and Informatics of professional field: 4.6 Informatics and Computer Science (Informatics), announced for the needs of the Department of Computer Science at the Faculty of Mathematics and Informatics.

To participe in the competition, documents have been submitted by only one candidate – Associate Professor Elena Petrova Somova, PhD, from the University of Plovdiv "Paisii Hilendarski".

The set of materials for the competition, presented by Associate Professor Elena Petrova Somova, is complete and is in accordance with the Regulations on the Development of the Academic Staff of the University of Plovdiv „Paisii Hilendarski".

Assoc. Prof. Elena Somova has submitted a total of 39 scientific publications, 5 monographs and one textbook, not used in previous academic procedures.

2. Brief biographical data

Assoc. Prof. Elena Petrova Somova graduated in 1995 as a Mathematician specializing in Computer Science at the University of Plovdiv „Paisii Hilendarski". She obtained the educational and scientific degree "Doctor" (01.01.12. Informatics) at the Faculty of Mathematics and Informatics at the same university in 2003.

Assoc. Prof. Elena Petrova Somova has been a lecturer in Informatics at the Department of Computer Science at the Faculty of Mathematics and Informatics at the University of Plovdiv „Paisii Hilendarski" since 1996. She successively held the positions of Assistant Professor, Senior

Assistant Professor and Chief Assistant Professor. Since 2007, she has been an Associate Professor in Informatics in the same department. She has been the head of the department since 2012.

I have known Elena Somova as a very good student and after her graduation – as an excellent specialist in the field of informatics and as a lecturer.

Since 1992, she has attended various specializations, courses and practical training at universities in the country and abroad: Marketing and Advertising Strategy, Expert in Distance Education, Language Specializations, Functional Programming, Focusing education on the composition, comprehensibility and correctness of working software , Equality between women and men, etc.

3. General characteristics of the candidate's activity

Assoc. Prof. Elena Somova has taught the following lecture courses with different specialties at the Faculty of Mathematics and Informatics and in other faculties of PU: "Introduction to Computer Science", "Programming", "Programming Languages", "Logical and Functional Programming", "Algorithms and Data Structures", "Object-Oriented Programming", "Web Programming", "Business Process Modeling and Management", "Multithreaded Programming in C#", "Object-Oriented Programming in C# ", "Information Technologies in Education", "Design of e-Learning Content", "Contemporary Information Technologies in Education", "Workshop on Informatics 1". 12 e-learning courses have been developed from these lecture courses.

She has taught 3 lecture courses at 6 foreign universities under different programs. She has participated as head and member of expert groups in the National Agency for Evaluation and Acreditation.

The scientific activity of the candidate can be divided into 4 scientific fields:
1. Technologies, models and systems for e-learning – 18 scientific publications and 3 monographs;
2. Models and systems for gamification of education – 7 scientific publications;
3. Mobile learning technologies – 7 scientific publications;
4. Automated generation of metadata for digital documents and artifacts – 7 scientific publications and 2 monographs.

In *scientific field 1*, publications, continuing the work of the candidate from her PhD thesis, related to the development of e-learning, are presented. The monographs [9, 21, 22] are on the topic of e-learning and distance education and in particular about the e-learning system PeU, working at Plovdiv University. Publication [33] addresses the issues of equality between women and men in relation to the strategic documents, focusing on the policy of the EU and Bulgaria in this direction.

In [1, 5, 18, 25, 29], research and results related to the development of the virtual educational space, pilot conducting of e-courses in different environments, analysis of the results of the carried out courses, collaborative learning and assessment in an e-learning environment are presented. Models of e-learning courses in different environments are offered.

In [3], an approach to facilitate test assessment in an electronic environment by automatically generating multiple different test questions based on accumulative questions, is proposed. A classification of the main types of questions is presented.

In [19, 23, 27] the possibility for invariant teaching and learning of computer programming, regardless of the specific programming language, is considered. A software system for learning of programming based on template algorithms has been implemented.

In [42, 44], a new algorithm called Tunnel Parsing to parse and build concrete syntax trees for languages defined by context-free grammars without left recursion is introduced.

In [11, 14, 15], different approaches for creating systems for administration of the learning process using e-services are considered.

[12] presents the S-Syslog software system, which aims to solve the main problems arising when working with logs from multiple sources using the syslog protocol. In [17], a cloud system for collection, centralized storage and analysis of logs is presented. Means to deal with vulnerabilities, threats and risks in the security of NoSQL databases are considered [28].

2. Models and systems for gamification of learning – in [24, 26], the concepts of game and serious game are considered and an attempt for classification of serious games is made. The categories of serious games are distinguished: game-based learning, gamification of learning (for short, gamification will be used), organizational-dynamic games, simulation games and edutainment. There are two types of gamification: structural gamification (gamification of structure) and gamification of content.

Existing appropriate learning models in the field are presented [24], as well as e-learning systems [24, 37, 10, 40], which use serious games. Existing gamification plugins in Moodle are also discussed in [37, 40].

Methodologies [26, 30] for designing and examples of gamified e-learning courses are presented. In [31], pedagogical approaches, theories and models suitable for the design and development of gamified e-courses are presented and analyzed.

In [43], a study of gamification in face-to-face joint learning in a cloud environment is presented. A gamified learning methodology has been proposed and an experiment with real learners has been conducted.

3. Mobile learning technologies – [32, 34, 38, 41] presents research in the field of mobile learning for creation of interactive learning content. An approach to integrate a system that converts learning activities into EPUB learning content, suitable for usage and tracking of any mobile device, in an existing e-learning environment is proposed and learning courses are developed.

[20] explores the types of cloud services and how they can be used to support mobile learning. Special attention is paid to the analysis of models for the implementation of cloud computing and the possibility of application in education in terms of implementation and maintenance costs, security, standardization, information services offered, compatibility with e-learning systems and mobile device support. An experiment with real learners has been conducted.

A classification of the types of games suitable for mobile realization in the learning of mathematics in primary school is presented [36]. An approach for creating a software package with mobile games in support of the learning of mathematics to students in primary school is presented.

[35] demonstrates an easy-to-use approach that can affect energy efficiency through appropriate localization of mobile applications. Existing energy techniques, tools and storage, as well as the

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types of mobile applications and the nature of the localization process for each type are presented. Good practices and recommendations depending on the type of application and the mobile platform are offered.

4. Automated generation of metadata for digital documents and artifacts – the use of standards in the field of education [4], in e-learning [2] and in scientific publishing [39] are studied.

An overview of current trends in the field of digitization of cultural heritage and research [16], carried out within the project "Automated generation of metadata for specifications and standards of e-documents", is done. The main contribution is related to the organization of digital content, generation of metadata and methods to improve the discovery of resources.

Research related to digitalization, creation, storage and distribution of digital cultural and historical objects has been done. [7] presents contemporary standards used in various fields: museums, libraries, archives, etc. An overview of the digital repositories created in the area, focusing on the Europeana initiative, is made. The state of the process of digitalization of the regional cultural and historical heritage has been studied. Correspondence of Europeana metadata with the data maintained by the Ethnographic Museum in Plovdiv is proposed.

Several experiments in the field of presentation of cultural and historical heritage have been made [8, 13].

In [10] systematization of information on the following topics is made: systems and standards for e-learning, standards for cultural-historical heritage, standards and systems for e-learning and cultural-historical heritage, standards for multimedia content, digital repositories, spatial information standards and applications with e-learning standards. The results in the field of standardization and automated generation of metadata for e-documents in different formats (text, graphics, audio, multimedia, etc.) obtained within the project "Automated generation of metadata for specifications and standards of e-documents" are also presented. The personal contribution of the candidate is in presenting the standards for cultural and historical heritage, multimedia content and e-learning.

[6] discusses the basic standards for metadata of files containing digital images. A software system for extracting metadata in EXIF, IPTC and XMP standards, in order to find information about the content and context of raster images, as well as to realize the ability to search for photo images by various criteria, is presented.

The materials presented for the competition include a textbook "Object-oriented design and programming (with examples of C #) – developed for the needs of various university specialties. The topics covered are related to the respective curricula. The material is richly supported with examples and fully solved assignments for designing and programming in C#.

The candidate's contributions in field 1 are: Systematic presentation of the field of e-learning and distance learning; Participation in the design of the e-learning environment PeU; Approach for automatic generation of different types of test questions; Proposed different pedagogical approaches in the field of collaborative learning and project-based e-learning; Conducted pilot e-learning and analysis of the learning; Approach for invariant teaching and learning of computer programming, regardless of the specific language; Design and implementation of a software system for training in programming based on invariants; Algorithm for parsing and building syntax trees for languages defined by context-free grammars; Design and creation of a system for administration of elective

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learning courses; Design and implementation of an effective method for classification of syslog messages based on rules for classification of messages in a tree hierarchy of regular expressions; A Creation of a S-Syslog software system (server application, web-based application and RESTful API for communication between the two applications) and a cloud-based CloudLog system for working with logs from multiple sources using the syslog protocol; First steps in the development and implementation of the Gender Equality Plan in PU, etc.

The candidate's contributions in field 2 are: Determination of game elements, techniques and actions from e-games, suitable for the process of gamification of e-learning; Creation of a general four-stage cyclic gamified model of the gamification process of e-learning; Methods for creating a gamified e-course in any subject area; Methodology for gamification in face-to-face joint learning in a cloud environment; Gamification approach in a traditional e-learning environment (Moodle); Architecture of systems and prototypes for gamification in an e-learning environment.

The candidate's contributions in field 3 are: General model of a process for tracking interactive learning activities; Approach for creating, accompanying and tracking interactive learning activities in an independent mobile environment; Automated conversion of e-course from the Moodle system to EPUB format; Architecture of a system for automatic creation of an interactive e-book in EPUB format and accompanying and tracking of the learning; Software prototype of a tool for creating, accompanying and tracking interactive learning activities; Classification of game types suitable for mobile realization in the learning of mathematics in primary school; Approach for creating a software package with mobile games in support of the learning of mathematics to students in primary school; Approach for developing green software for mobile devices through localization of mobile applications, etc.

The candidate's contributions in field 4 are: Ensuring interoperability of a specific university information system with the relevant European standards; Approach for standardization of e-learning in Bulgaria; Systematized and presented standards for cultural and historical heritage, multimedia content and e-learning; Museum metadata portability approach; Designed and implemented virtual tours of the Ethnographic Museum in Plovdiv; Designed and implemented software system for extraction of metadata from photo files.

The presented scientific papers cover the minimum national requirements for occupying the academic position of „Professor".

Of the presented publications, one has 5 co-authors, 6 has 4 co-authors, 18 has 3 co-authors, 13 has two co-authors and one has one author. Four of the monographs have over 11 co-authors and one has 7 co-authors. There are 5 scientific papers referenced in Scopus and 13 papers refer-enced in Web of Science. One of the articles has an impact factor.

A total of 124 citations of the works submitted for the competition have been noticed, 24 of which are in Scopus and WoS.

The candidate has 56 participations with reports in international and national scientific forums.

Assoc. Prof. Somova has participated in 36 international and national research and educational projects, and has been the leader of 16 of these projects. She has participated in 20 program and organizational committees of scientific forums.

4. Assessment of the personal contribution of the candidate

Despite the fact that most of the presented publications are co-authored, there is no doubt about the personal participation and contribution of the candidate in the presented materials. I found no evidence of plagiarism.

5. Critical comments and recommendations

I have no comments and recommendations to the candidate.

6. Personal impressions

Assoc. Prof. Elena Somova, PhD, is an established scientist and specialist in the field of informatics. He actively continues his researches, also works with young scientists and currently she is the supervisor of 3 PhD students. He handles teaching and administration very well.

CONCLUSION

The documents and materials presented by Assoc. Prof. Elena Somova, PhD, in the educational and research activities fully meet the requirements, conditions, and criteria of the Law on the Development of Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for the Application of the LDASRB, and the Regulations for the Development of the Academic Staff of the University of Plovdiv "Paisii Hilendarski" for occupying the academic position of "Professor".

The results achieved by her in teaching and research fully comply with the specific requirements of the Faculty of Mathematics and Informatics.

All of the above is sufficient reason to give a **positive conclusion** for the election of Associate Professor Elena Petrova Somova, PhD for the academic position of Professor in „Informatics" of professional field „4.6 Informatics and Computer Science", area of higher education 4. „Natural Sciences, Mathematics and Informatics".

I recommend that the highly respectable Scientific Jury, designated for the announced competition, propose to the Honorable Faculty Council of the Faculty of Mathematics and Informatics at the University of Plovdiv „Paisii Hilendarski" to elect Associate Professor Elena Petrova Somova, PhD for the academic position of „Professor".

11.03.2021 г.   Signature: ....

Plovdiv   /Prof. Angel Golev, PhD/