The 2nd International Conference

INNOVATIONS AND CREATIVITY

PROGRAM

ABSTRACTS

April 5 – 7, 2018

Liepaja, Latvia

2nd INTERNATIONAL CONFERENCE "INNOVATIONS AND CREATIVITY" ABSTRACTS

Liepāja University, Liepaja, Latvia

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LAYOUT

Dina Barute

CONFERENCE HOMEPAGE

http://mathart.liepu.lv/

PROGRAM

FRIDAY, APRIL 6

9:00 – 10:00	Registration
	Welcome Coffee

Plenary session (Room 227)

10:00 – 10:20	Opening of the conference
10:20 – 10:50	Danguole Rutkauskiene. The trends of E-Learning in Higher Education. Introduction to MOOC's
10:50 – 11:20	Sharif E. Guseynov. Regularization Techniques for Applied Inverse and Ill-Posed Problems Incipient in Science, Technology, Economy, and Society

11:30 – 12:50	**Sections**

Innovations in Computer Science (Room 227)

11:30 – 11:50	Arnis Cirulis, Kristaps Brigmanis-Brigis, Gatis Zvejnieks. Analysis of suitable natural feature computer vision algorithms for augmented reality services
11:50 – 12:10	Guntars Būmans, Kārlis Čerāns. RDB2OWL: A Language for Database to OWL Mapping and its implementation
12:10 – 12:30	Dzintars Tomsons, Arta Šokolaite. Testing Usability of Web-Based Virtual Tours
12:30 – 12:50	Martins Sinka, Anita Jansone. Quality Assurance usage in webpage application development

Creativity in math education (Room 225)

11:30 – 11:50	Ingrida Veilande. Creation of mathematical problems inspired by ornamental art
11:50 – 12:10	Dace Kūma, Dina Barute, Valdis Priedols. Liepaja University Math and Physics Olympiad for school-students – challenges and possibilities
12:10 – 12:30	Vaira Kārklina. Mental Arithmetic
12:30 – 12:50	Emiliya Velikova, Magdalena Petkova. Analysing the students' creativity in integrating GeoGebra applets in solving geometrical problems

12:50 – 14:00	**Lunch time**

New technologies and approaches in education (Room 227)

14:00 – 14:20	Loreta Juškaite. New challenges and opportunities for STEM education in the Latvian educational context
14:20 – 14:40	Dzintars Tomsons, Vineta Tomsone. Development of Programming Skills for In-service Teachers: A Case Study of Liepāja University
14:40 – 15:00	Judita Kasperiuniene. Collective creativity and teacher professional development in social media

15:00 – 15:20	Olga Sakadineca, Anita Jansone. Students' attitudes toward learning activities organized with the means of WebQuests method

Mathematical modelling   **(Room 225)**

14:00 – 14:20	Sharif E. Guseynov, Jekaterina V. Aleksejeva. On an approach for computing local-slip length profiles of liquid on unidirectional super-hydrophobic surfaces in the Cassie-Baxter state
14:20 – 14:40	Sharif E. Guseynov, Dace Kūma, Jekaterina V. Aleksejeva. On an approach of constructing a finite-state automaton to protect distributed information systems in the presence of networks with public accesses
14:40 – 15:00	Sharif E. Guseynov, Jekaterina V. Aleksejeva, Armands Grickus. On an approach to reconstructing the distorted or lost parameters of acoustic speech production on observed signal
15:00 – 15:20	Jevgenijs Kaupuzs. How long does it take to board an airplane?

15:20 – 16:00	**Coffee break** **(Room 221)**

New technologies and approaches in education   **(Room 227)**

16:00 – 16:20	Lāsma Ulmane-Ozoliņa. Moodle as personal knowledge managment tool
16:20 – 16:40	Mantas Jurgelaitis, Vaidotas Drungilas, Lina Čeponienė. Gamified Moodle Course for Teaching UML
16:40 – 17:00	Asta Slotkiene. Context Aware Information Model for Active Learning Object
17:00 – 17:20	Valdis Priedols. Tools supporting the process of teaching Business Intelligence
17:20 – 17:40	Maksims Žigunovs, Anita Jansone, Anita Ziverte. Microsoft word document formatting applies

Advanced Technologies and their applications   **(Room 225)**

16:00 – 16:20	Uldis Žaimis, Roberts Jūrmalietis. Automatic Indoor Mini-garden/farm Technologies: Guidelines for Harmonious Design
16:20 – 16:40	Uldis Žaimis, Anita Jansone. Software development for numerical modelling of controlled formation of periodic nanostructures after laser irradiation
16:40 – 17:00	Juris Černenoks, Andrejs Cibulis. Tetrads and their Counting

19:00 – …	**Gala dinner**

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HARDWARE NEURAL NETWORK NODES FOR DISTRIBUTED ROBOT CONTROL

Karlis Berkolds

Riga Technical university, Latvia

Keywords: Hardware neural networks, Distributed intellectual systems, Asynchronous systems, Machine learning, Robotics

Complex robotic systems could benefit from decentralized, asynchronous decision making allowing individual actuators react more quickly to changes in the environment. Adding neural networks to individual nodes would allow training these systems instead of programming them and during usage, systems could adapt to minor changes in task or environment. To make systems that could respond in real time, hardware neural networks must be used.

Paper presents an approach for controlling single actuator using hardware neural network in Intel Curie module. The approach allows individual nodes to make asynchronous control decisions, by responding to local sensor readings and other node signals. Node prototype is made with 128 neurons and its training results are analysed and discussed. Future research possibilities of complex distributed control structure with multiple nodes are explored.

RDB2OWL: A LANGUAGE FOR DATABASE TO OWL MAPPING AND ITS IMPLEMENTATION

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Keywords: Database to ontology mapping, ontologies, RDF, mapping patterns

Most data in industry still resides in relational databases (RDB) but Semantic web uses standard RDF and OWL formats. Therefore exposing the contents of RDB to RDF and OWL formats enables the integration of the RDB contents into the Linked Data and Semantic web information landscape. An important benefit of RDB to-RDF/OWL mapping is also the possibility of creating a conceptual model of the RDB data on the RDF Schema/OWL level and further on accessing the RDB contents from the created semantic/conceptual model perspective.

The task of mapping relational databases to RDF/OWL formats is well understood, widely studied and technically implemented, for example in D2RQ, Virtuoso RDF Graphs, Ultrawrap, Spyder, R2RML parser among different RDB-to-RDF/OWL mapping languages and tools. Nowadays more tools are created for W3C standard R2RML language. Most of the RDB-to-RDF/OWL mapping approaches offer languages for conceptually clear mapping structure with less attention paid, however, to the concise mapping writing.

The RDB2OWL language allows to specify the RDB-to-RDF/OWL mappings in a compact textual form by placing them as annotations to classes and properties in an OWL document. The RDB2OWL language allows also re-using both the domain ontology and source database structure information within the mapping definition, as well as introducing user defined functions.

The high-level RDB2OWL tool is implemented to allow converting a RDB2OWL mapping into an executable D2RQ or R2RML mapping that can further on be used by the corresponding platform (eg. D2R Server, R2RML parser, ONTOP) to turn it into a SPARQL endpoint to query conceptually organized data from the relational database or produce the RDF dump of the source RDB. The implementation offers to use some inference specification options, for example, to create create mappings for superclasses and superproperties and also supports some mapping optimization options, for example, to avoid lengthy SQL filter expressions if many OWL data properties has a common domain class but maps to

linked DB table. The RDB2OWL tool has also its own RDF triple generation functionality but it is not further enhanced due to the existence of D2RQ and R2RML tools. The further development is aimed at optimization options for some widely used RDB-to-RDF/OWL mapping patterns.

TETRADS AND THEIR COUNTING

Juris Cernenoks, Andrejs Cibulis
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A *tetrad* is a plane figure made of four congruent shapes in such a way that every pair of shapes has a border arc in common. In accordance with the famous popularizer of mathematics M. Gardner [1] the name 'tetrad' first was used by M. R. W. Buckley in the Journal of Recreational Mathematics (1975, Vol. 8.). Already DeMorgan (1806 – 1871) had noticed that no more than four regions on the plane can all be in mutual contact with each other. Here we shall study tetrads that are made of *polyominoes*, i.e. plane shapes formed by joining unit squares edge to edge. If a polyomino consists of exactly *n* unit squares it is called *n-omino*.

With purpose-built computer programmes, all *n*-omino (up to $n = 17$) have been tested, and it was determined how many of them are those that form the tetrads. We paid a special attention to such computer-assisted proofs [2] that give the opportunity to obtain the proof in the classical sense, if possible, a beautiful proof. As the good example of this type of computer-assisted proof in the context of tetrads we mention the proof of the following theorem: for every $n \geq 11$ there is a full polyomino tetrad made of *n*-omino.

Let us list some facts about polyomino tetrads, see also [3], [4]. The smallest such a tetrad uses 8-ominoes or octominoes. Moreover, there are exactly 8 octominoes forming tetrads. None of these tetrads is full. The smallest full polyomino tetrad uses 11-ominoes. There is only one 11-omino out of the total number 17073 forming the full tetrad. With the help of computer programmes, all the tetrads from *n*-ominoes, $8 \leq n \leq 17$, have been found now. Several more interesting tetrads have been selected and will be considered in this paper.

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4. http://userpages.monmouth.com/~colonel/tetrads/tetrads.html

ANALYSIS OF SUITABLE NATURAL FEATURE COMPUTER VISION ALGORITHMS FOR AUGMENTED REALITY SERVICES

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Keywords: Augmented reality, Computer vision, Natural feature detection algorithms

First step for working with object augmentation in an augmented reality system is to identify the target object, so its pose in respect to camera can be determined, for precise and accurate augmented content generation over target object.

In modern augmented reality systems natural feature detection algorithms are widely used for detecting, identifying and tracking planar textured objects. All natural feature algorithms detect interest points or keypoints (detector) in image (scene) and/or calculate descriptors for keypoints (extractor). Algorithms can include both parts, detection and extraction, and also can have just one of them realized.

There is variety of algorithms available nowadays for developers to use. Starting from floating point descriptor based ones as SIFT and SURF and a row of binary descriptor based algorithms such as BRIEF, ORB, BRISK, FREAK, KAZE, A-KAZE, LATCH. Besides there are algorithms which only detect interest points, as FAST or A-GAST. Furthermore it is possible to use one algorithm for keypoint detection afterwards using other one for descriptor extraction.

By such a variety of available algorithms, it is needed to analyze them by understanding their working principles so they can be classified, what are their strengths and weaknesses, in what situations one or another algorithm use is more appropriate. Since it possible to use combinations of algorithms, a table of possible cases is provided.

For clarity we have to mention that various algorithms, which are not mentioned here, are available but we take an overview of above listed as all of them are included in OpenCV library and are widely used in industry.

THE INTEGRATED MODEL ON USING VIRTUAL AND AUGMENTED REALITY IN EDUCATION

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Keywords: Virtual reality, Augmented reality, Model education

Over the past few years, VR and AR have been gaining popularity very fast. Implementations of new technologies caused the development of AR and VR explicabilities. Neither virtual reality nor augmented reality is not yet widely used in higher education and the purpose of this paper is to provide a virtual reality model for the development of integrated learning objects. The new emerging technologies can upgrade education in ways that we never thought of. Students can learn by doing and without AR or VR it was almost impossible for some study fields like simulation. As demand to apply 3D information visualization for learning has boosted, the development of learning objects practices followed as well.

Now, the biggest challenge is either the teachers will see the value in implementing VR and AR technologies into their teaching subjects and if they will use it as one of the learning tools. It is clear that success of virtual and augmented reality in education is closely connected to the development of distance learning, or blended learning in the classrooms, which will stimulate teachers to see in educational process.

In the paper, authors present the literature review on virtual and augmented reality and analysis of integrated models for educational process implementation. In addition, the authors suggest the model, supported by validation conclusions and will provide recommendations for the model implementation into practice.

REGULARIZATION TECHNIQUES FOR APPLIED INVERSE AND ILL-POSED PROBLEMS INCIPIENT IN SCIENCE, TECHNOLOGY, ECONOMY, AND SOCIETY

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Keywords: Inverse problem, Ill-posed problem, Regularization method, Mathematical modelling

In the very various fields of science, engineering, economics, geophysics, meteorology, social sphere (criminology, psychology, politics, etc.), agriculture, biochemistry, immunology, medicine, ecology, and other life sciences, it often has to solve inverse problems, in which it is required to determine some set of cause-effect characteristics by measuring the state of systems of objects, processes or phenomena. In order that understand the essence of the term "inverse problem", it is necessary to firstly define the concept of "direct problem". If we abstract away a concrete subject domain, then any problem in which it is necessary to define *all means possible consequences* by the known causes can be called a direct problem. Consequently, if we make a start from this definition of a direct problem, then in the wide sense, an inverse problem can be considered as arbitrary problem, in which it is required to determine the specific causes by some limited set of consequences, at that these consequences can be circumstantial and / or distorted. Comparing these two definitions, we can observe that the definition of direct problem involves the word combination of "all means possible consequences", and the definition of inverse problem involves the word combination of "some limited set of consequences." In other words, in the definition of inverse problem it is not at all assumed that we must know all means possible consequences to determine the specific causes of already happened or expected process or phenomenon. If we look at the just-mentioned difference between direct and inverse problems from the mathematical standpoint, in particular from the mathematical modelling standpoint, then the stated difference means a possible violation of the natural cause-effect relationships in inverse problems, and this circumstance very significantly separates direct and inverse problems, and in the majority of cases it is this distinction that excludes the interconvertibility of the original direct problem and the corresponding inverse problem. Here it is important to emphasize that the mentioned difference is not the single significant separator between direct and inverse problems.

Further, the above-mentioned violation of natural cause-effect relationships in inverse problems entails ill-posedness of mathematical statements in the sense of Hadamard: (a) in the classical sense the solution of the problem does not exist for all admissible initial data; (b) for one and the same set of initial data the solution of the formulated problem is not unique, and moreover, its solutions can be very differ significantly from each other; (c) arbitrarily small changes of the initial data can lead to uncontrollable arbitrarily large changes of the solution of the formulated problem, and therefore, an adequate interpretation of the measurement results is extremely difficult or even impossible. Therefore, any inverse problem is an ill-posed problem. However, this does not mean that the property of ill-posedness is inherent only to inverse problems: among the direct problems describing real objects, processes or phenomena of various human activities and the surroundings, there is the vast class of ill-posed problems, for each of which either the conditions of mathematical certainty are violated (i.e. the conditions (a) and (b)) or the condition of physical determinacy (i.e. the condition (c)) is violated, and consequently, the physical interpretation of the solution of the considered mathematical model becomes impossible. By virtue of the foregoing, it is clear that the development of methods for solving ill-posed problems is extremely important and this arouses the self-reliant interest regardless of whether the inverse or direct problem is being investigated.

Throughout the history, people are continually faced with ill-posed problems: both with ill-posed direct problems (see conditions (a)-(c)) as well as with inverse problems, which, as has been mentioned above, are ill-posed. And people tried to solve such kind of problems dispensing with the appropriate apparatus, which now there is in modern mathematics. In effect, any endeavour to expand the boundaries of direct perception (sensory, visual, auditory, etc. perceptions) of the surrounding world leads to ill-posed problems. Almost every one of us understands that it is easy to make mistakes trying to restore the past by some facts of the present, for example: to identify the causes of origin of the disease and to understand the key stages of the development of the disease by the bounded set of results of patient examination; to restore the motives and details of the crime according to available evidence, which, as a rule, are not only incomplete, indistinct or distorted, but often are contradictory; to foresee the direction of the country's development by the available measured economic, financial, social, environmental, scientific and technical, political, etc. indicators; to determine deposits and volumes of mineral wealth on the data obtained by frequency electromagnetic sounding of the near-surface layer of the Earth; to determine such economic "corridor" within which the considered country

can reach the desired level of the gross domestic product (GDP) during the certain time, for example, doubling the GDP; to predict the child's life path analysing his current cognitive and practical abilities only; etc.

In the present paper, the techniques of solving inverse and ill-posed problems arising in the most diverse fields of human activity are discussed. As a rule, these techniques are based on the fundamental concepts of the stabilizing functional and the regularizing operator, which in the 60s of the 20th-century have been proposed by one of the greatest mathematicians of the XX century Academician A.N.Tikhonov who made significant contributions to the mathematical physics, theory of differential equations, topology, functional analysis, geophysics, theory of difference schemes, computational mathematics and theory of mathematical modelling.

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ON AN APPROACH FOR COMPUTING LOCAL-SLIP LENGTH PROFILES OF LIQUID ON UNIDIRECTIONAL SUPER-HYDROPHOBIC SURFACES IN THE CASSIE-BAXTER STATE

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Keywords: Super-hydrophobic surface, Cassie-Baxter state, Local-slip length

In the Cassie-Baxter state anisotropic super-hydrophobic surfaces have high lubricating properties ([1], [2]). Such super-hydrophobic surfaces are used in medical implants, aircraft industry, vortex bioreactors etc. In spite of the fact that quantitative understanding of fluid dynamics on anisotropic super-hydrophobic surfaces has been broadened substantially for last several years, there still are some unsolved problems in this field.

This work is an extension of the work [3], and it investigates dynamics of a liquid on unidirectional super-hydrophobic surfaces in the Cassie-Baxter state, when surface texture is filled with gas and, consequently, the liquid virtually is located on some kind of an air cushion. Energy of the interphase boundary liquid-gas is much smaller than energy of the interphase boundary solid-liquid, that is why the contact angle at wetting such surfaces differs a lot from the Young contact angle and depends on contact area ratio of liquid-gas and liquid-solid in visible contact of liquid and surface. Considering difference in energy obtained if we slightly shift the three-phase contact line, expression for macroscopic equilibrium contact angle, which describes the Cassie-Baxter state, can be deduced. In the work the design formula for computing local-slip length profiles of liquid on the considered super-hydrophobic surfaces is obtained.

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ON AN APPROACH TO RECONSTRUCTING THE DISTORTED OR LOST PARAMETERS OF ACOUSTIC SPEECH PRODUCTION ON OBSERVED SIGNAL

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Keywords: Speech recognition, Mathematical model, Regularization algorithm, Stable signs of the speech signal

Speech recognition, identification of language in a voice message and different problems of language biometrics are the most important problems of automatic speech processing (for instance, see [1]). Main methodology of solving the above listed problems is finite-dimensional vector representation of initial voice signal calculated based on its spectrum. These vector representations are called signs of the voice signal (for instance, see [2]-[4]). While constructing systems of automatic voice signal processing, the main objective is stability of the signs in different acoustic conditions, when a big amount of interference and distortion takes place (for example, additive nonstationary noise) in the initial voice signal: this distortion leads to variability of computed signs. In other words, there arises a need for development of such stable signs whose work does not depend on acoustic ambience of data transmission and which are able to distinguish the wanted signal against its noisy background. The main difficulty here consists in the fact that classifiers trained in one communication channel do not allow to qualitatively identify signal received in another channel. The simplest change of channel is, for instance, increment Signal-to-Noise Ratio-SNR.

In this work a theoretical base for finding stable acoustic signs used in different tasks of voice signals processing and classification is developed: different mathematical models describing the process of acoustic speech production in the system of human vocal tract are developed and investigated; analytico-numerical approach for searching unknown components of sound field (pressure and velocity of particles), which in the final form the observed voice signal, is developed.

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ON AN APPROACH OF CONSTRUCTING A FINITE-STATE AUTOMATON TO PROTECT DISTRIBUTED INFORMATION SYSTEMS IN THE PRESENCE OF NETWORKS WITH PUBLIC ACCESSES

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Keywords: Distributed information system, Information system security, Finite-state automaton

Nowadays, information systems and technologies have become an important part of every field of human activity by accelerating processes of world community globalization and integration, world economy, world culture ([1]-[3]). Information systems and technologies actively influence the condition of industrial, economic, financial, environmental, energy, food, transport, criminogenic, information, military-industrial etc. complex security components of any developed country (so-called first and second world countries: see [4]) and many developing countries (so-called third world countries: see [4]). Information is becoming even a more critical resource, and its change, theft or destruction may lead to huge losses.

Protection of corporate distributed information systems is one of the main information security tasks of any organization. Exterior and interior invasions of confidential data in corporate distributed information systems, distribution of malicious software, anonymous unsolicited mass emailing, growing trend of combining malware technology with mass spam distribution form list of the most essential threats to secure functioning of corporate distributed information systems. It should be emphasized that usually in corporate information system the organization works harder in order to protect itself from exterior threats, however more than half of all invasions and computer security violations occur as the result of its own employees' or other people's who have legitimate access to the information system ([5]-[7]) actions. In the case of interior invasion, insider usually acts maliciously and knows that he is violating his company's security policy ([5]). However, while classifying interior threats, we should distinguish a special group of threats commited by negligence or technical incompetence ([8]): for instance, insiders's wish to simplify his work or aiding a colleague who does not have respective authorities.

In the present work a method for automatic detection of exterior and interior invasions of corporate distributed information systems is developed

on the basis of observation of distributed information system's objects' behaviour and interaction. For method's development finite-state automaton theory and apparatus of relational algebra theory, which allows to perform difficult operations with relations of different types, were used.

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GAMIFIED MOODLE COURSE FOR TEACHING UML

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Keywords: Gamification, UML, RUP, E-learning, Moodle

Gamification is considered a fairly new trend, in recent years it gathered a fair amount of attention in software engineering and education. Gamification in education has positive results as game elements tend to provide a framework with goals and structure which help to better guide student behavior [1].

Unified Modelling Language (UML) is constantly used in object oriented software development. UML is also the part of software engineering curriculum in many higher education institutions [2]. Currently in Kaunas University of Technology, Information Systems study programme fourth year undergraduate students are taught an extensive course on Unified Modelling Language and Object-Oriented methodology for development of Information Systems. During the course a vast amount of information related to OO Information System design and specification is being taught to students.

Whereas UML is only a language, it provides the diagram notation, without giving the instructions for using these diagrams in software development. The software development process or framework defines which models are used during each development stage. One of the most UML based processes is Rational Unified Process [3].

The current Information System Design course teaches both UML and RUP principles and therefore covers a broad range of topics. Unfortunately, students' motivation and engagement play a huge role in the teaching process, many of the students tend to lose their motivation and thus the quality of learning diminishes.

To combat this problem and to increase student engagement into the learning process an idea of gamifying the course was proposed. It was decided to implement a gamified course in Moodle learning management system [4], as it is a familiar platform for students in Kaunas University of Technology. At the start of autumn semester in 2017 student were invited to participate in gamified course. Students' activity in gamified course was recorded and analyzed.

Analysis results show that gamification had a positive effect on student grades. In addition to the learning platform data, students were surveyed measuring their intrinsic motivation. Surveys' results indicate that students'

intrinsic motivation increased, provided they used the gamified system regularly.

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NEW CHALLENGES AND OPPORTUNITIES FOR STEM EDUCATION IN THE LATVIAN EDUCATIONAL CONTEXT

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Keywords: Information technologies, Secondary education skills

The article is dedicated to theoretical and practical insights into the use of information technologies (IT) in the process of STEM subjects education, which includes using innovative methods in the Latvian educational context. It analyses the significance of IT application in educational process, functional capabilities of the use of educational portals and presents the theoretical model of the realization of IT in STEM education. The article introduces to empirical research in order to present the approach of secondary education learners to the use of open education resources service system as the possibility of functional application of a separate IT unit in secondary education. Educational support for secondary teachers to use contemporary IT and open education resources provisions more effectively for their competence development are presented.

DIVERSIFICATION OF THE ONE-DIMENSIONAL HEAT CONDUCTION SOLUTION`S PROBLEM

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Keywords: 1-D diffusion-convection initial-boundary value problem, Conservative averaging method, Exponential type splines

The article focuses on the tasks of the mathematical physics – one-dimensional diffusion-convection boundary-value problem (BVP) for heat conduction equation solving. The equation with piece-wise smooth coefficients in the multi-layer media is given (one and two layers are analysed), $u = u(z,t)$ is the unknown function, dependent of coordinate z and time t.

For solving these problems the conservative averaging method (CAM) is using with special created the integral splines of exponential type that interpolate the middle integral values of piece-wise smooth function. With the help of these splines through averaging in z-direction, named BVP is reduced to the system of ordinary differential equations (ODE) dependent on time t. This enables to find out the averaged solutions of BVP – non-stationary and stationary.

For analysing the CAM an analytical solution of the system of ODE was found and the present BVP has been resolved also numerically using MATLAB routine 'pdepe'. There were compared the numerical and analytical (for stationary problem) results obtained with CAM and 'pdepe' for two layers. The error of approximation for stationary solutions with exponential type splines is 10^{-7}, with parabolic type splines [2] – 0.2116; for non-stationary solution – 0.0163. In the case for one layer the maximal error for non-stationary approximation with exponential type splines is 0.0183.

As an application for modelling of heat transfer problems in the layered media we have studied the heat transfer processes in two layers of gypsum material at high temperature [1]. We have considered gypsum board material with two layered plates in z-direction – gypsum plate and gypsum carton plate. Plate has been exposed to fire at high temperature by specific relationships depending on time t.

Heat transfer mechanisms and models for a gypsum board products have been investigated, for example, in [3], here was described the specific heat coefficient c_p and the thermal conductivity coefficient K depending on the temperature of the combustion process. This study also found coefficients` c_p and K dependence on the temperature (increasing and

decreasing intervals). For analysing coefficients` c_p and K dependence on the temperature the MATLAB routine 'pdepe', as well as the CAM were used.

The obtained results indicate the conservative averaging method and the MATLAB routine 'pdepe' suitability for successfully solving the article`s presented problem.

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MENTAL ARITHMETIC

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Keywords: Mental arithmetic, Visualisation, Creative thinking

Mental arithmetic is arithmetical calculations using only the human brain without any aids. Mental arithmetic benefits both pupils learning mathematics and adults in their everyday lives. Some simple techniques for performing mental arithmetic are also taught at school.

Arriving at a solution is only one of the results of arithmetical calculations. Another important result is related to the fact that several simultaneous activities take place in our minds when doing mental arithmetic — **analysis, calculation and keeping the subtotal in mind.** Analysis of numbers is performed to evaluate the situation and to find the best strategy for calculation.

Various analysis of numbers allows one to feel freer with numbers, for example when looking for a number that eases calculation or when changing a number to simplify a task. Thus, numbers become more understandable and one feels less afraid of them.

During analysis, new links between neurons form, which promote the brain efficiency and keep our mind sharp in various ages — as pupils, adults, and seniors.

Techniques for mental arithmetic differ from those of written calculation. Tasks in written calculation process follow a set algorithm, while mental tasks can involve various techniques from which the most rational one must be selected. Calculations require concentration or ability to pay and keep attention to a specific task. Mental arithmetic as a brain exercise develops individual critical and creative thinking and reaction speed, which is of importance at any age.

Keeping the subtotal in mind is another important part of mental arithmetic. There are various systems for memorising the subtotal, which are based on internal visualisation of numbers.

The paper analyses experience in mental arithmetic techniques.

COLLECTIVE CREATIVITY AND TEACHER PROFESSIONAL DEVELOPMENT IN SOCIAL MEDIA

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Keywords: Collective creativity, Identity construction, Teacher professional development, Self-regulated learning social media

Collective creativity develops in situations where creative self-regulated adults collaborate to create product or service. In this research we supported the ideas that collective creativity could happen at many levels: at the level of the culture, at the level of the subculture, at the level of the group, and at the level of the self-regulated adult (Giuffre, 2016). The results of collective creativity are often unpredictable (Von Held, 2012). Social media sites are contemporary medium for collective creativity development. Communicating, discussing, sharing and participating, self-regulated adults construct their professional identities. Although it has been researched for several years, identity construction in social media sites remains one of main areas of scholar investigation (Papacharissi, 2010). Our research question was – how (if all this is happening) collective creativity of self-regulated adult develops in university teacher professional environment then teacher is involved in social media. University teachers from 5 Lithuanian universities in 2 main cities participated in the research. These teachers were engaged in 5 scientific fields: sciences, social sciences, humanities, biomedicine and technologies. We have purposefully selected such teachers who have been involved in social media activities. Teachers used Facebook, LinkedIn and Youtube for sharing, communicating and collaborating with their students, colleagues and other self-regulated adults. For the qualitative data collection 20 interviews were conducted. We constructed grounded theory (Charmaz, 2014) to explore university teacher professional development in social media sites. A core category Collective creativity showed the process of teacher professional identity construction in social media. Text hunting and maintaining networked connection with the students were two main preconditions what lead to collective creativity. Collective creativity helped to strive for academic goals and construct professional identity. These findings contributed to understanding how the university teacher's collective creativity in social media could influence not only professional development but also professional identity construction.

HOW LONG DOES IT TAKE TO BOARD AN AIRPLANE?

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A simple airplane-boarding model, introduced earlier by Frette and Hemmer, is considered. In this model, N passengers have reserved seats, but enter the airplane in arbitrary order. We are looking for an analytical expression, which describes the mean boarding time depending on the total number of passengers N. For this purpose, we first determine precise values of the exponents and expansion coefficients in the asymptotic expression at N tending to infinity. It is reached by mathematical calculations and fitting the Monte Carlo simulation data for very large N. Finally, we compare the obtained analytical approximation to the simulation data for a realistic number of passengers, about 500 or smaller, and find a good agreement.

LIEPĀJA UNIVERSITY MATH AND PHYSICS OLYMPIAD FOR SCHOOL-STUDENTS – CHALLENGES AND POSSIBILITIES

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Keywords: Math Olympiads, Team competitions, Multiple-choice tasks, topics in math competitions

Liepāja University Olympiad take place since school year 2005/2006. Idea and form of this competition is taken from Virumaa math contest in Estonia. It is team competition for 8th – 9th Grade students and 10th – 12th Grade students. Olympiad is organized in two rounds – individual competition and team competition both in Mathematics and Physics. Each school could be represented by one team in each age group, but the teams could be different for math and physics competitions. However, many students take part in both competitions. At first students have Maths competition, and after that – Physics competition.

In the individual competition students should comply multiple-choice test while in the team competition teams should solve problems in cooperation with team members.

Math papers are checked while students are doing Physics, and Awarding ceremony for Math competition takes place in the afternoon of competition's day. To speed up checking of the papers, IT tools like MS Excel are used.

In the report will be discussed problem posing for the Olympiad, results and typical mistakes in 2018th year's Olympiad as well as progress of students during last three years.

ENHANCING UNIVERSITY COMPETITIVENESS THROUGH ICT INFRASTRUCTURE: THE CASE OF KAUNAS UNIVERSITY OF TECHNOLOGY

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Keywords: **E**ducation, E-services, Student needs, Competitive infrastructure

The main challenge for higher education in the nearest future is the global competitiveness (the Bologna process), as the present global market requires the higher schools to present their courses in the international level. Thus, traditional universities must adapt educational infrastructure in response with the global requirements. What are the essential factors that can influence changes forming the educational infrastructure?

The crucial factor influencing the main changes while forming the higher education institution environment over the last decades is a rapid development of new learning technologies. It is obvious that the introduction of the new technologies requires the preparation of new educational environments and methods adapted for these technologies. The development of Information and Communication Technology (ICT) and the occurrence of novel technologies regularly influence the infrastructure of higher schools.

Despite the fact that higher schools pay special attention to the implementation of ICT in the educational process, the study of the literature sources shows that there is no unique methodology of a coverage of study needs by ICT services. So far, higher schools usually develop their own ICT infrastructures based on experts' advice or delegate this task to private IT companies. Thus, this study aims to contribute to this area by filling this gap.

This paper pays attention on the development of competitive ICT infrastructure. The mentioned competitive infrastructure in the paper is defined through the support of the student needs in order to complete the higher school.

The experience of Kaunas University of Technology (KUT) has been proposed according to support of student needs. KUT is running its own hybrid infrastructure, which provides many e-services; most of them are cloud-computing based solutions. This hybrid infrastructure allows the university students and staff to access e-services via Web, both in computer classes at the University, and for self-working place at home. The

originality of the infrastructure is that there are additional functions implemented to manage users who are working with virtual resources. Administrators have opportunity to see how many users are working with virtual resources and to disconnect the users if they are using resources not for work.

Even though most institutions of higher education can provide a long list of e-services to support student needs, this does not mean that students actively use all of these services. There might be a discrepancy between the provision and the usage of support services. The usage of KUT e-services related to the academic process has been analysed.

This paper begins by presenting the components of hybrid infrastructure implemented in KUT. Then goes on by laying out the list of e-services provided in KUT, and looks at how these services accomplish with students needs specified by support model being already presented. Then, the usage of selected e-services by KUT students over different time periods is explored.

The present paper has provided the evidence with respect to the implementation of student needs in terms of e-services as a framework for competitive ICT infrastructure. Other higher education institutions can learn from KUT experience while developing or improving their ICT infrastructures and enhancing their competitiveness.

SOFTWARE DEVELOPMENT AND NUMERICAL SOLUTION OF HEAT CONDUCTION EQUATION USING TH EHIGHER ORDER FINITE-DIFFERENCE APPROXIMATION SCHEME

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Keywords: Heat conduction equation, Finite-difference approximation, Numerical solution

Higher order finite-difference approximation scheme is formulated for the heat conduction equation. The scheme is simple for writing programs. The advantage of the scheme can be seen to solve large problems.

This work is dedicated to the numerical solution of the following boundary value problem for heat equation:

$$\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial^2 t} + f(x,t), \quad 0 < x < l, \ 0 < t \le T \qquad (1)$$

$$u(x,0) = \varphi(x) \quad 0 < x < l \qquad (2)$$

$$u(0,t) = v(t)$$
$$u(l,t) = \vartheta(t) \qquad 0 < t < T \qquad (3)$$

To solve our problem, we introduce regular grid in the domain $[0,l] \times [0,T]$:

$$\omega = \{(x_i, t_j): x_i = ih, t_j = j\tau, i = \overline{0,N}, j = \overline{M}, h = \frac{1}{N}, \tau = T/M\},$$

where *N, M* are the given positive integers.

On the grid, the boundary value problem (1) – (3) is approximated by the following two layer 5-point implicit scheme [1]:

$$\frac{1}{12h^2} u_{i-2}^{j+1} - \frac{4}{3h^2} u_{i-1}^{j+1} + \left(\frac{5}{2h^2} + \frac{1}{\tau}\right) u_i^{j+1} - \frac{4}{3h^2} u_{i+1}^{j+1} + \frac{1}{12h^2} u_{i+2}^{j+1}$$
$$= \frac{1}{\tau} u_i^j + \frac{1}{\tau} f_i, \qquad 2 \le i \le N - 2$$

$$u_i^0 = \varphi_i, \ i = \overline{0,N}$$
$$u_0^j = v_0^j$$
$$u_M^j = \vartheta_M^j, \ j = \overline{0,M}$$

Our difference scheme has the following form:

$$a_i u_{i-2}^{j+1} - b_i u_{i-1}^{j+1} + c_i u_i^{j+1} - d_i u_{i+1}^{j+1} + e_i u_{i+2}^{j+1} = \phi_i, 2 \le i \le N-2,$$

Unlike 3-point implicit approximation, the above difference scheme has order of accuracy $o(h^4)$ and is solved by the 5=point fifthdiagonal matrix method (Thomas algorithm) [2].

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"SOFT COMPUTING" TECHNOLOGIES OF HYBRID MODEL STRUCTURE FOR THE AUTOMATED CONTROL OF FLIGHTS

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Keywords: Hybrid intellectual systems, Artificial neural networks, Genetic algorithm, Soft computing, Matlab, Clustering

In this work the specificities of hybrid-intelligent systems are considered from the standpoint of selection and applying model structure genetic and neural systems of artificial mind for solving the tasks of classification of testing technic devices providing flight safety and effectiveness of aircraft.

The problem consists of selecting system efficiency key indicators for recognition and evaluating their values. The effectiveness of system work is evaluated on the base of the experimental data, obtained from the study of the real and simulated systems with the aid of mathematical model.

The model may be used in all testing stages in e-learning for trainees in order to undertake the objective assessment of the level and the quality of knowledge.

Theoretical prerequisites are disclosed in using hybrid-intelligent systems in the interaction of concepts structural and evolutional projecting, are discussed the practical scope of application.

As a result of the solution of the target is selected the network structure, complied educational sequence of indicators and have conducted the hybrid network. The mathematical model has been constructed and has been analyzed. The results of research lead authors to the fact to assume the possibility of using neuron networks and genetic algorithm in carrying out the tasks of classification of users. The researchers have come to opinion about the appropriateness of application of hybrid-intelligent technologies systems in predefined multicriteria classification of users on a variety of characteristics. The model may be used in all testing stages in e-learning for trainees in order to undertake the objective assessment of the level and the quality of knowledge.

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COMPLEX APPROACH TO TEACHING OF MATHEMATICS USING INFORMATION AND COMMUNICATION TECHNOLOGIES

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Keywords: Education, ICT, System, Model, Communication studies, Electronic learning course

As a result of the recent socio-economic changes in the society, development of the technologies its influence to the all areas of human activity puts new problems for the high education. High school must, foremost, give integral ideas about the natural-science picture of the world, to lay the scientific foundation for the estimation of the professional activity, to assist creative development of personality and faithful choice of the individual program of life.

It should be noted that one of key priorities of UNESCO in the area of education, rendering assistance to the members of UNESCO, is in making of strategy and realization of politics of informatization of the education process: modernizations of the national systems of education on the basis of introduction of innovative models of management by educational establishments and also strategies of decision of problems of upgrading of education through introduction of modern ICT and front-rank pedagogical methods in everyday educational practice.

Azerbaijan as a participant state of this project considers the education as a key element in the cultural, economic and social development.

In this accordance the state standards for the first and second generation in the on-line tutorials of faculties of teaching in the higher institutes of the Azerbaijan Republic is included the block of natural-science disciplines, one of component parts of that is a block of "Mathematics and Informatics".

Purview of information and communications technologies (ICT) in education is constantly enlarges: from the use of computer and corresponding information technologies as an object of study of informatics accents are carried to deployment it as the facilities for intensification of educational process on general disciplines.

These changes of cause have influence on the educational sphere both from the point of view of maintenance of tasks of education and to the use of the discovered technological possibilities for the achievement of the aims of education.

Therefore, in this work the is justified the necessity to produce the complex approach and practical direction for using information and communication technologies with the aim of increasing the efficiency and

quality of education process and its goals on the all levels of education on the base of ICT and pedagogics and a scheme is proposed for the complex implementation of ICT in teaching of all disciplines and inter-disciplines subjects.

TOOLS SUPPORTING THE PROCESS OF TEACHING BUSINESS INTELLIGENCE

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Keywords: Business Intelligence (BI), Data analysis, BI tools

Business Intelligence (BI) uses methods and technologies that collect, store, report, and analyze data to help to make better decisions in any kind of situations. Modern BI is about the process of turning data into usable information, using an assortment of tools, techniques, and applications. Variety of tools are easy to use, they are user friendly and demonstrate an exceptional amount of examples. But the tools in often case are not the main cause for misinterpretations. In teaching process for the lecturer, challenges include access to data sets and finding suitable cases, as well as providing realistic and meaningful examples. There exist several problems in the process of dealing with data. In most cases the data is not understandable, it is separated or inaccurate. Therefore a scientific approach has to be used, but usually students have problems with the proper approach. One of the challenge of data analysis is also a lack of skilled professionals. It is necessary to overcome these challenges.

STUDENTS' ATTITUDES TOWARD LEARNING ACTIVITIES ORGANIZED WITH THE MEANS OF WEBQUESTS METHOD

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Keywords: WebQuests, Web 2.0 tools, Students' attitude, motivation.

The development of the skills and competencies of the 21st century leads education to the need for the reform, with a view to realizing the social and economic needs of the students and the entire society of the 21st century. In the conditions of the transition of education to a competence approach, new means and new educational technologies based on them are needed, contributing to the improvement of the quality of education. One of the factors influencing the development of the society, as well as changing the learning processes changing, is the development of technology. Information and communication technologies are becoming an integral part of the educational process, qualitatively changing the information and educational environment. The technology WebQuests, as an interactive method of learning, is based on research-oriented activities with the use of the Internet resources [1]. The educational process built on the basis of WebQuests develops the ability of students to work both individually and in a group, as well as the ability to search information and transform it into deeper knowledge [2]. The article describes the techniques and methods of introducing the interactive method of learning WebQuests at the lessons of the Latvian language and literature, based on web 2.0 tools, into the learning process. One of the goals of the study was to identify students' attitudes toward learning activity using the WebQuests method. Structural components of the relationship were singled out according to the method of O. Voronina [3]: emotional-evaluative attitude, attitude to work in the group, external and internal motivation. The article presents the results of the survey of the students of the 6th, 8th and 12th grades of Liepaja Secondary School No. 7.

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QUALITY ASSURANCE USAGE IN WEBPAGE APPLICATION DEVELOPMENT

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Keywords: Quality Assurance, Web applications, Automatic testing

In nowadays to successfully create a project; company not only need a good idea, but also proper execution. Because of massive information flow, developers might have only a couple seconds until user decides if it wants to stay or leave. Right now there is 1 861 493 500 active websites, and this number is growing by day. [1] Every second that user is on your website, he is not others. And that time should feel flawless.

Google assessed that if webpage load time will be decreased by one second there is 27% bigger chance of user conversion. [2]

Article describes ways how to potentially increase quality assurance by using different tools. Quality assurance is not only testing and finding bugs and mechanic that prevents bugs from being created. It consists of multiple stages, and each stage is important. Some of these stages are – software design, software coding, code control and others. In Article, all these aspects has been looked over and checked for possible solutions how to cover all these stages.

Also article looks over typical mistakes that prevent webpage becoming successful as well as looking over typical development problems and how to avoid them, for example – not understanding tasks, code quality, testing environments, etc.

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CONTEXT AWARE INFORMATION MODEL FOR ACTIVE LEARNING OBJECT

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Keywords: Active learning object, Information model, Authoring context, LO reusability, LO specification

This paper presents how to express and describe context of learning content, which enables the design of active learning object (ALO) and their educational content, prediction of active learning process and creation of problematic learning situations. For this purpose, in the paper we proposed an ALO information model, which uses context of educational content and meaningful action of learners. This paper also analyses the results of research and shows that while developing ALO, it reusability is not lost.

TESTING USABILITY OF WEB-BASED VIRTUAL TOURS

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Keywords: Usability testing, User behavior, Virtual tours, Web-based systems

The current paper describes results of usability studies of web-based virtual tour application for Real Estate Company. "Interactive virtual tours become popular since they enhance visual presentation and spatial understanding. …. The main item in such a tour is a viewing window that the user can control." [5] The goal of the studies was to identify all usability problems and to evaluate user satisfaction on the product. The main research questions were:

- Are users able to complete the task applying built-in tools?
- How long it takes for users to complete the task?
- What is the frequency of the use of each built-in tool?

The techniques and tools used for finding answers on the defined questions was user contextual interviews [3], applications of Rainbow Spreadsheet and A/B testing [1], and analysis of user behaviour based on mouse clicks and virtual tour view frequency [2]. The usability of more than 30 web-based virtual tours was analysed. "Usability testing refers to evaluating a product or service by testing it with representative users. Typically, during a test, participants will try to complete typical tasks while observers watch, listen and takes notes" [4].

As result of the current studies, users' behaviour analysis can substitute users' interviews for usability testing. That provides possibilities to evaluate efficiently, fast, and continuously the quality and usability of the developed and modified software tools and functionality, and to identify items for improvements.

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DEVELOPMENT OF PROGRAMMING SKILLS FOR IN-SERVICE TEACHERS: A CASE STUDY OF LIEPĀJA UNIVERSITY

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Keywords: Algorithms, Visual programming, Programming skills, Teacher training

The number of programmable device has been dramatically increasing both in households, in society, and in workplaces. "Programming is an important part of our culture. The effects of programming are widely experienced throughout society in a multitude of social, work-related, and leisure software applications" (Shehane & Sherman, 2014). Thus, the acquisition of programming skills has been integrated in school curriculum for schoolchildren of any age. "Programming skills are receiving widespread attention for different age groups alongside occupational education programs to better prepare individuals for their future careers" (Topalli & Cagiltay, 2018). Due to cross-disciplinary characteristics of applications of programmable devices and algorithmic problems, at least basic programming knowledge and skills must get teachers of any learning subject. However, most of in-service teachers have not learned programming as part of higher education curriculum. Responding to the new challenges and development trends of information and communication technologies, academic staff of Liepāja University provides life-long learning courses for primary school teachers on programming. The curriculum includes introduction to algorithms and programming using visual programming language Scratch, programming language Java, and visual programming language LabView for Lego Mindstroms EV3 robots. Since 2015, more than 220 in-service teachers have trained. The presentation and full paper will describe the main results and their analysis of implementation the life-long learning courses.

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MOODLE AS PERSONAL KNOWLEDGE MANAGMENT TOOL

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Keywords: Moodle, Blended-learning, Personal knowledge managment, Higher education

Moodle (Open Source software package) is one of the most used learning space in the word (230 countries and 94,839 sites are registered (data from Moodle.net, retrieved 11.03.2018.). Moodle is known as tool for learning managment but can it be used for development of students personal knowledge managment skills.

Personal knowledge management got topical by development of ideas of knowledge society. Management of knowledge is valuable in three fields – (1) quicker and better decisions – getting familiar with organizations' experience mistakes can be avoided by using adapted solutions un right decisions; (2) wider possibilities – motivating employees to acquiring knowledge and use it they become responsible for their investment; (3) speeded up learning – differentiate all new knowledge acquired personally or in learning process in organization.

Students have to manage their knowledge in the learning process, they have to socialize and acquired knowledge must be internalized. In the context of sociocultural theory important condition is before knowledge sharing person need to organize it and make it as own – and this is beginning stage of socializing.

In Moodle.org discussion board there was a question – can Moodle be considered as a knowledge managment solution (https://moodle.org/mod/forum/discuss.php?d=76083, retrieved 11.03.2018) and several answers showed, that it is solution.

Article will research possibilities of Moodle for persona knowledge managment skills support as well as research practice in higher education institution.

CREATION OF MATHEMATICAL PROBLEMS INSPIRED BY ORNAMENTAL ART

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Keywords: Ornament, Tiling, Mathematical problems

In architecture and decorative arts ornamental elements are traditionally used that are created from geometric figures, interpreting motives of fauna and flora, stylizing the phenomena of nature or applying specific symbols originating from mythical or religious beliefs. These elements are either presented as a complete composition or composed as a band of continuous meanders, or applied as a plane tessellation.

Challenging problems of geometry, combinatorics, graph theory, and of algorithm theory can arise from ornaments. Students can investigate and discover basic principles of their construction, research particular properties of the geometric figures included in ornaments, find relationships between the figures, and calculate the proportions of elements in the layout (Massarve et al., 2015). An exciting topic is the research of plane tessellations to find different types of symmetry. A beautiful mosaic can include a number of objects' motions (Lovric, 2003).

Students can try to create a similar separate ornament or plane tessellation by applying discovered regularities of some patterns. They can create different ornaments that principally differ from the one investigated.

The research on ornaments and patterns raises new questions that lead to the formulation of additional problems. An algorithmic approach is to draw an ornament step by step, where the figure increases by applying specific rules to get symmetric or irregular forms. This investigation can be inspired by the chemical structure of ice (Libbrecht 2004). A particular case is to create a set of tiles that can be connected in some way to cover a given figure in the shape of triangle, square, hexagon or other. Such disposition is the basis of board games like Tantrix, Octiles, or Carcassonne.

The solution of the mentioned and similar problems requires both mathematical and artistic creativity. Their additional value is in learning the ethnographic art and history of art of different folks and tribes (Jones 1868). Mathematical problems on geometric ornaments can be an exciting supplement to mathematical classes or extracurricular activities for any grades, and they can support cross-disciplinary learning.

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ANALYSING THE STUDENTS' CREATIVITY IN INTEGRATING GEOGEBRA APPLETS IN SOLVING GEOMETRICAL PROBLEMS

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Keywords: Students' creativity, Creative product, Integrating GeoGebra applets, Geometrical problems

The challenges facing the economy and technologies determine the needs of the labor market for creators and competent specialists, easily adaptive to the technologically changing information environment. This sets for the university the main task to experiment and to discover new opportunities for stimulating student creativity, for teaching and learning for mastering specific knowledge, for developing skills and competencies as a key element in their preparation for professional growth.

The authors' research involves the creativity of students (future Mathematics and Informatics teachers in high schools) in developing and integrating GeoGebra applets for solving geometric problems. The opportunities which the attractive GeoGebra software provides for training in Mathematics are used in the experimental survey. Quantitative and qualitative analyses of the results are presented.

AUTOMATIC INDOOR MINI-GARDEN/FARM TECHNOLOGIES: GUIDELINES FOR HARMONIOUS DESIGN

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Keywords: Design, Golden ratio, Computer aided, Indoor mini-garden/mini-farm

Growing public interest on Indoor gardens/farms reflects urgency of health related problems faced by contemporary urban environment – mass production of unhealthy food and imited access to nature. Indoor gardens/farms represent themselves different man-made miniature ecosystems/technologies like aquariums/aquaponics, terrariums, birdcages, insect houses, mini greenhouses, etc. which cover a wide spectrum of functions beneficial for human well-being. These functions include e.g. indoor greening/design, wildlife attraction, environmental therapy, education, hobbies enhancement, small-scale food-producing and like.

Conventional versions of these miniature systems could be made more efficient and easy-manageable through using specific computer-aided devices which would automatically control basic environmental parameters, such as temperature, humidity, light, dissolved oxygen, etc. Besides, this purely functional construction could be enhanced through adding aesthetic, harmonizing dimension in order to support indoor gardens`/farms` therapeutic, educational, marketing, etc. values.

Paper analyses conceptual advantages of automatic and semi-automatic indoor gardens/farms as well as discusses criteria and proposes guidelines for harmonious design of these technologies.

SOFTWARE DEVELOPMENT FOR NUMERICAL MODELLING OF CONTROLLED FORMATION OF PERIODIC NANOSTRUCTURES AFTER LASER IRRADIATION

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Keywords: Periodic nanostructures, Numerical modelling, Laser irradiation, Software development

One of the important and prioritized directions of modern science is the study of the properties of nanostructured materials - objects of nanometer size in at least one dimension (1 nm = 10-9 m). Many materials with a micro- and nanostructured surfaces, due to their unique properties, are widely demanded by modern technologies, for example parts whose surfaces have hydrophilic properties with lubricating materials, which are required in mechanics to create viscous friction pairs. Similarly, hydrophilic properties are required for the lubrication of moving parts of the implants for body fluid attachment, while the hydrophobic - fluid-repellent properties are important for the construction of the inner surfaces of the pipelines or the treatment of the external surfaces of the bodies in the streams, helping to increase the speed of movement in a viscous environment or save energy resources.

The development of new mathematical models and software based on them can greatly facilitate the work of researchers. Computer realization helps to save time, materials and expensive experimental hardware resources, facilitates the storage of the obtained results in a virtual environment and gives an idea of the process development - the 3D graphs obtained show the evolutionary trends of the surface nanostructures and thus facilitate the decision making about the desired changes in the processing parameters.

A giant benefit for any researcher would be software that could quickly and visibly see and measure the shape, size and configuration of the nano and microstructures that are to be acquired. It is especially important that the obtained results in the form of 3D graphs allow us to see the evolutionary trends of surface nanostructures and help to decide on changes in the processing parameters. The researcher would be given the opportunity to input a wide range of parameters - laser wavelength, pulse energy, polarization angle, pulse repetition range, pulse duration, processing time or number of impulses per coordinate, and the result obtained in seconds or minutes would serve to better understand common trends and

give a reasoned decision for the actual processing parameters to be used in the experiment.

MICROSOFT WORD DOCUMENT FORMATTING APPLIES

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Keywords: Font changer, Word format, Xml structure

Nowadays world mostly tents to make peoples life easier and more comfortable. It goes in different fields including IT as well. As the mostly used data transmitting technology is WEB and sometimes WAP the document sharing can be enrolled in these fields as well.

The nowadays sight problems makes more difficult to read some digital documents. It means that to make easier to read digital documents there should be a mechanism to alter the document according to the user needs.

The paper provides overlook on our approach of Microsoft Office document automatical altering according to WEB user configurations. As MS Word docx document format is used as an example of the paper.

The concept of the solution is a user preference data (such as preferable text font size, style, color, image sizes) usage to transform the original document and transformed document only providing for the user.

The document transformation can be done in several ways:
- Using VBA programming language
- Using macros scripts
- Using OLE (COM+) objects
- Using pure docx files editing

The VBA programming language is part of MS office pack, so there are several objects that are compatible with MS office files. MS macros scripts have to be a part of the edited document. It means that these two approaches are strictly binded to MS office installation.

The OLE object usage is binded to the Windows operation system. It means that the WEB servers has to have Windows operating system.

The most universal approach is to make changes in docx content files. The docx file format is ordinary zip file format with changes extension. So the files can be renames *.docx to *.zip and opened. The *.zip file is opened there can be found "_rels", "docProps", "word" folders and "[Content_Types].xml" file. The folder "word" contains current file content and it's formatting.

The docx content and formatting are implemented as XML type files. It makes possibility to run these files changes on the server as the original file preparation for the final user.

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