ANNOTATIONS OF THE SCIENTIFIC PUBLICATIONS INCLUDED IN THE DOCUMENTS FOR THE PROCEDURE

of assoc. prof. Elena Somova, PhD

1. Doneva R., N. Kasakliev, E. **Somova**, P. Ivanova, *e-Taster Project: Bulgarian Case Study on Pilot Delivery of e-Learning Courses*, Proceedings of the First Int. Conf. Research People and Actual Tasks on Multidisciplinary Sciences, Lozenec, 2007, pp. 22-26, ISBN 978- 954-91147-3-7.

This paper aims to shed light on the results of the e-Taster Minerva Project implementation. To that end, the study briefly outlines the achieved contributions to the investigation for developing a competitive virtual educational area of Europe. As a demonstration of the above the paper presents the analysis of the pilot delivery of the Bulgarian language versions of the e-learning taster courses developed in the frame of the Project. The analysis is a part of the survey and evaluation of the taster's delivery in Bulgarian language. It shows some statistics on courses piloting in relation to students' group profile, background, needs, satisfaction, etc. It includes the users' feedback and suggestions about e-courses content and e-learning environment.

2. Донева Р., Г. Тотков, Е. **Сомова**, *Към единна информационна образователна среда в България*, Сборник на 38-та Пролетна конференция на Съюза на математиците в България, Боровец, 2009, с. 268-274.

The e-learning standardization process is an active, continuously evolving and dynamical process that has been developed very rapidly in the last years. The seriousness of the problem because of absence of integrated information education area in our country is not well understood. The goal of the paper is to pose the problem for discussion to the educators' community and to review some possible solutions to solve it. Some of well-known e-learning standards, specifications and reference models are presented shortly as a possible basis for creation of a national standard/ specification in the field of e-learning. Some of the most successful foreign initiatives and projects related to the development of efficient education infrastructures are examined. The main objectives and the first obtained results of a Project for automated creation of standardized digital repositories in various subject domains (incl. e-learning) are presented.

3. Соколова М., Г. Тотков, Е. **Сомова**, *Акумулиращи тестови въпроси*, Сборник на Трета национална конференция с международно участие по електронно обучение във висшето образование, Свищов, 15-17.05.2009, с. 241-248.

The paper offers an approach to facilitate the work of the author of test questions by automatically generating many different test questions from one question called an accumulative test question. The main goal of the approach is to avoid the problem of writing distractors by the authors, which are obtained from the natural source of wrong answers - the learner. The main steps for creating the accumulative test questions are presented, as well as the classification of their main types. The issue of integrating a methodology based on Bloom's taxonomy to assist teachers in composing accumulative test questions in order to measure the 6 levels of knowledge are also discussed. The realization of 13 new types of questions from the proposed classification in the open source system Moodle is presented, as well as the conducted experiments with them, which are realized with real learners.

4. Тотков Г., Р. Донева, Е. **Сомова**, Н. Касъклиев, *Университетска информационна система, базирана на европейски образователни стандарти за мобилност, квалификации и компетенции*, Сборник на Трета национална конференция с международно участие по електронно обучение във висшето образование, Свищов, 15-17.05.2009, с. 185-192.

Changes in learning, education and training are stimulated by two important and wide-ranging processes: the development of a unified European educational environment in higher education (the so-called Bologna Process) and increasing European cooperation in vocational education and training (the so-called Copenhagen process). The paper examines the main informative and measurable tools introduced by the European Union in this area: the European Credit Transfer and Accumulation System (ECTS) and the European Transparency Framework for the description of qualifications and competences - Europass, as well as the information system of Europass and the standards European Learner Mobility Model (ELM) and Metadata for Learning Opportunities (MLO) related to learning opportunities and learner mobility. The paper presents the main goal and activities of a study conducted at the University of Plovdiv "Paisii Hilendarski"- based on a study of European standardization activities, ensuring interoperability of information systems, to ensure and demonstrate compatibility within a specific university information system with the relevant European standards.

5. Doneva R., A. Grigorescu, E. **Somova**, *Piloting of a Joint European Bachelor Curriculum in Information Technology: Evaluation of a Course Delivery*, Proceedings of ICL Conference, Villach, Austria, 2009, pp. 1175-1181.

The work presents an analysis of the students' feedback on piloting of one of the courses from the joint Bachelor curriculum in Information Technology developed in the frame of Socrates-Erasmus BIT2010 Project. The analysis emphasises on the course participators' satisfaction with the course content and structure, with the course delivery, with the applied teaching approach, etc. It resumes the learners' feedback about the achieved training objectives, learner's satisfaction, etc.

6. Totkov G., E. **Somova**, H. Petrov, *About Relationship between Metadata and Content of Digital Photo Images*, Proceedings of INFORMATICS'2009 – International Scientific Conference on Informatics, Herlany, Slovakia, 23-25.11.2009, pp. 106-111.

Working with files, containing raster graphical information, analyzing the content is a difficult task. Even something elementary for human eye recognition, can appear unachievable for program recognition. That is why, the metadata of the digital photo images are from particular importance, because they can give some information about the content of the image. For example, a number of technical characteristics (as picture taking conditions), saved as metadata, bring information about the content and the context of the photo image. The paper discusses the main metadata standards of files containing digital photo images. Software system realizing extraction of metadata in EXIF, IPTC and XMP standards with the aim of finding information about image content and context is presented. The system saves extracted metadata in database and gives the opportunity for searching photo images with different criteria.

7. **Сомова** Е., Г. Врагов, Г. Тотков, *Към регионален агрегатор на цифровизирани културно-исторически обекти*, Сборник на Национална конференция "Образованието в информационното общество", Пловдив, 27-28.05.2010, с. 154-161.

Issues related to digitalization, creation, preservation and distribution of digital cultural and historical objects are considered. Contemporary standards used in the field are presented. In connection with the Europeana initiative, the state of the process of digitization of the regional cultural and historical heritage has been studied. The possibility of creating a regional aggregator of digital cultural and historical artifacts based on the standard used by Europeana is discussed.

8. **Сомова** Е., Б. Йорданова, К. Стоянов, *Експериментална 3D-виртуална разходка на Етнографския музей в Пловдив*, Сборник на Национална конференция “Образованието в информационното общество”, Пловдив, 27-28.05.2010, с. 162-167.

The paper describes the types of virtual tours: spherical panoramic tours, cylindrical panoramic tours, video virtual tours and 3D-virtual tours. It provides an overview of existing 3D modeling software and 3D models’ visualization. The paper presents an experimental 3D-model of the Ethnographic Museum in Plovdiv and a virtual tour based on this model.

9. Тотков Г., Р. Донева, Е. **Сомова**, Е. Шойкова, А. Ескенази, М. Райкова, Б. Сивакова, Ст. Хаджиколева, Е. Хаджиколев, Д. Благоев, Св. Енков, Хр. Инджов, Д. Тупарова, Г. Тупаров, Р. Радев, А. Смрикаров, Д. Левтерова-Гаджалова, *Е-обучението в информационното общество: технологии, модели, системи, достъпност и качество* (под ред. на Г. Тотков), Университетско издателство “Паисий Хилендарски”, Пловдив, 387 стр., 2010, ISBN 978-954-423-651-9. (монография с участие от 15.78%, глави – 1, 2 и 5)

The monograph covers the following topics: education in the information society, models and systems for e-learning, e-learning for people with special educational needs, standards in e-learning, tests and systems for e-testing and evaluation of the quality of education. The monograph also presents scientific results obtained by researchers from the University of Plovdiv "Paisii Hilendarski", the Institute of Mathematics and Informatics of Bulgarian Academy of Science, Southwestern University "Neofit Rilski" and the University of Ruse "Angel Kanchev" within the project MI-203 "Modeling of learning processes and management of e-learning projects”.

10. Тотков Г., Р. Донева, Е. Шойкова, П. Станчев, Е. **Сомова**, Кр. Марков, Кр. Иванова, Ив. Койчев, М. Шнитер, Г. Врагов, Сл. Добрева, Ин. Маркова, *Стандарти и спецификации за метаданни на е-документи* (под ред. на Г. Тотков), Университетско издателство “Паисий Хилендарски”, Пловдив, 260 стр., 2010, ISBN 978-954-423-650-2. (монография с участие от 7.5%, глави – 2, 4 и 7)

The monograph covers the following topics: e-learning systems and standards, standards for cultural and historical heritage, standards and systems for e-learning and cultural and historical heritage (in the Bulgarian context), standards for multimedia content, digital repositories, standards for spatial information and e-learning standards (annex). The monograph also presents scientific results in the field of standardization and automated generation of metadata for e-documents in different formats (text, graphics, audio, multimedia, etc.), obtained by researchers at the University of Plovdiv "Paisii Hilendarski", Institute of Mathematics and Informatics of Bulgarian Academy of Science, Technical University - Sofia and New Bulgarian University within the project DO02-308 "Automated generation of metadata for specifications and standards of e-documents".

11. Енев Й., Е. **Сомова**, *Система за онлайн администриране на избираем учебен курс*, Сборник на IV Национална научна конференция 2011 за студенти, докторанти и млади учени, Пловдив, 30.04.2011, с. 126-130.

The paper presents a system for administration of elective learning courses during the different stages of their existence: initial setup of the process, publication of courses, approval of the list of courses, student application, student pre-selection, automatic ranking generation, training and final stage (completed course).

12. Попов С., Е. **Сомова**, *Система за събиране, класифициране, съхраняване и анализ на syslog съобщения*, Сборник на IV Национална научна конференция 2011 за студенти, докторанти и млади учени, Пловдив, 30.04.2011, с. 131-136.

The paper presents a software system that aims to solve the main problems that arise when working with logs from multiple sources using the syslog protocol. An effective method for classification of syslog messages has been designed and implemented - rules for classification of messages in a tree hierarchy of regular expressions are defined. A server application, which receives, classifies and sends for storage and analysis the received syslog messages; a web-based application for storing and analyzing logs and a RESTful API for communication between the two applications are presented.

13. Стоянов К., Б. Йорданова, Е. **Сомова**, Г. Тотков, *Две експериментални виртуални разходки на Етнографския музей в Пловдив*, Сборник на Национална конференция “Образованието в информационното общество”, Пловдив, 26-27.05.2011, с. 35-43.

The paper considers the different approaches to creating virtual tours. The ways and means for realizing panoramic and 3D-virtual tours are discussed in more detail. Two examples of such virtual tours of the Ethnographic Museum in Plovdiv are presented - panoramic and 3D. The inclusion of these virtual tours in the aggregator under construction in the Plovdiv region is commented, in order to further add to Europeana.

14. Blagoev D., G. Totkov, E. **Somova**, *An Application of Business Process Modeling System ILNET***,** Proceedings of International Conference INFORMATICS’2011, Roznava, Slovakia, 16-18.11.2011, pp. 216-221.

In this paper we present a system for accompanying of the process of Bachelor and Master thesis administration, including all stages: publication of thesis themes, thesis choice, documents fulfillment, thesis writing, thesis submission, thesis review, thesis publication, etc. The system is developed on the base of business process modeling system ILNET and its basic model for describing and executing workflow models. The basic model allows the creation and usage of both high-level constructs that are available in all popular business modeling standards as well as low-level programming language constructs that allow the implementations of new building blocks. Amongst the main features of the system are the capability of the blocks to implement their own custom visualization using the same workflow model, the centralized independent hosting and execution of the models, the ability to hot-swap a compiled and running model with another (newer) one and the automatic wrapping of web services and .NET libraries into ILNET building blocks.

15. Blagoev D., G. Totkov, E. **Somova**, *An Application of Business Process Modeling System ILNET*, journal “Acta Electrotechnica et Informatica”, Vol. 12, No

1, 2012, pp. 60-65, DOI: 10.2478/v10198-012-0013-7. (invited paper, extended paper No 14).

In this paper we present a system for accompanying of the process of Bachelor and Master thesis administration, including all stages: publication of thesis themes, thesis choice, documents fulfillment, thesis writing, thesis submission, thesis review, thesis publication, etc. The system is developed on the base of business process modeling system ILNET and its basic model for describing and executing workflow models. The basic model allows the creation and usage of both high-level constructs that are available in all popular business modeling standards as well as low-level programming language constructs that allow the implementations of new building blocks. Amongst the main features of the system are the capability of the blocks to implement their own custom visualization using the same workflow model, the centralized independent hosting and execution of the models, the ability to hot-swap a compiled and running model with another (newer) one and the automatic wrapping of web services and .NET libraries into ILNET building blocks.

16. Ivanova Kr., P. Stanchev, G. Totkov, K. Sotirova, J. Peneva, St. Ivanov, R. Doneva, E. Hadjikolev, G. Vragov, E. **Somova**, E. Velikova, I. Mitov, K. Vanhoof, B. Depaire, D. Blagoev, *Access to Digital Cultural Heritage: Innovative Applications of Automated Metadata Generation*, (editors: Kr. Ivanova, M. Dobreva, P. Stanchev, G. Totkov), University Publishing House "Paisii Hilendarski", Plovdiv, Bulgaria, 254 pages, 2012, ISBN: 978-954-423-722-6. (monograph, 1 глава)

The main purpose of this monograph is to provide an overview of the current trends in the field of digitization of cultural heritage as well as to present recent research done within the framework of the project D002-308 funded by Bulgarian National Science Fund. The main contributions of the work presented are in organizing digital content, metadata generation, and methods for enhancing resource discovery.

17. Попов Ст., Е. **Сомова**, *Cloud базирана система за събиране, съхраняване и анализ на логови съобщения*, Сборник на Пета национална конференция „Образованието в информационното общество”, Пловдив, 31.05-01.06.2012, с. 81-89.

The work presents a software system CloudLog, whose goal is to solve main problems in working with many log sources. CloudLog is a cloud-based system for collecting, centralized storing and analysis of log messages. CloudLog uses cloud web services provided by Amazon.com (AWS). Data is stored in cloud-based database SimpleDB. The code of the application can be executed on 2 or more EC2 instances placed behind an Elastic Load Balancer in order to achieve high availability and horizontal scalability. The whole communication coming in and out the web application is completely encrypted.

18. **Сомова** Е., Един опит за използване на съвместната работа на обучаемите като начин за обучение и оценяване, Сборник на Пета национална конференция по Електронно обучение във висшите училища, 16-17.05.2014, Русе, 2014, с. 188-193.

The paper describes an attempt for creation of a model of e-learning course on the base of variety of learning resources and activities from different types, together with scheme, that allows complex evaluation of the learners' progress. Several approaches like computer-supported learning, collaborative learning, team-based learning and problem-based learning are used in the model of the e-learning

course. The learning content of the created course on the base of the model is placed in the system Moodle.

19. **Сомова** Е., Й. Енев, Г. Тотков, *Инварианти в обучението по програмиране*, представена на 24-та международна научна конференция на Съюза на учените в Стара Загора, 5-6 юни 2014, Стара Загора; публикувана в International scientific on-line journal Natural & Mathematical science, Vol. 4, No.3, 2014, pp. 25-30.

The main goal of the research is to discover the programming algorithms, which are taught in basic courses of imperative programming and which do not depend on used algorithmic language. These algorithms can be presented as template codes in different programming languages. The paper shows an approach for teaching imperative language programming on the base of set of templates, called invariants. 98 invariants of algorithms from course “Programming” and 44 invariants of algorithms from course “Algorithms and data structures” are proposed. Example programming codes on two languages (C# and Visual Basic) are given for the particular realization of invariants. The work represents the first step in realization of software system for learning programming on the base of invariants.

20. Касъклиев Н., Е. **Сомова**, Ст. Хаджиколева, *Използване на облачни услуги за подпомагане на мобилното обучение във висшите училища*, представена на 24-та международна научна конференция на Съюза на учените в Стара Загора, 5-6 юни 2014, Стара Загора; публикувана в International scientific on-line journal Natural & Mathematical science, Vol. 4, No.3, 2014, с. 94-98.

Education in present days is closely connected to usage of information and communication technologies in a larger scale. The need of bigger computing power pushes the educational institutions to rely on external providers of information services or to use cloud computing for part of proposed information services. The work emphasizes to the research of types of existing cloud services and how they can be used for supporting mobile learning. Special attention is given to the analysis of the realization models of cloud computing and the opportunity of application in education from the point of view of expenses, security, standardization, etc.

21. Тотков Г., Р. Донева, С. Гафтанджиева, Е. **Сомова**, С. Хаджиколева, Н. Касъклиев, Г. Кирякова, Н. Ангелова, М. Райкова, Хр. Костадинова, В. Сивакова, Е. Хаджиколев, *Увод в е-обучението*, Изд. Ракурси, Пловдив, 694 стр., 2014, ISBN: 978-954-8852-41-8. (монография, 2 глави)

This monograph from the "E-learning" series is dedicated to the phenomenon of e-learning and distance learning. In it, the authors try to present a wide range of areas relevant to the field – from education in the modern information society, to the main problems and issues related to e-learning – nature, models, systems, life cycle (including evaluation and quality), methodology, specialized software (including to ensure adaptability, accessibility and mobility), etc.

22. Тотков Г., Р. Донева, С. Гафтанджиева, Е. **Сомова**, Н. Касъклиев, М. Близнаков, Е. Алендарова, *Пловдивски е-университет*, Изд. Ракурси, Пловдив, 197 стр., 2014, ISBN 978-954-8852-48-7. (монография)

This monograph from the series "E-learning" presents the created environment of the type "electronic university" and the results achieved during the implementation of the project BG051PO001-4.3.04-0064 "Plovdiv Electronic University (PeU): a national

standard for conducting quality e-learning in the higher education system ". An analysis made on the occasion of the design of the PeU system concerning the creation of a university information system, is included. In addition to brief descriptions of the created and experimented software prototypes of PeU modules – E-student, E-teacher and E-administrator, as well as components for managing the candidate-student campaign, making inquiries, electronic payments, etc. are also presented. An accessible interface technology has also been experimented with in PeU. Special attention is paid to specialized tools designed for conducting quality e-learning - modules for adaptive learning, automated creation of test units and accessibility.

23. Enev J., E. **Somova**, *Software Learning System Based on Invariants in Computer Programming*, International Journal of Emerging Research and Solutions in ICT (ERSICT), Vol. 1, No 1, 2016, pp. 59–67, doi:10.20544/ERSICT.01.16.P06.

The paper considers the idea about invariant teaching and learning of computer programming, independent of concrete programming language and version. Software system, built on the base of template algorithms (called invariants), is presented. 98 invariants are proposed for the course "Programming" from the bachelor degree programs at Plovdiv University, Bulgaria, and 44 invariants – for the course "Algorithms and Data Structures". The proposed invariants are made till now with template codes on two programming languages (C# and Visual Basic) with more than 170 realizations in one language. The invariants are classified in 13 groups on the base of kinds of basic assignments (algorithms), which are solved during learning computer programming. The invariants have parameters of 5 types – variable, data type, random invariant, invariant from given list and invariant from given kind. Several levels of difficulty for solving of assignments are proposed. The system can be used as main learning resource in self-learning during the traditional learning.

24. Gachkova M., E. **Somova**, *Game-based approach in E-learning*, Сборник на IX Национална конференция „Образованието и изследванията в информационното общество", 26-27.05.2016, Пловдив, 2016, с. 143-152.

In this article a summary is made of the use of standard electronic game's methods in e-learning. It shows how game-elements and game-mechanics can be applied in e-learning environments. Different types of Serious games – Game-based learning, Gamification of learning, Organizational-dynamic games, Simulation Games and Edutainment have been discussed. The article introduces the game-based model for learning and 70:20:10 education framework. There are examples for e-Learning environments that include some of the abovementioned game-elements and game-techniques. The focus in the conclusion is on the potential benefits of successful implementation of serious games into a learning environments.

25. Takev, M., E. **Somova**, *Collaborative learning and assessment in E-learning*, IX Национална конференция „Образованието и изследванията в информационното общество", 26-27.05.2016, Пловдив, 2016, с. 153-161.

The article provides a summary of collaborative learning and assessment and presents their definition, basic elements, advantages and application. It is focused on the new role of the learners – who carry the responsibility for their own education and to their peers', in which they work together, during collaborative activities. Collaborative assessment can be regarded as an educational activity in the collaborative learning. Other advantages, besides the academic ones, are shown – social and psychological. Particular attention is paid to the use of this method in e-learning. E-learning environments that implement collaborative education and assessment are reviewed.

26. **Somova** E, M. Gachkova, *An Attempt for Gamification of Learning in Moodle*, Proceedings of International Conference on e-Learning (e-Learning'16), Bratislava, Slovakia, 08-09.09.2016, pp. 201-207, ISSN: 2367-6787 (online), ISSN: 2367-6698 (print), ISSN: 2367-6701 (cd-rom).

The paper presents an attempt for gamification of learning on the base of the standard e-learning course in the virtual learning environment Moodle. Short summary of the serious games, their usage in learning and their kinds is done. Gamification of learning is described in more detail. Game elements, activities and techniques and their possible realization with elements of an e-learning environment, which is not game-based, are discussed. An example of methodology for designing gamification course is presented.

27. **Somova** E., J. Enev, *Learning by coding on the base of Bloom's levels of knowledge*, International Journal on Information Technologies and Security (IJITS), vol. 10, Issue 1, 2018, pp. 35-46. (**Web of Science, ISI Impact Factor (IIF) = 1,449**)

The paper represents an invariant approach for teaching how to code programs, regardless of the studied programming language. The approach is based on the currently taught main programming algorithms. The invariant and parametric parts of these algorithms are determined. Questions and assignments, related to different cognitive levels of Bloom's taxonomy, are provided, which test the learners' knowledge of invariant algorithms. The work also shows the developed software system based on this approach.

28. Karavasilev T., E. **Somova**, *Overcoming the security issues of NoSQL Databases*, Journal of the Technical University - Sofia, Plovdiv branch, Fundamental Sciences and Applications, Volume 24, 2018, pp. 123-128, ISSN 1310-8271.; Proceedings of the Technical University - Sofia, Plovdiv branch, Seventh International Scientific Conference "Engineering, Technologies and Systems" TECHSYS 2018, 17-19.05.2018, pp. II 151-156, ISSN Online: 2535-0048.

With the current escalating popularity and use of NoSQL databases, the amount of sensitive data stored in these types of systems is increasing significantly, which exposes a lot of security vulnerabilities, threats and risks. This paper presents effective ways to mitigate or even completely overcome them. The purpose of the developed practical tests using MongoDB is to evaluate how applying those security measures can affect the overall system performance. The results of this experimental research are presented in this article.

29. **Somova** E., S. Gaftandjieva, R. Doneva, *An Attempt of Project-Based Learning in e-Learning*, 7-ма национална конференция „Електронно обучение във висшите училища", 20-23.09.2018, p. 58-65.

The paper presents an attempt to realize active learning in a distance education course through project-based learning. The authors propose a pedagogical approach where individual project assignments are combined with collaborative activities or assignments. Individual and collaborative activities are placed in each learning week, continuously throughout the whole course. The e-learning course is carried out with students from the University of Plovdiv. The obtained results are analysed and some measures for improvement of the quality of the learning are given.

30. Gachkova M., M. Takev, E. **Somova**, *Learning and Assessment Based on Gamified e-Course in Moodle*, journal Mathematics and Informatics, vol. 61, No 5, 2018, pp. 444-454. (**Web of Science**)

The paper presents game-like elements suitable for the realization of a gamified e-course and their representation as components in the e-learning environment Moodle. An example of the design of a gamified e-learning course in Moodle is shown. The paper contains comparison charts for the assessment of the course participants. Feedback of the effectiveness of certain aspects of the gamified e-course is collected by a survey.

31. Gachkova M., E. **Somova**, *Plug-in for creation of gamified courses in the e-learning environment Moodle*, published: IOP Conference Series: Materials Science and Engineering, vol. 618 012079, doi:https://doi.org/10.1088/1757-899X/618/1/012079, 2019, pp. 1-7; presented: TechSys 2019: 8th International Scientific Conference "TechSys 2019" – Engineering, Technologies And Systems, Technical University of Sofia, Plovdiv Branch, 16-18.2019. (**Scopus, SJR=**0.192)

The article examines the challenges associated with designing and delivering effective training. The authors propose the use of serious games in learning (in particular gamification) to achieve higher motivation in learners than traditional e-learning. Pedagogical approaches, theories and pedagogical models, suitable for the design and construction of gamified e-courses are presented and analysed. A plugin is presented for creating gamified e-courses in a Moodle e-learning environment. The plug-in can be used to automatically transform a standard e-course into a gamified one or the initial creation of a gamified course. It is shown how standard Moodle environment elements can be used in game contexts.

32. Takev M., M. Rodriguez-Artacho, E. **Somova**, *Creating Interactive and Traceable ePub Learning Content from Moodle Courses*, journal Mathematics and Informatics, vol. 4, No 62, 2019, pp. 459-470. (**Web of Science**).

Technology enhanced learning is shifting from a centralized platform environment to a variety of elements to support and enrich interactions between learners and educational material. In this context, the paper addresses the creation of eBooks in EPUB format based on the existing content in a Moodle environment. The main purpose is to create enriched eBooks capable of supporting and tracking student activity usually reserved to educational environments. The work describes a plug-in developed to support Moodle course translation to EPUB and details potential user tracking formalization using xAPI.

33. Doneva R., S. Gaftandjieva, E. **Somova**, N. Mileva, *How to promote the change in the area of gender equality in academia and research – Bulgarian case*, Proceedings of ICERI2019: 12th annual International Conference of Education, Research and Innovation**,** Seville, Spain, 11-13.11.2019, ISBN: 978-84-09-14755-7, ISSN: 2340-1095, doi: 10.21125/iceri.2019.1864, pp. 7870-7880. (**Web of Science**)

Nowadays, the equality and equal treatment of women and men are general issues that have been addressed in many strategic documents at various levels (international, national and institutional) around the world. EU has a very clear policy in gender equality issues, which is contained in its legislation as a legal guarantee for gender equality. The paper starts with a short overview of EU policy on gender equality issues and main gender equality documents. The current state in Bulgaria regarding gender

equality is shown on the basis of national legislation documents and gender equality responsible units. The short statistics of gender equality of women and men in Bulgarian higher education (in public and private institutions) are provided as well. Authors present a preliminary analysis of the current situation, in the direction of gender equality and more generally against any discrimination, at one typical Bulgarian public university – University of Plovdiv "Paisii Hilendarski", which is the second largest university in the country. The historical, cultural, economic and organizational (structure and governance) background of the University of Plovdiv in relation to the equality is described. A special attention is given to the gender equality issues, mentioned in principal university documents and the existing organizational measures and policies, protecting students and staff from any form of discrimination. The paper presents the first steps in the development and implementation of the Gender Equality Plan of the university in the frame of EU Horizon 2020 project – SPEAR "Supporting Plans for gender Equality in Academia and Research". The main goals of the university team, some common positives, risks and obstacles and particular measures in gender equality work of the team are discussed. The university team plan for the project activities is presented, including activities as data collection and analysis, finding stakeholders, Gender Equality Plan development, acceptance and implementation, raising awareness and dissemination, etc.

34. Takev M., E. **Somova**, M. Rodriguez-Artacho, *Converter from Moodle lessons to interactive EPUB ebooks*, journal Mathematics and Informatics, vol. 62, No 6, 2019, pp. 616-625. (**Web of Science**)

This article describes a software, that automatically converts already created Moodle Learning Resources of type "lessons" into interactive e-books, stored in EPUB format. The advantages of EPUB format to present learning content are discussed, as well as existing examples of its use in education. Emphasis is given to creating interactive EPUB lessons that enable tracking learners' activities and saving their current progress with the help of xAPI statements and state API implementation.

35. Kasakliev N., M. Gocheva, E. **Somova**, *Green mobile application development through software localization*, International Journal on Information Technologies and Security (IJITS), vol. 11, Issue 4, 2019, pp. 3-16. (**Web of Science**)

Developing green mobile application software is closely connected to reducing energy consumption during the applications' usage. The article demonstrates an initial easy-to-use approach that can affect energy efficiency through appropriate localization of mobile applications. It presents existing energy-aware techniques, tools, and repositories, as well as the types of mobile applications and the nature of the localization process for each type. It will also guide developers through best practices and recommendations, depending on the type of application and mobile platform.

36. Gocheva M., E. **Somova**, V. Angelova, Kasakliev N., *Types of mobile educational games for children in primary school*, Proceedings of 14th Annual International Technology, Education and Development Conference – INTED'2020, Valencia, Spain, 2-4.03.2020, ISBN: 978-84-09-17939-8, doi: 10.21125/ inted.2020.0698, pp. 2291-2300. (**Web of Science**).

Today's children, representatives of the so-called Generation Z, are constantly using the latest information and communication technologies in their daily lives (games, training, social communication, etc.). They even feel more confident using a mobile device rather than a personal computer. In addition, no matter of the environment, games prove a strong motivator in education for every generation which

is utilized by educators. Therefore, according to the authors, the integration of games in a mobile environment is the most appropriate approach to enhance the learning motivation of this generation of children. The authors' ultimate research goal is to create a package of mobile mathematical games for primary school education and to test mobile applications with 3rd grade students. The article begins with an argument about the place of games in training and the relevance of different types of so-called serious games. This paper presents the views of other scientists on the topic of games in the educational process of primary school children, as well as classifications of educational games for this age group according to pedagogy specialists. With the development of modern information and communication technologies, a number of the well-known didactic games have been created as computer games. They are successfully used both for the realization of cognitive activities and for motivating children to study and support the understanding of the educational content. This article presents a study of the sources of educational games for Bulgarian children, as well as an overview of the existing educational computer games for children, mainly in the Bulgarian language, for mathematics and Bulgarian training. This paper offers a reasoned conclusion, about which mobile operating systems should develop gaming applications, based on statistics for the used mobile operating systems worldwide and in Bulgaria. The results of the study on existing mobile educational games for children are briefly presented, and it is found that the number of games in Bulgarian is small while the variety of English games is large, which proves inappropriate for children because of the language barrier. The article presents a classification of game types suitable for mobile implementation in primary school mathematics education. There are 13 types of games available that are suitable for children in primary school mathematics, as well as for mobile implementation. Each type is visualized with a real-life example of a 3rd grade mathematics textbook in Bulgaria. An approach for creating a software package with mobile games to support the teaching of mathematics students in primary school is presented. The games will be able to be used for self-study at home, with children solving assignments by playing on their own mobile device or at school if the teacher wishes to use the new technologies in the classroom. This game-based approach for learning through mobile games aims to further develop students' mathematical skills and to offer an entertaining environment where learning is easier and fun even for children who do not fancy mathematics.

37. Gachkova M., E. **Somova**, *Moodle plug-ins for design and development of gamified courses*, Proceedings of 14th Annual International Technology, Education and Development Conference – INTED’2020, Valencia, Spain, 2-4.03.2020, ISBN: 978-84-09-17939-8, doi: 10.21125/inted.2020.0676, p. 2187-2195. (**Web of Science**)

The current generation of learners desires fast, attractive, quality and effective training that utilizes the latest information and communication technologies and tools. This naturally leads to the need for new or changed pedagogical methods, approaches and strategies. The article examines the use of serious games (in particular, gamification) as a suitable approach for attaining effective education for modern learners. The authors present how the implementation of games and game elements and techniques influences student motivation. This paper reviews software systems which use gaming and in particular existing gamification plugins in the Moodle e-learning environment. The game elements of electronic games that can be applied in training are explored - story/history, level, badge, leader board, bonus, reward, combo, challenge/quest,

hidden treasure, game rules, game progress, team and time frame. An appropriate interpretation of these game elements is offered in a learning context, as well as their possible implementation through elements of the Moodle environment, which is the main e-learning environment of the University of Plovdiv “Paisii Hilendarski”, Bulgaria. The authors’ main goal is to design and develop software for implementing structural gamification of learning, which integrates game elements and techniques with the e-learning process, without any changes to the learning content of the courses. The article introduces the two plug-ins developed to assist the authors of the Moodle courses in the creation of gamified courses. The first plug-in changes the design of a new or already existing training course in a gamified way - based on game levels (open or locked with input requirements), and offers support for how to apply existing Moodle elements in a game context. The second plug-in allows for adding specific game elements to standard e-courses that do not exist in Moodle or cannot be implemented with standard Moodle elements. This plugin implements the game elements leaderboard, avatar and game progress.

38. Takev M., E. **Somova**, M. R. Artacho, M. Castro, S. Martin, *Can e-book technology be enough to support elearning?*, Proceedings of EDUCON’2020: IEEE Global Engineering Education Conference, Porto, Portugal, 28-30.04.2020, pp. 1915-1921. (**IEEE Xplorer**, **Web of Science, Scopus SJR= 0.31**)

In this paper a model to track learning experiences from an interactive e-book is presented. For this a digital book coherent with the EPUB3 standards has been made by exporting an existing course in a learning management system and replicating its interactive behavior. Defining trigger points throughout the book and amongst the interactions made by the students, that send data to a learning record store, enrich the e-book and provide the possibility to analyze and preview statistical data for students’ commitment to learning the material and their actions over the whole course. The xAPI specification helps collect educational data and store it in a database, which can be used for creating a further set of reports anytime in the future.

39. Kasakliev N., M. Gocheva, E. **Somova**, Impact on research visibility using structured data and social media integration, journal Mathematics and Informatics, vol. 63, No 2, 2020, pp. 192-201. (**Web of Science**)

The paper presents a study on applicability of structured data(metadata) in increasing of scientific articles’ visibility, published on the Web. The usage of structured data in the description of the scientific content is discussed. The brief analyses of the used approaches for scientific publishing and some academic publishing systems are presented. The special attention is given to the metadata schemas (Metadata Object Description Schema, Dublin Core Metadata Element Set and Schema.org) used successfully for the publishing purposes. The appropriate integration of the information on scientific articles within social media (with OpenGraph and Twitter Card tags) is also examined.

40. Gachkova M., E. **Somova**, S. Gaftandzhieva, *Gamification of learning course in the e-learning environment*, published: IOP Conference Series: Materials Science and Engineering, vol. 878 012035, https://doi.org/10.1088/1757-899X/878/1/012035, 2020, pp. 1-9; presented: 9-th International scientific conference Engineering, technologies and systems – TechSys’2020. (**Scopus, SJR=**0.192)

The paper presents a study in the field of gamification of learning, in particular – in structural gamification. The four-stages cyclic (Learning – Evaluation – Rewarding –

Ranking) gamification learning model is proposed. The used gamified elements (level, story/history, challenge, team, time frame, game progress, status (avatar), bonus, badge, reward, hidden treasures, combo and leaderboard) with their impact to the learner's motivation are explained. Two plug-ins are designed, developed and tested with real users. One of the plug-ins changes the design of the learning course in game-like view, while the other ranks the students in a leaderboard with their avatars, according to their course progress. The short explanation of the experiment with learners is done and part of the statistical results from the conducted survey in five areas (practical applicability; motivation; design and accessibility; interactivity and communication; and intelligibility) are shown.

41. Takev M., E. **Somova**, S. Gaftandzhieva, M. Rodriguez-Artacho, *System for creation, support and tracking of interactive learning activities*, published: IOP Conference Series: Materials Science and Engineering, vol. 878 012034, https://doi.org/10.1088/1757-899X/878/1/012034, 2020, pp. 1-9; presented: 9-th International scientific conference Engineering, technologies and systems – TechSys'2020. **(Scopus, SJR=**0.192**)**

The paper presents a study in the field of m-learning with interactive learning content. The approach used is to integrate a system (plug-in), which converts learning activities into EPUB learning content, suitable for usage and tracking on any mobile device, with an existing e-learning environment, full with learning courses. Therefore, a plug-in for exporting learning content from the Learning Management System Moodle into an EPUB interactive book is developed. The plug-in can export the following Moodle resources and activities: labels, files, folders, URLs, pages, books, lessons and tests. The data about students' learning activities is collected through xAPI statements, stored in a Learning Record Store. On the basis of the stored data, various types of reports are generated, which help teachers track students' progress. The software is tested with real users and short statistics are derived from their opinions in six areas (practical applicability; design; accessibility; interactivity, support and feedback; communication and collaboration; understanding).

42. Handziiski N., E. **Somova**, *Tunnel Parsing with countable repetitions*, journal Computer Science, v. 21, No 4, 2020, DOI: https://doi.org/10.7494/csci.2020.21.4.3753, pp. 441-462. (**Web of Science, Scopus, SJR=0.106**)

The article describes a new and efficient algorithm for parsing, called Tunnel Parsing, that parses from left to right on the basis of a context-free grammar without left recursion and rules that recognize empty words. The algorithm is applicable mostly for domain-specific languages. In the article, particular attention is paid to the parsing of grammar element repetitions. As a result of the parsing, a statically typed concrete syntax tree is built from top to bottom, that accurately reflects the grammar. The parsing is not done through a recursion, but through an iteration. The Tunnel Parsing algorithm uses the grammars directly without a prior refactoring and is with a linear time complexity for deterministic context-free grammars.

43. Sharkova D., E. **Somova**, M. Gachkova, *Gamification in cloud-based collaborative learning*, journal Mathematics and Informatics, vol. 63, Issue 5, 2020, pp. 471-483. (**Web of Science)**

Gamification is a widely accepted approach aimed at increasing the learner's motivation. The paper presents a study on gamification approach in face-to-face collaborative learning, supported by cloud-based environment. The concept of

gamification is discussed, paying detailed attention to the motivating power of game elements and techniques. The existing elements and techniques in electronic and video games, as well as their applicability in the learning process are shown. The relations between game elements, game techniques and game actions are introduced. A gamified learning methodology is proposed and experimented with 93 real university students. A survey is conducted with learners and the results are provided. The findings reveal that when implemented properly, gamification of collaborative learning can prove an effective and motivational tool in education.

44. Handzhiyski N., E. **Somova**, *Tunnel Parsing*, 3COWS – Central European Functional Programming School (CEFP) 2019 book in the series of Springer Lecture Notes in Computer Science (LNCS), Volume 11950, 2021. (**Web of Science, Q4, IF=0.402**)

The article presents a new and effective algorithm for parsing and building of concrete syntax trees for languages defined by contextfree grammars without left recursion and rules that recognize empty words. The different states in which the parsing machine can be are precomputed into a control layer of objects together are all possible sets of steps (tunnels), that can be executed during the parsing to enable the parsing machine to progress from one state to another. When implemented, all precomputed data is read-only and can be used by more than one parsing machine at a time. The Tunnel Parsing algorithm uses the grammars directly without a prior refactoring, and can linearly parse some ambiguous grammars.

45. **Сомова** Е., Р. Донева, С. Гафтанджиева, *Обектно-ориентирано проектиране и програмиране (с примери на C#)*, учебник, Университетско издателство “Паисий Хилендарски”, 2020, ISBN 978-619-202-611-0.

The textbook is intended for use in the study of disciplines related to the application of the object-oriented approach to creating software systems by students of University of Plovdiv "Paisii Hilendarski" in all specialties for which the curriculum requires it. Learners gain knowledge that allows to enter the theory and practice of developing software systems by applying object-oriented (OO) principles. As a result of the in-depth study of the topics included in the textbook, students will be able to freely use and apply the basic concepts, tools and methods of OO design and programming in creating or evaluating specific OO systems. The main goals of the authors are the following: clarification of the essence and principles of the OO programming (OOP); explanation of the basic concepts of the OO approach; assistance in mastering the terminology of OOP; learning the basic methods of OO analysis and design, as well as tools for presenting OO models; review of the means for realization of OO concepts in the classic and some modern versions of OO programming languages such as Simula, Smalltalk, CLOS, Object Pascal, C++, Java, C#, Python, Ruby, Groovy, PHP; detailed consideration of OO capabilities in the C# language in order to develop real OO programming systems and step-by-step development of a course project. The textbook consists of an introduction, 9 chapters and appendices. The wording of these chapters usually includes: concepts of OOP related to the OO principle in question; problems affecting OO analysis and design in order to implement this principle; examples of OO analysis and design illustrating the implementation of this principle; advantages and disadvantages of the OOP, arising from the principle and the introduced concepts; means for realization of the respective concepts in C#; C# programming examples illustrating the principle and related means. In the theoretical consideration of the principles of OOP and related concepts, an attempt has been made to clarify them in general, beyond their dependence on specific programming languages. The material

is richly supported with examples and fully solved assignments for designing and C# programming. In the structure of the exposition, as well as at the end of each chapter, questions, assignments and projects for independent work are provided.

Plovdiv, Bulgaria signature:

15.01.2021 assoc. prof. Elena Somova, PhD