7th INTERNATIONAL DOCTORAL CONSORTIUM ON INFORMATICS ENGINEERING EDUCATION RESEARCH
IEER

International annual event, organized since 2010 by the Vilnius University Institute of Mathematics and Informatics

Students Extended Abstracts

November 30 – December 4, 2016
Druskininkai, Lithuania
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GAMIFICATION IN INFORMATICS ENGINEERING: THE MODEL OF CREATING INTERACTIVE TASKS

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Brief Biography

Diplomas:

- Bachelor degree in Mathematics and Informatics Teaching at Vilnius University, Mathematics and Informatics faculty.
- Master degree in Mathematics and Informatics Didactics at Vilnius University, Mathematics and Informatics faculty.

Paper:


Conferences:

2. From 2012-09-14 until 2012-09-16 “Geogebra” conference in Estonia (Tartu).
4. 2015-12-08 – 2015-12-12 „International Doctoral Consortium of Informatics Engineering Education Research”, Druskininkai. My presentation: „Gamification Methods to Teach Informatics Engineering“;

Research area description

The problem of research

How to create a valid and useful model of gamification in informatics engineering as well as join technology of templates to create interactive tasks and frameworks of tasks’ components?

The aim of research
When I do the analysis of application of gamification in informatics engineering, I will create the model of gamification in informatics engineering, which will join technology of templates to create interactive tasks as well as frameworks of tasks’ components.

A presentation of preliminary ideas

The research questions

1. How to find valid and useful models from scientific informatics engineering papers?

2. What kind of technologies of templates for creating interactive tasks exists and which of them are valid for joining such templates technology with frameworks of tasks’ components?

3. How to create a better model for gamification of templates for creating interactive tasks in “Bebras Lodge” system and what kind of methods use to validate it?

The research tasks

1. To make the overview and analysis of scientific publications in the area of gamification in informatics engineering.

2. To explore the technology of templates as specification and application of method for creating interactive tasks.

3. To create the model of gamification for interactive tasks, which is based on technology of templates and frameworks of components of tasks.

4. To realize model of creating interactive tasks and validate it in “Bebras Lodge” system.

What I plan to do

- To improve analysis of publications in area of gamification in informatics engineering.
- To define and classify classes of informatics and informatics engineering interactive tasks; system them and create schema of improved templates to create such tasks.
- To expand “Bebras Lodge” system’s possibilities of templates of creating interactive tasks.
- To make recommendations for making frameworks of components of interactive tasks.
- To create model of gamification of interactive tasks; validate it; try it and apply it into “Bebras Lodge” system.

I was interested in computer science, especially in some applications of programming languages that allows producing dynamic programs on the internet on browsers. I became interested in creating websites when I created my first website after I finished IT subject in 3 year of my bachelor studies.
Educational games are games, which educate skills or improve knowledge of one or more kind of science area (such as mathematics, computer science, and physics). Nowadays majority pupils and students use web browsers to entertain themselves on their free time. It is good thing not only to be entertained, but also at the same time learn some useful knowledge or acquire skills in computer science. One aspect of informatics engineering is that people apply computer science knowledge and skills to obtain some kind of science area.

Educational games improve cooperating, where players communicate with friends, who play the same game at the same time. It also improves logic thinking, helps to understand principles of the science, which game educates the student. (Andreas Schäfer, 2013).

There are many important factories for educational games to be successful. E. g., a feedback is an important and necessary part in education and educational games (Azmi et al., 2015; Cuba-Ricardo et al., 2015; Tillmann et al., 2013). The embedding of gamification in programming courses can be one of solutions for that: it can help to maximize student participation and learning, motivate and reduce dropout rates, especially for novices in programming (Azmi et al., 2015). The most successful factors are multiple modalities of games, players’ collaboration, adaptive or personalized game components based on real world sensory data (Laamarti et al., 2014).

Expectations and motivation to attend Doctoral Consortium

I want to participate in Doctoral Consortium, because I want to know about applications of computer science and teaching practice of other more experienced lecturers, assistant professors, professors, and PhD students’ works, articles and plans what they intend to write, especially if it is concerned on computer science applications, or method about validation of models, or technologies of creating templates for interactive tasks.

I expect interesting discussions; work in small groups and useful lectures.
Literature


LEARNING OBJECTS PERSONALISATION APPLYING SEMANTIC WEB METHODS AND TECHNOLOGIES

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Your Brief Biography

Prior studies:
- Bachelor degree in Mathematics(2013), Vilnius Gediminas Technical University
- Master degree in Mathematics(2015), Vilnius Gediminas Technical University


Research area description

- The main problem you are trying to tackle and its relevance
  Learners have different learning styles and every learning object is not suitable to everyone.
  Personalisation of learning process is too hard job for teacher so we need recommender system which could help find suitable learning objects and activities for current learners according to their learning styles.

- The aim of research
  Using semantic web technologies research and prepare tools and methods for learning objects identification in web that are suitable to different learning styles

A presentation of any preliminary ideas

I have done systematic review of semantic web technologies using in learning personalisation process and find out that there is just several authors suggesting learning personalisation approach based on Web 3.0 tools. My approach is based on RDF (Resource Description Framework). According to this approach, RDF triples should interlink (1) LOs (“subject”) including metadata, (2) contextual information about particular learner (“object”), and (3) suitable learning methods, activities and tools (“predicate”). In this RDF triple, the “subject” denotes the resource, and the “predicate” denotes traits or aspects of the resource and expresses a relationship between the subject and the object.

Implementation of this approach consists of the following stages:
- Creating learners’ dynamic profiles/models according to their learning styles and other features.
- Creating interlinks and ontologies to establish suitability of learning components to particular learning styles.
- Creating recommender system to recommend suitable learning components to particular students.
Bibliographic References


Expectations and motivation to attend Doctoral Consortium

I expect to get new knowledge, critics and feedback from colleagues in order to improve my Phd. thesis theme.
EDUCATIONAL DATA MINING / LEARNING ANALYTICS APPLICATION TRENDS TO PERSONALISE LEARNING

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Research area description

In order to identify scientific methods, tools, techniques, and possible results on application of educational data mining / learning analytics to personalise learning, systematic literature review method devised by Kitchenham (2004) has been used. The following research question has been raised to perform systematic literature review: “What are existing educational data mining / learning analytics methods, tools, and techniques applied to personalise learning?”

After applying Kitchenham (2004) systematic review methodology, on the last stage 47 suitable articles were identified to further detailed analysis on the topic “learning analytics”, and 33 – on the topic “educational data mining”. After eliminating duplicating articles, 67 suitable articles left to further analysis.

The analysis results are as follow:

Williamson (2016) surveys and maps the landscape of digital policy instrumentation in education and provides two detailed case studies of new digital data systems. The author considers LA platforms that enable the tracking and predicting of students’ performances through their digital data traces.

The main objective of (Casquero et al., 2016) is to analyse the effect of the affordances of a virtual learning environment (VLE) and a personal learning environment (PLE) in the configuration of the students’ personal networks in a higher education context. The findings reflect the effectiveness of a PLE for facilitating student participation and for assisting students in the creation of larger and more balanced personal networks with richer social capital. From a methodological point of view, this paper serves as an illustration of the analysis of personal networks on digital data collected from technology-enhanced learning environments.

Experiment of Hung et al. (2016) demonstrated that a hybrid learning style identification can successfully cluster learning styles into three or four combinations based on learning performance, which suggests that the EDM technique can successfully explore multiple learning styles in problem-solving abilities.

Campagni et al. (2015) paper presents EDM methodology to analyse the careers of University graduated students. The authors present different approaches based on clustering and sequential patterns techniques in order to identify strategies for improving the performance of students and the scheduling of exams.

Pesare et al. (2015) argue that, in the latest years, LA are becoming the most popular methods to analyse the data collected in the learning environments in order to support teachers and learners in the complex process of learning. If they are properly integrated in learning activities, indeed, they can supply useful information to adapt the activities on the basis of student’s needs. In this context, the (Pesare et al., 2015) paper presents a solution for the digitally enhanced assessment. Two different learning dashboards have been designed in order to represent the most interesting LA aiming at providing teachers and learners with easy understandable view of learning data in VLEs.

According to van Leeuwen et al. (2015), because the amount of available learning information is high, teachers may be supported by LA. The (van Leeuwen et al., 2015) experimental study (n = 40) explored the effect of two LA tools (the Concept Trail and Progress Statistics) that give information about students’ cognitive activities. The results showed that when teachers had access to LA, they were not better at detecting problematic groups, but they did offer more support in general, and more specifically targeted groups that
experienced problems. This could indicate that LA increase teachers’ confidence to act, which in turn means students could benefit more from the teacher’s presence.

Systematic review shows that, currently, there is an increasing interest in EDM / LA. In the latest years, EDM / LA are becoming the most popular methods to analyse the data collected in the learning environments (e.g. LMS / VLE) in order to support teachers and learners in the complex process of learning. EDM / LA seek to enhance the learning processes through systematic measurements of learning related data and to provide informative feedback to learners and teachers. EDM / LA researchers are addressing questions of cognition, metacognition, motivation, affect, language, social discourse, etc. using data from LMSs / VLEs, intelligent tutoring systems, massive open online courses, educational games and simulations, and discussion forums. EDM / LA are also used to develop the assessment of learners’ skills. EDM / LA increase teachers’ confidence to act, which in turn means students could benefit more from the teacher’s presence. EDM / LA systems are used to support teachers in evaluating and monitoring individual progress within teamwork. EDM / LA dashboard is one of the popular applications to show students’ online behaviour patterns in a LMS / VLE. EDM / LA could be also used to analyse data on students’ informal conversations on social media (e.g., Twitter, Facebook) concerning their educational experiences-opinions, feelings, and concerns about the learning process. We can conclude that EDM / LA are useful tools to improve learning outcomes and the overall learning process in e-learning environments and computer-supported education.

Concerning learning personalisation, only some information could be found in scientific literature during last years. A hybrid learning style identification can successfully cluster learning styles into three or four combinations based on learning performance, which suggests that the EDM / LA technique can successfully explore multiple learning styles in problem-solving abilities. Most recently, new data analytics approaches are creating new ways of understanding trends and behaviours in students that can be used to improve learning design, strengthen student retention, provide early warning signals concerning individual students and help to personalise the learner’s experience.

Thus, we could conclude that EDM / LA could be helpful to personalise learning, but future research is needed in the area, and, first of all, we should clearly identify the main trends concerning application of EDM / LA to personalise learning.

**Bibliographical references**

DESIGNING TECHNOLOGY-BASED LEARNING ENVIRONMENT: IMPROVING MONITORING IN LEARNING AND ACHIEVEMENTS

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Your Brief Biography

Education
2016 – Vytautas Magnus University, Doctoral of education.
2002 – Kaunas University of Technology, Master of Information Technology and Distance Learning.
2010 – Siauliai University, Bachelor of Computer Network Administrator.

Work experience

Publications
Reports

2015-11-05 Misiulienė, R. “Quality of Distance Learning in Northern Lithuania College of Teachers Attitude”. International conference "Open professional collaboration". VDU, LieDM association.

2014-12-12 Misiulienė, R. “Video lectures system possibility in distance learning “, LieDM asociacija, Šiaulių S. Daukanto gimnazija.


2013-02-21 Misiulienė, R. “Quality of Distance Learning in Northern Lithuania College of Students Attitude “. Mokslas ir studijos 2013: Teorija ir praktika. Šiaurės Lietuvos kolegija.


2011-03-01 Misiulienė, R. „Sociologinis tyrimas e. švietimo paslaugų vartotojų požiūriu“. Studijos šiuolaikinėje visuomenė. Šiaurės Lietuvos kolegija.

2010-02-25 Misiulienė, R. „Ontology-based test development system “, Studijos šiuolaikinėje žinių visuomenėje. Šiaurės Lietuvos kolegija.


Research area

The research problem - how to design TEL environment that responds to learners meta-cognitive learning characteristics, enabling learners to monitor and evaluate their learning achievements, learning progress, as well as to ensure quality training curriculum and the quality of studies.
COLLABORATIVE LEARNING USING ICT CREATION, IMPLEMENTATION AND EVALUATION OF PEDAGOGICAL SCENARIOS IN SECONDARY SCHOOLS

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3rd year
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Your Brief Biography
I am a PhD student in the Department of Education at the Vytautas Magnus University, Lithuania. I hold bachelors and master’s degrees in psychology. My research interests focus on organizational change and behaviour, learning at work, and information technology (IT)–based and technology-enhanced learning.


Research area description
The main problem you are trying to tackle and its relevance
Paradigm of traditional education is no longer suitable for nowadays secondary school. In order to achieve set goals, schools must keep up with the educational and technological innovation. Information and communication technologies (ICT) cannot simply supplement traditional teaching and learning activities, because the use of ICT exchanges teaching and learning objectives and techniques. After all, it is not possible to affirm that ICT changes teaching and learning process turning it more productive or improve students’ achievements. The question is whether schools, looking to the educational goals, selects the proper training methods and properly complements them with ICT.

The main focus in this research is on teachers in Lithuania, and their experiences about engaging with collaborative learning enhanced with different information and communication technologies (ICT). This collaborative learning study, which takes account of the uses of technologies among teachers, is the first of its type in Lithuania. This state-of-the-art research gives an opportunity to see how collaborative learning is happening in practice from teachers’ perspectives.

Collaborative learning combines constructionism with social learning — sometimes referred to as “social constructivism” (Vygotsky, 1978; Wertsch, 1985; Laurillard, 2009). Collaboration is one of the elements that is concerned with learning together, and can encourage individual cognitive processes. While learning, pupils take responsibility and make decisions on how they will work together, and make their contribution to the development and improvement of knowledge. ICT in the learning process are connected with positivistic pedagogy, which says that learner should be given needed tools and support in their learning experiences (McRobb et al., 2007). All this process should be developed by teacher. If positivism is based on realistic ontology, then constructivism says that reality is constructed. According to constructivists, the truth can be an agreement between those who are involved in to learning construction and must be oriented to the process in
which useful constructs are developed (McRobb et al., 2007). Ontologically collaborative learning and usage of ICT in educational process is analyzed basing on constructivist perspective. According to Vygotsky (1978) pupils in collaboration, rather than learning individually, can make a higher intellectual level tasks. The reason is that the pupils are faced with different interpretations, explanations or answers, so it is needed to review taken learning decisions.

Collaborative learning can be used while working with students of different age groups, in various subjects; it can be long-term (over several lessons) or short-term (in 1-2 lessons) activities. Typically collaborative learning shifts away from teacher-centred or lecture-centred approaches, but principles of traditional learning do not disappear entirely as they play their part in other learning activities. Studies show that collaborative learning can lead to deeper level learning, critical thinking, shared understanding, and long-term retention of the learned material. Technologies can play a part in the change of the roles in the teaching-learning process, and support collaborative learning (Mercier and Higgins, 2015).

When talking with Lithuanian teachers, it is obvious that collaborative learning has been a success in Lithuania, as teachers are using collaborative learning in lessons practically and develop different methods of active learning. In the research field, the topic of collaborative learning is not very popular, but aspects have been analysed since early studies in 1996. Butkienė and Kepalaitė (1996) studied collaboration from an educational psychology perspective and suggested that there is a need for developing collaboration skills and producing different suggestions for teachers. Gailienė et al. (1996) looked from the perspective of developmental psychology and argued that the process of socialisation would be better if the skill of collaboration would be developed as early as possible. Teresevičienė and Gedvilienė (2000) concentrated on a more educational perspective, suggesting different collaborative learning methods for teachers, and the positives and negatives of collaborative learning. Lipeikienė (2003) discussed virtual learning environments and the focus was on collaborative learning environments. Ozolaitė and Čiapas (2005) researched collaborative learning in special schools. Unfortunately there are very few researches analyzing integration of ICT using unconventional learning methods. The early 1990s was the start of the development of the current system of education in the Republic of Lithuania, and it is still undergoing change. When talking with Lithuanian teachers, it is obvious that collaborative learning has been a success in Lithuania, as teachers are using collaborative learning in lessons practically and develop different methods of active learning.

Aim of the research – To promote collaborative learning using ICT in secondary schools by creating a pedagogical scenario, implement and evaluate it.

Research questions:
1. What is the essence of collaborative learning using ICT?
2. What kind of learning scenarios are there?
3. How ICT are developed and implemented into the learning process?
4. Is the implementation of collaborative learning pedagogical scenario using ICT makes learning process more effective than traditional learning? An outline of the current knowledge of the problem domain (What is the state-of-the-art in relation to existing solutions to the problem)

A presentation of any preliminary ideas, the proposed approach and achieved results

Current status of the research plan

Time table of the research implementation
1st semester: review of recent studies on project topic.
2nd semester: deciding on research aim and main goals.
3rd semester: developing research methodology.
4th semester: quantitative research.
5th semester: design-based research.

6th semester: summarizing results of the research.

7th semester: making conclusions.

8th semester: preparing summary of research project.

Currently collaborative learning with ICT integration lessons are planned, implemented and discussed.

A sketch of the applied research methodology (data collection and analyzing methods)

Selected methodology for this research is design based approach. Research is held in several phases. The first thing was to answer the question what is the essence of collaborative learning using ICT, therefore an analysis of international, European Union and national documents, regulating education in schools, scientific works, other research dissertations and articles was made. This analysis also helped to answer the question what kind of learning scenarios are there, as it provided information about the development of different educational scenarios using ICT. In addition of analysis of various resources, a questionnaire was made and applied to teachers working in Lithuanian schools in order to answer the previous question as well as the new one How ICT are being developed and implemented into the learning process? This instrument will also helped to know if teachers are using ICT while pupils are involved in collaborative learning, what kind of learning scenarios there are. The last question is how teachers develop scenarios and implement it into the learning process. This question will be answered practically working with several teachers and implementing short term and long term collaborative learning scenarios. The last step of this research will be to analyze observation data of the lessons and data of teachers’ reflection.

Expected achievements and possible evaluation metrics to establish the level of success of your results

The research is focused on how teachers are involved in collaborative learning activities and how they use technologies implementing these activities. Results of the research will provide overview of the, covering different perspectives from the literature of how collaborative learning can be defined, a discussion of different collaborative practices in lessons, how technologies are used in collaborative learning lessons, and roles of individuals and groups in collaborative learning. Results from the survey that has gathered gave evidence from across Lithuania. The results offer evidence about collaborative learning practices of teachers nationwide, and explore when collaborative learning is used within lessons and projects, in which schools, by which teachers, and educational practices adopted within lessons and projects. These results already now draws out some important new evidence about forms of collaborative learning, and ways that technologies takes place are related to practices within collaborative learning lessons. Therefore, it is interesting to see what designed based research results will show us about implementation of collaborative learning and ICT.

Bibliographic References


**Expectations and motivation to attend Doctoral Consortium**

Doctoral Consortium is my opportunity to present my doctoral thesis and to get ideas from students working in the same field as I am. I hope that presenting and discussing my thesis during the doctoral consortium will help me to focus on what I need to improve in the research. My main motivation for attending the Doctoral Consortium is to discuss with senior researchers the contributions of my PhD and get feedback on my research. Furthermore I think that the possibility to exchange my ideas with the other doctoral consortium student participants will also provide me with insight in their interesting works.
PREPARATION SYSTEM FOR IT TALENTS FROM PRIMARIES TO IOI

Ágnes Erdősné Németh

5th semester of overall six semesters
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Brief Biography

I am a teacher of informatics and mathematics in a high school. I have taught children grade 5 till 12 and children grade 9 to 12 for ten years. I have built a system for pupils talented in IT and math during these years. This system is very efficient and unique not only in Hungarian but - maybe - internationally as well. The uniqueness of the system is: I work at the same place and same time together with children who are at very different levels of informatics knowledge and who are of a wide range of ages. They work in small groups. Working such a various age and divers knowledge group creates a very inspiring environment for the members, but it needs very sophisticated preparing from the teacher and very strong cooperation between teacher and students. I use online preparation- and contest sites in this process.

Publications (in English)


Research area description

Future keypoints of my research:
• to make an overview of the national and international talent management in informatics: analysis, comparison.
• to find principles and methods of effective talent management (competitions, courses, camps, online courses, online bank of tasks, online competitions).
• To place an IT talent management system in public education, to examine international connections.
• To design a new curriculum for the talented with strong methodology.

A presentation of any preliminary ideas, the proposed approach and achieved results
Two years ago I began my doctoral studies at the Doctoral School of Informatics Faculty of Eötvös Loránd University. I work at the Department of Media and Educational Informatics on my PhD.

In the first year I read a huge amount of papers about teaching informatics, especially selecting and teaching talented students preparing for IOI. I read articles about algorithms used in competitions and about different methodologies to teach programming:

- and proceedings of conferences, like ISSEP, WiPSCE, DIDMATTECH

In the next semesters I gathered information about the current state of IT talent programs and resources of Hungary: competitions, courses, summer courses, learning materials, selection processes, “best practices” of teachers. I made an overview about the mathematical talent programs too. I made an overview of international preparation and contest sites. It was examined the connection between public education and the courses for talented, especially the problem-solving and computational thinking part.

Last year I flashed a glance on the VU-DC for international IT talent management: I asked other participants about their national selection and preparation process for IOI.

I would like to develop a system with didactical comments on the base of my practice and other’s experience.

Bibliographic References


Expectations and motivation to attend Doctoral Consortium

On the consortium I hope to meet others who works on
- developing curricula for all,
- making talent selection
- preparing students for algorithmic contests.

I hope
- to be in a friendly environment on the consortium as last year,
- to receive new ideas for my research,
• to have strong motivation to keep on working.
CONSTRUCTING A COMPOSITE INDICATOR FOR EDUCATION MONITORING

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Your Brief Biography


Publications:


Conferences:

Background. The socio-economic phenomena are complex and cannot be measured by a single descriptive indicator – it should be represented with multiple dimensions. This multiplicity implies a number of theoretical and statistical problems, especially when we need to make comparisons over time or space. Phenomen such as education can be measured and evaluated by applying methodologies known as composite indicators. In this way we can rank countries or periods, it is very useful for monitoring progress toward education goals.

The main task is how to assigns weights to the components when combining them to Composite indicator. In literature we can find that there are used Statistical models such as Regression analysis, Factor analysis or Data envelopment analysis and Participatory methods such as Analytic hierarchy processes, Conjoint analysis, Budget allocation processes or Multiple criteria decision analysis for weighting. Sometimes there are combine two or more methods. For example, Factor analysis and Regression Analysis or Data envelopment analysis and Analytic hierarchy processes.

Purpose. The purpose of PhD thesis is to develop and suggest new method to construct composite indicator for education monitoring.

Research methodology. The education monitoring index is constructing following structural CIPO framework, which describes relationships between Input, Process and Output in education within a certain Context (Figure 1). Context indicators describe external conditions, Input indicators describe personnel and material resources, Process indicators describe process in educational system and Output indicators describe educational outcomes and results. This model includes comprehensive information of education system, while European Commission benchmarks include only output indicators. There are 7 context indicators, 11 input indicators, 11 process indicators and 17 output indicators. All data are for EUROSTAT and OECD databases.

Figure 1. CIPO model

After literature review we pick out 5 stages for composite indicator constructing: data treatment, data normalisation, weighting, aggregation and comparing the indices (Figure 2). After literature review we pick out 5 stages for Composite Indices constructing. At the first stage we used single imputation for missing data. More over all indicators are treated as the profit type - “the larger the better”. At the second stage we standardized data by subtracting the mean of the data and dividing by the standard deviation, so data have mean = 1, standard deviation = 0.

How to assigns weights to the components when combining them to Composite index? In literature we can find that there are used Statistical models such as Regression analysis, Factor analysis or Data envelopment analysis and Participatory methods such as Analytic hierarchy processes, Conjoint analysis, Budget allocation processes or Multiple criteria decision analysis for weighting. Sometimes there are combine two or more methods. For example, Factor analysis and Regression Analysis or Data envelopment analysis and Analytic hierarchy processes.
In order to compare the different methodologies, the education monitoring index will be calculated for Lithuania, Latvia, Estonia, United Kingdom, Finland, and Germany over time.

**Work plan for the next year:**

- To apply principal components analysis and data envelopment analysis to construct a composite indicator for education monitoring.
- To compare correlation between the scenarios and context of education.
- To review methods to evaluate uncertainty related to model results.

**Bibliographic References**

RESEARCH OF TESTS GENERATION AND VALIDATION FOR INFORMATICS EDUCATION

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Brief Biography

I studied a program of distance learning information technologies and got master degree in Vilnius Gediminas Technical University. I started my research in PhD studies in Vilnius University two years ago and started working in the Institute of Mathematics and Informatics this autumn.

I was interested in e-learning education, e-assessment, learning strategies and technologies during my studies and work, before PhD studies. Now I focus on my research about the validation of informatics education tests, assessment.

1. Publications:


Research area description

In this research, I explore parameters that influence the validity of educational informatics test. The basic idea of my research are based on the test theory. I focus on methods that measure validity of test, test questions. This research should be developed in the area of informatics.

The difficulty of my research is finding method that could be improved and applied in educational assessment. There are very important to clarify concepts of an assessment, test,
competences, the principle of test creation. Test creator should review and rethink criterion such as time taken to solve task, the total number of questions in the test, the concept’s distribution, theme, sequence. In addition, test validity could be influenced by student’s interest, motivation, abilities to solve specific domain tasks, understanding theme, question, task difficulty, etc. All this criterion could be evaluated by using statistical data analysis, but this analysis will show the results after testing and we can guess that was the reason, which influenced test results. But we can’t predict validity of future assessment, so we need methods, which allow to predict the difficulty of task before the assessment.

The second task of my research is to find methods to describe validity of interactive tasks. Solving interactive tasks students are able to communicate, reach better results, think deeper, concentrate on a specific task. In this way students are able to manage information and avoid information overload. Solving interactive tasks depends on knowledge and solution construction. Researchers claim that in this way the motivation and interest to get correct answer is growing, reflection on the solution is promoted, we can evaluate how student think, built their knowledge. But we have not enough research on interactive task analysis.

In addition, all research is based on the assessment of competences of informatics education. So, I should investigate the dependency between parameters which describe selected test theory or method and competences which should be evaluated using the tests.

The aim of research is to create recommendation lists of reliability assessment of informatics and suggest better methods for evaluation of test validity and reliability.

The outline of the current knowledge of the problem domain

Nowadays educational organization develop test system for the assessment of student knowledge. That systems have to fit the requirements of learning and teaching model or standard of tests. The main problem of this process is to identify correct assessment of the knowledge, especially competences, and describe item difficulty. Organization like the Test Commission emphasize the importance of validity (Abad, F. et al. 2013).

A calculation of the task difficulty value involves all participants’ abilities to solve the task. The value of difficulty could be calculated as a ratio between the number of correct answers and the total number of answers (the number of tasks that students have not tried to solve at all). Lower values indicate more difficult tasks and higher values indicate easier tasks (Aesaert, Braak, 2015). The value of difficulty 1 indicates a very easy task and a task with the value of difficulty 0 indicates a very difficult task. The value of difficulty depends on the tasks and participants. It can be limited by the presentation on the screen, the number of attempts, etc. (Peerear, Petegem, 2012).

Methods used to measure test validity are complicated and require to measure dependency between cognitive inputs and cognitive attributes, goals of the testing (Lamb, R. et al. 2014). There exist classical test theory and item response theory.

In the classical test theory are not define how different person or group will answer the specific questions. The statistic of the test depends on selected items, item difficulty, item discrimination (Assert, K. at al., 2014). Assert (2014) investigate competences and skills of information communication technologies based on classical test theory. He represent the matrix of this competences and skills, but this theory is not sufficient to evaluate latent variable, which „can’t be observed or determined by directed measurement“ (Fayers, P. M., 2007), or evaluate answer then the parameter of test attempt depends on validity. The classical test theory should be evaluated again then the second test results is different from the first. We can simulate item complexity, test statistic, which is not depending on student and his mark (Hambletonet al., 1991, Lamb, R. et al. 2014). Item Response Theory (IRT) are used in Computerized Adaptive Tests as a modern mental test theory (Fayers, P. M., 2007). IRT works when there is a need to determine a student’s level of knowledge, but not measuring the student’s knowledge in
every concept or level in the course. For example, in the article "Measuring Student Competences" are mentioned that “the main goal of IRT analysis is the estimation of two parameters: the item difficulty … and person parameters” (Hubwieser, P., et al., 2014). IRT is used analyze test score and the impact of the proportion how „easy“ or hard“ is the task (Forišek, M., 2009). Forišek (2009) clarify that, this test theory could „work“ as the rating system. IRT model include latent variables and item parameters. So, the task is to find effective method for validity of the test. Some tools exist. Test generation system uses the ontology “to memorize pieces of knowledge of application” or has been used as a persistent level by test system (Bogdan, C. M., Ciobanu, G., 2013). Fan (1988) mentioned, that the invariance property of “IRT model parameters makes it theoretically possible to solve some important measurement problems that have been difficult to handle within the classical test theory framework.”

Interactive elements of the task (graphic, animation, etc.) support student understanding of a content and how they construct meaning from the presented content. The following goals of the interactive tasks benefit could be mentioned: greater validity, increased student engagement and motivation, measurement of higher order thinking skills, promoted students’ reflection by solving tasks, better evaluating the cognitive and problem-solving skills (Dagiene, Stupuriene, Vinikiene, 2016).

Interactivity is very typical of computers, so it is clear that a computer oriented challenge should apply interactive elements to explain or solve tasks. These interactive elements attract student’s attention quicker and make the problem statement better understandable. (Dagiene, Stupuriene, Vinikiene, 2016)

The next preliminary step is to define method how to measure interactive tasks validity and realiability.

Bibliographical references

ASPECTS FOR CHOOSING TEXTUAL PROGRAMMING LANGUAGES FOR HIGH SCHOOL EDUCATION

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Your Brief Biography

My main interest is ICT supported education of natural sciences and also methodology of teaching programming. My current research is about evaluation of textual programming languages used in Hungarian high school education and also about using informatics as a tool for multidisciplinary school activities. Another project of mine is about developing an interactive web application for presentations and education.

Research area description

Implementing algorithms is an integral part of teaching programming and data modeling in high school. For this the teacher has to choose a programming language to use. Choosing the right language and development environment is of decisive importance for having an effective and useful teaching process. In this paper there is a list of aspects for textual programming languages that we have to take into consideration when choosing. For these aspects there is a system and for languages commonly used in Hungarian high school education I examined how well they do in terms of these aspects. Based on the results I listed the pros and cons for groups of languages. I also examined the latest changes in recent years and based on this I also examine the possibility of a new trend of using script languages for education. Among them I deal with the educational pros and cons of the Python and JavaScript, also the typed version of JavaScript, TypeScript.

Studies

High School
Fazekas Mihály Primary and Secondary School and Teacher Training Centre
Natural Sciences specialization

BSc
Eötvös Loránd University, Budapest, Hungary
Computer Scientist, Teaching specialization with Environmental Sciences minor

MA (currently)
Eötvös Loránd University, Budapest, Hungary
Informatics Teacher, Environmental Sciences Teacher
Vilnius University, Vilnius, Lithuania
Erasmus Studies

Research/Interests

Programming languages and paradigms
Object-Oriented PHP Library for Valid HTML5 Application Development
(OTDK Conference, Budapest, Hungary, 2013)
OOPS! PHP – HTML5 Application Development with Self-Developed Object-oriented PHP Library (BSc thesis, 2013)
“Perfect Babel” – How to Choose a Programming Language?
(InfoÉRA Conference, Zamárdi, Hungary, 2015)
Aspects for Choosing a Programming Language for Education
(MIDK Conference, Bratislava, Slovakia, 2016)

**Learning environments**
Kozta – Interactive Presentational and Educational Platform
(InfoÉRA Conference, Zamárdi, Hungary, 2016)

**Multidisciplinary education of informatics, IT supported education of natural sciences**
The Ball – “Thought experiment” in the Classroom
(InfoÉRA Conference, Zamárdi, Hungary, 2016)

Motivating questions:
- What the ideal textual programming language for education is like?
- What programming language should be used in education?
- What tools could make the learning process more effective?
- How is it possible to use computer science/programming to teach other subjects (primarily natural sciences)?
- How is it possible to use other subjects to teach computer science/programming?
- What is an effective approach to teach programming?

**Teaching experience**

**High School/Secondary School**
- informatics class and programming extracurricular programming classes (2007-2012)
- teaching practice informatics, environmental sciences (2015-2016)

**University**
- Web-development practice (2013-2016)
- Web-programming practice (2015-2016)
- Application development practice (2015)