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HARMONIZING THE COMPETENCY PROFILE OF THE TEACHER IN TECHNOLOGY TRAINING WITH THE EUROPEAN QUALIFICATIONS FRAMEWORK

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Abstract - The article expresses the author's understanding on the establishment of an objective competency profile of the teacher in Technology training, justified by references to its conformity to the European Qualifications Framework for lifelong learning. The author defines the necessity of developing the competency profiles and methods to achieve the professional and job identification of teachers in Technology training at the level of Bachelor degree according to the European Qualifications Framework. His statements are based on analysis of the higher education in Pedagogy as well as theory summarization and monitoring in practice. The aim is to reduce the gaps and overcome the contradiction between education and the labor market by supporting the processes of validation and recognition of the professional qualifications of teachers in Technology training.

I. INTRODUCTION

With the advent and development of the Bologna Process [1] and subsequent European directives of Lisbon [9], Berlin [4] and Bergen [3] were activated a number of processes of change, both in the higher education system of the member states of the EU and the overall philosophy of European education in the context of globalization and the ambition of the EU to make Europe a "competitive area of knowledge." The first steps began with the so-called "harmonization" which basically means using universal mechanisms to facilitate the recognition of the periods of study with the educational degrees and professional qualifications granted to enable successful realization on the European labor market. The main instruments to achieve "harmonization" were issued by the European Commission- The European system for the recognition of credits ECTS (European Credit Transfer System), which had its harmonized analogue in Bulgaria named as the System of accumulation and transfer of credits approved by the Ministry of Education and Science in 2004; the European Reference Framework on Key Competences for Lifelong Learning, adopted with a Recommendation of the European Parliament and the Council from 18 December 2006; the European Qualifications Framework for Lifelong learning, which came into force in 2008. Nowadays, the process of harmonization still continues to be based on key criteria set by the European Commission such as relevance, transparency, comparability, reliability and portability, which are particularly important for the recognition of qualifications between countries, systems and institutions in the European Community. Having a background with variety of educational and qualification systems in the European area, reasonably comes into question how to harmonize the educational qualifications. In particular, we consider the competency profile of the teacher in technology training whose comparability in the first place is a very difficult task, primarily due to the lack of references for the harmonization of the educational cycle related to the identification of the technology teaching in the different stages and levels of the general secondary education. Second, there are certain difficulties to be overcome in determining the competency profile of teachers in Techniques and Technology (this is the professional qualification legally adopted in Bulgaria) and these are associated with the operationalization of the content parameters set out in the European Qualifications Framework [8]. This competency profile of the teacher is directly related to and dependent on the outcomes from the learning process such as knowledge, skills and competencies. Furthermore, the complexity of the problemattic situation is determined by the adoption of the National Classification of Jobs and

Occupations in Bulgaria in 2012, which refers to the establishment of complex relationships and dependencies between the competency profile, competency model, position and job description.

II. QUALIFICATION COMPATIBILITY AND INTERACTION

The philosophy of European integration in education implies at first place the use of reliable approaches and tools for achieving qualification compatibility, allowing recognition of periods of study and certificates attesting the degree and the professional qualification received. Secondly, but not less important, is the synergy between the institutions involved in this process- universities, ministry of education, social ministry, professional organizations, employers. As a result of such interaction the National Qualifications Framework of Bulgaria is in line with the European Qualifications Framework, which led to compatibility of qualification levels and educational descriptors for all levels of secondary and higher education. There is an understanding of the knowledge, skills and competencies required for certification at any level of competence. A structural reform was conducted in the system of higher education and it includes three educational cycles now: the first cycle corresponds to the learning outcomes for level 6 of EQF (educational and qualifications degree 'Bachelor'), the second cycle corresponds to the learning outcomes for level 7 EQF (educational and qualifications degree 'Master'), the third cycle corresponds to the learning outcomes for level 8 of EQF (educational and scientific degree "doctor"). The preparation of the teacher in Techniques and Technology is situated in the first cycle which corresponds to the outcomes of training level 6; subsection 6B-Bachelor of the National Qualifications Framework. The professional qualification is called 'teacher in techniques and technology' and is valid for primary and secondary school. So speaking, everything is all right as compatibility and transparency have been achieved, because as all other graduates, this specialist is allowed to receive his diploma and European Diploma Supplement in English, making it legitimate for the European labour market. Of course, this is a necessary but not sufficient condition as the connoisseurs of this matter are well aware that the curriculum and qualification characteristics form a competency profile which is too conservative because it does not comply with one of the main participants in the labour market- the employers. The business management in all areas is much more flexible, comprehensive and analytical in their approach to the recruitment of the necessary personnel. Peculiar instruments in this field are competency models whose structural components appear competency profiles. In this way, for example, is already underway a process of designing the so called 'sectored competency models' and 'competency profiles' for assessing the competence of the workforce in the Bulgarian industry (Bulgarian Industrial Association - Union of the Bulgarian Business, 2011) [2].The competency profile is used for identification and customization of the activities in a professional environment, taking into account the educational potential that is needed and other specific requirements of the position to a given profession. In that sense, it is a competency profile position to a profession, which includes the necessary skills for the position, while the description of the specific type of work and the related to its performance features, requirements and responsibilities are contained in the job description, which is the official document for each employer. In this way is achieved completion of the competency model, and we can assume that there is harmonization with EU directives. However, the design of sectored competency models in education is still far from the labour market reality as a whole, for the job 'Teacher' and of the competency profile of the teacher in techniques and technology in particular. In another publication related to this matter is reasonably emphasized that "the enumeration and the order of competencies is not sufficient enough to refer to the competence profiles, including the specialties for Bachelor degree preparing specialists with professional qualification 'teacher in Techniques and Technology ", the main user of which are secondary schools" [7].

There are reasons to state that the harmonization of the competence profile of the teacher in Techniques and technology is possible if both qualification and job compatibility are achieved. The actual educational practice is too dynamic and determined by educational innovations, provocations, needs and conflicts which necessarily involve standardizing the position of 'teacher'. The standardization will allow the job 'Teacher in Techniques and Technology' to be situated competently and functionally among the variety of 195 roles and functions of the teacher brought out by the big Serbian educator Mirceta Danilovic. Given the

complexity of the preparation of such 'multifunctional teachers', the author states that '... the question remains, who will teach them all this, and who will teach them what they need to learn in what departments and what content [6].

Based on the current 'frozen' state of interaction between educational policy and educational practice we endeavor to achieve compatibility between the qualification characteristics, related to the competence of future teachers in techniques and technology with Bachelor degree and the National Qualifications Framework in the context of European Qualifications Framework. One of the possible steps in the harmonization process is the secondary schools to facilitate this process by using the seven-point system of Roger described by M. Armstrong [5].

These seven points are:

- Appearance, health, physics, exterior, speech;
- Education- qualifications, experience;
- Skills- manual and machine;
- Interests- intellectual, practical and social;
- Positions- impacting others, dependency from others;
- Mental agility- intelligence and manifestation of the intelligence;
- Social roles;

For understandable reasons, this type of feature cannot be operational in the qualification of teachers, as another standard is missing, the educational environment one.

III. Model For Qualification Characterisitc Of Bachelor Degree For Graduates In Techniques, Technology And Enterpernourship

A. Purpose

The educational qualification "Bachelor" and professional qualifications of graduates in majoring Techniques, technology and entrepreneurship corresponds to level 6 on the European Qualifications Framework, subsection 6 B of the National Qualifications Framework and the National Classification of Jobs and Occupations in Bulgaria.

The Graduates in majoring Techniques, technology and entrepreneurship are prepared to carry out teaching and didactics, research, methodological, organizational and managerial activities related to training in techniques, technology and entrepreneurship in the school education system. They are competent to organize and manage activities in the support centers for personal development of interests, skills and expertise in the field of science and technology, and the development and expression of initiative and enterprise of students.

The graduates in techniquess, technology and entrepreneurship can occupy management positions in various institutions requiring pedagogical background. They have the necessary skills to fill vacancies in specialized service units in the school education system and can perform research and information, organizational and methodological support, organizing training activities and training for pedagogical professionals in technology and entrepreneurship. They are also competent to carry out activities in the organization, preparation and conduct of internal and external evaluation and for participation in international research related to the training in technologyy and entrepreneurship.

The graduates in Techniques, technology and entrepreneurship are competent to manage international programs for the realization of educational policies related to technological and entrepreneurial training in formal and informal learning environments.

Graduates in Techniques, technology and entrepreneurship have advanced and in-depth theoretical and factual knowledge on:

- **critical** perception and analysis of the theories, strategies, principles and practices in the field of general pedagogy, general, age, pedagogical and occupational psychology, pedagogy of general and technological training, didactics of technological training, didactic forecasting and modeling; methodology of technological training in primary and secondary education, methodology of formation of economic culture in technological training, methodology of entrepreneurial training, career guidance and school counseling, organization and management of the institutions in the system of school education;
- **self-interpretation** of scientific principles, facts, laws and regularities in mathematics, mechanics, materials science, machine

science, electrical and electronics, information technology, engineering and computer graphics, biology and applied ecology, at the level required to compile and solve cognitive and practical tasks corresponding to the National educational standards for training in Technology and entrepreneurship;

- **connection** of facts, understanding and expression of theories and principles of art, technology, economics, and scientific schools in the field of entrepreneurship;

The graduates in techniquess, technology and entrepreneurship are able to:

- **communicate** and **work** in teams;
- **plan, organize and carry out** teaching and educational activities in technology and entrepreneurship in the state, municipal and private schools, in the centers of support for personal development and specialized service units;
- **lead** technological activities and entrepreneurial initiatives at school, extracurricular and production environment by conducting educational and production instructions;
- **assess and ensure** the safety of the process in the educational environment;
- **apply** modern information and communication technologies in the teaching in technology and entrepreneurship;
- **identify, select and use** appropriate materials, components and products, tools, machines, devices and equipment for the student technology activity;
- **solve** problems related to the equipment of offices, laboratories, training workshops and educational testing grounds for the realization of educational and working process, and student entrepreneurial initiatives, marketing and advertizing of student output.

Personal and professional competencies of graduates in techniquess, technology and entrepreneurship:

B. Independence and responsibility;

- **apply** knowledge of mathematics, science, technology, economics and entrepreneurship for developing and solving of cognitive and practical tasks corresponding to the curriculum of Technology and Entrepreneurship;
- **implement** pedagogical interaction in interactive learning environments;
- **use** contemporary scientific methods and tools for research and diagnostics of results from the training on Techniques and entrepreneurship.
- **plan, organize and conduct** different forms of technological activities, entrepreneurs initiatives and educational projects in the school education system and informal education by building partnership between the participants in the educational process, institutions, parents, municipalities and other interested parties.

C. Competency of learning

- **assess** the level of their own qualification, provide arguments and plan the expansion and actualization of the professional qualification;
- **choose** appropriate forms and programs for continuous education in professional fields of techniques, technology and entrepreneurship, education of adults, professional orientation and career development corresponding to the National Qualifications frame and the European Qualifications Framework.

D. Communicative and social competencies

- **provide** up to date information for the profession and career of teachers, pupils and parents;
- **communicate** effectively in English using the correct terminology in the field of techniques, technology, economics and entrepreneurship;
- **differentiate** and select electronic resources for training, evaluation and effective communication with the participants in the educational process;

E. Professional Competencies

- **model** technical objects, **develop** and use documentation for school technology activity and entrepreneurs initiatives**;**
- **know and apply** the basic economical definitions and categories related to the forming of entrepreneurial culture in the students**;**

- **form** entrepreneurial attitude and initiative in the students**;**
- **explore** and **evaluate** the development of curricula, teaching methods and practices applied in the teaching of techniques, technology and entrepreneurship**;**

IV. CONCLUSION

The kind of conservative status quo outlined in the statement still persists as the main employer for the teachers are the school institutions in general secondary education system. At this stage they are not in functional interaction with the universities preparing teachers and there is no established practice of joint development of competency profiles, which naturally deprives them of the opportunity to act as a demanding factor on the educational labour market. It is mandatory to achieve meaningful and functional compatibility between qualification characteristics of the teacher, including the teacher in techniques and technology, and his job description.

REFERENCES

[1] About the Bologna Process. Bologna, 19 June 1999.

[2] Българска стопанска камара-съюз на българскиа бизнес, Проектиране на секторен компетентностен модел и компетентностен профил за оценяване на компетенциите на работната сила, София, 2011.

[3] Communique of the Conference ofuropean Ministers Responsible for Higher Education.Bergen, 19-20 may 2005. Conference of European Ministers responsible for Higher Education. Berlin, 18-19 September 2003.

[4] M Armstrong, A Handbook of personal Management Practice, Kogan Page, L., 1988.

[5] M. Danilovic, Nastavnik kao uzor, model, idol, ideal, simbol, vrednost, tj mera, savrsenog i svestrano obrazovanog coveka, Tehnologia, Informatika i Obrazovanje- Za drustvo ucenja i znanja, 6. Simpozium, Cacak, 3-5 jun, 2011, ss. 3-25.

[6] S. Plachkov, Competency profile of the teacher in Techniques and Technology in the context of the National Qualifications Framework, Vocational Education, Volume 15, Number 1, 2013, pp. 9-15.

[7] The European Qualification Framework for Learning. Official Journal of the European Union, C 111/1, 2008.

[8] The Lisbon Strategy.,European Council. Lisbon, 23-24 March 2000.

EXPERIENCES WITH TEACHING AGILE METHODS WITHIN THE "TECHNOLOGIES OF SOFTWARE PROJECTS" COURSES AT THE TECHNICAL UNIVERSITY OF KOSICE

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Abstract - Nowadays, fast delivery of software is even more important than several years ago, and agile methods are the modern standard to fulfill this demand. As reaction to the industry needs, we introduce agile methods into our curriculum of the 'Technologies of Software Projects' subjects, which is a pair of subjects for Informatics Master students in two consecutive semesters. In this paper, we present the learning and exercising processes introduced with emphasis on student project assessment.

I. MOTIVATION

The subjects 'Technologies of Software Projects' were originally founded as result of industrial cooperation, but this cooperation ended and the topics of the subjects became old – i.e. the aim to keep the learning content synchronized with the needs of the industrial partner and up-to-date failed due to the closing of the cooperation.

A new chapter needed to be introduced in the life of the subjects. Because of the variety of software engineering techniques, technologies and methods, and because of the in general low hire rates of new employees in software companies due to the economical crisis, the opportunity to construct a new agreement of similar kind disappeared. No company will promise to hire 30-40 new employees every year for a longer duration. On the other hand-side, to provide only theoretical knowledge to the students would prepare them insufficiently. There is no need of employees who are only theoretically founded; the practical knowledge is the important one.

Many companies focus on fast incremental software delivery, and agile methods are the new standard way to fulfill the increasing demand on incremental functional extension of software products [1]. Therefore, our aim is to present these methods in our curricula too.

We already used LMS (Learning Management System) Moodle in the course, but mainly for lecture/presentation sharing and testing student knowledge [2]. The new versions of the 'Technologies of Software Projects' (TSwP) courses aim to use this LMS for tracking and evaluating student activity too. In the following, we will refer to the TSwP-I course as First Course and to the TSwP-II course as Second Course.

The organization of the paper is as follows. In Sections II and V, we present the new structure of the courses. Next, we show our assessment method for student activity evaluation in Section III and VI. Finally, we present our results in Section IV and VII, and conclude and show future directions in Section VIII.

II. THE NEW STRUCTURE OF THE FIRST COURSE

A. *Learning Content*

The lectures focus on selected topics in software life cycle:

- Requirements engineering [3], because understanding user needs and requests is the most important key to project success,
- Design of (distributed) systems [4], because the majority of modern systems has a more complex and often a distributed architecture,
- Critical system development [5], because this area of software development requires much more knowledge, which could be

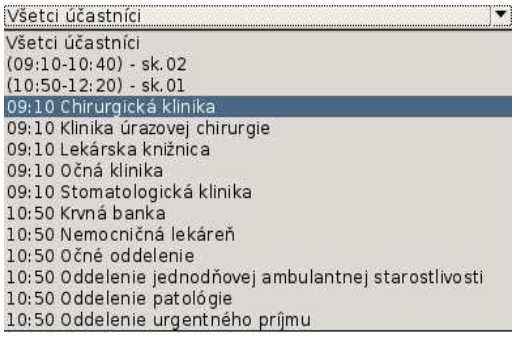

Figure 1. Moodle groups created for each team task to allow task-based assessment.

presented by academicians and experts from the industry,

- System security and safety, because of the age we are living in, where the misusage of information is a rapidly growing discipline.

B. *Exercise Content*

The lessons aim to provide practical technological knowledge to the students, which knowledge is then tested in different activities and homework:

- Essays about selected related software engineering topics such as agile methods and/or techniques.
- Individual work on requirement acquisition tasks, e.g. writing user stories known from several agile methods. Task description is shown in Fig. 3.
- Team work on semester task, where the task

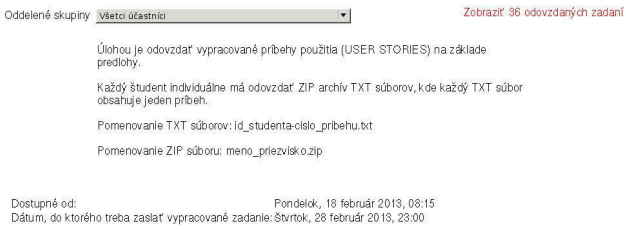

Figure 3. Example individual task in LMS Moodle. The one to write user stories

consists of requirement analysis and processing, software development and documentation.

- Semester tasks are oriented on clinical information systems, which represent the
- category of least safety critical medical systems, see Fig. 1.

C. *Exercise Process*

1. The teacher assigns essay topics to students. It is not allowed to change topics between students. The reason of this decision is the fact that the students need to learn something new and not to repeat their older essays in the new subject again. The essays are then presented to other students from the same class according to a timetable at the lessons, and selected essays are also presented as lectures for all students of the subject. The aim of this double presentation is to increase student knowledge about how to present their work.
2. Student teams also get the semester task

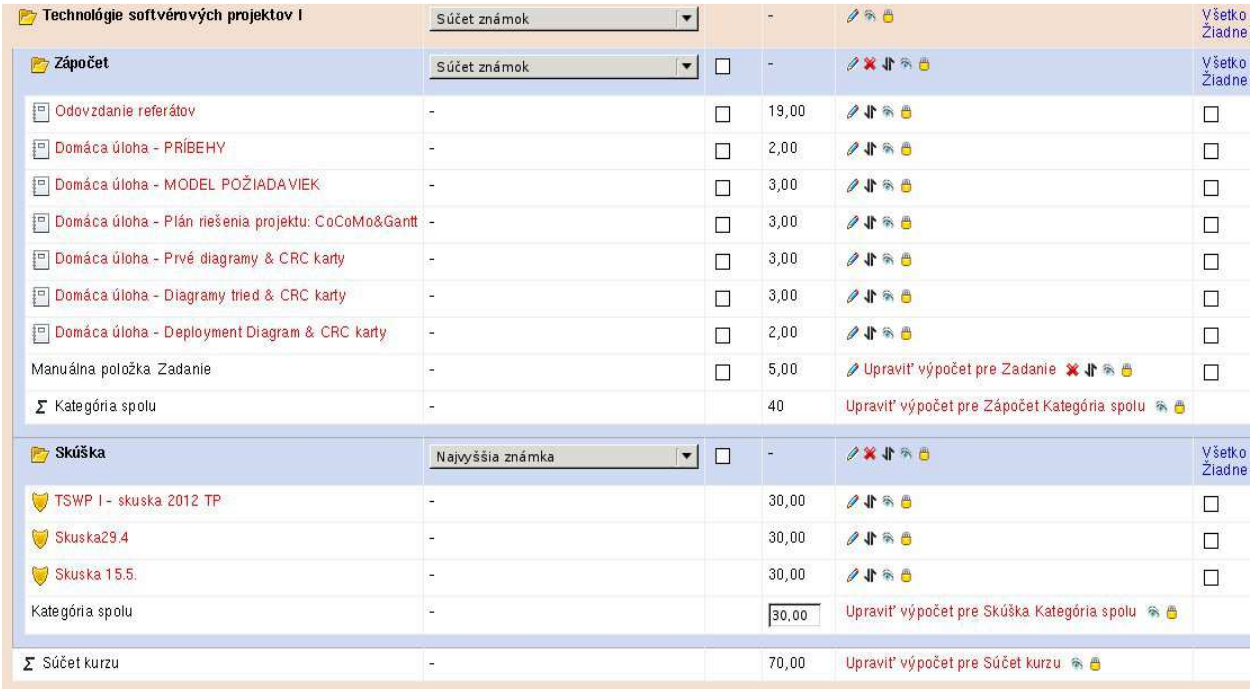

Figure 2. Grades table of the First Course in LMS Moodle

defined the first week. The topic applies for the individual task too, where the goal is to write several user stories based on the example provided on the lesson.

3. The team task is divided into seven steps (see Fig. 2). For each step, there is a smaller task defined. The small tasks represent the incremental process of requirement processing (and also understanding) and the incremental process of design and implementation. The last step of the task is the software product presentation. To achieve all goals, the team must operate fast. The best method for success is agile.

At the beginning, students create their user stories. Then, these are being analyzed in a team. To create the required requirements model (RQM), planning poker is used to determine requirement properties based on the user stories.

D. Process Documentation

A parallel task is also assigned to the team members: they have to report their activities using a predefined form. This documentation is included in the result set of each team task report and is the part of the final project documentation too.

III. ASSESSMENT METHOD IN THE FIRST COURSE

Student work in the semester is evaluated based on the grading structure presented on Fig. 2, maximum is 40, and minimum to pass the course lessons are 21 points. The 40 points could be collected as follows:

1. Maximum score for the essay is 19 points. Score is given by quality of the content of the essay and its presentation.
2. Six weekly controlled activities (small tasks) offer 16 points together. Every control affects the direct result and the activity report of each team member.
3. Presentation of the resulting system is worth up to 5 points.

The individual task is very important, because its results are used as base data for the other tasks.

To avoid possible problems caused by failing in one single task, students are allowed to upload their solutions after the deadline one time. Teamwork results need to be handed in only once, i.e. it is enough when one of the team members uploads the team result into LMS Moodle. The solution using separate groups for each team task allows easy assessment of these tasks.

IV. RESULTS IN THE FIRST COURSE

The presented course structure has been applied in the previous semester. We had 40 students in the course:

Téma	Meno	Typ zadania	Dátum, do ktorého treba zaslať vypracované zadanie	Zadanie bolo odovzdané
	Odovzdanie referátov	Preniesť jeden súbor	-	Zobraziť 36 odovzdaných zadaní
2	Domáca úloha - PRÍBEHY	Preniesť jeden súbor	Štvrtok, 28 február 2013, 23:00	Zobraziť 36 odovzdaných zadaní
3	Domáca úloha - MODEL POŽIADAVIEK	Preniesť jeden súbor	Pondelok, 4 marec 2013, 00:00	Zobraziť 10 odovzdaných zadaní
4	Domáca úloha - Plán riešenia projektu: CoCoMo&Gantt	Preniesť jeden súbor	Pondelok, 11 marec 2013, 00:00	Zobraziť 9 odovzdaných zadaní
5	Domáca úloha - Prvé diagramy & CRC karty	Preniesť jeden súbor	Pondelok, 18 marec 2013, 00:00	Zobraziť 9 odovzdaných zadaní
6	Domáca úloha - Diagramy tried & CRC karty	Preniesť jeden súbor	Pondelok, 25 marec 2013, 00:00	Zobraziť 9 odovzdaných zadaní
7	Domáca úloha - Deployment Diagram & CRC karty	Preniesť jeden súbor	Pondelok, 8 apríl 2013, 00:00	Zobraziť 9 odovzdaných zadaní

Figure 4. Task list in LMS Moodle for the First Course with deadlines and results

TABLE I. STUDENT SCORES IN THE FIRST COURSE

	Maximum	Group 1 average	Group 2 average	Course average
Essay	19	17,8	16,79	17,295
User Stories	2	1,85	1,58	1,715
RQM	3	2,85	2,38	2,615
Project plan, CoCoMo & Gantt Diagram	3	2,3	2	2,15
Sequence Diagram & Activity Diagram & CRC Card	3	2,45	2,16	2,305
Class Diagram & CRC Card	3	2,5	2,58	2,54
Deployment Diagram & CRC Card	2	2	1,79	1,895
Implementation	5	5	4,47	4,735
Project totals	40	36,75	33,79	35,27

1. 36 active,
2. 1 with a shortened semester,
3. 1 with individual study plan,
4. 2 on Erasmus exchange.

Only the active students produced complete results, the aim to involve the students with different semester organization partially failed. The students abroad could not be involved too.

Student feedback to the course organization was various, some students welcomed the strong limits, and others could not organize their team as required. The stressing situation was a simulation of real industrial circumstances.

Tab. 1 concludes the student assessment results from the semester. Average values indicate, that the course content is relatively easy to complete to average students.

V. THE NEW STRUCTURE OF THE SECOND COURSE

A. *Learning Content and Excercizing*

The content focuses on individual and teamwork in software development. Individual work is done in analysis of selected topic and preparation of a short presentation of selected properties of the main subject of interest in the selected field. Teamwork is self-organizing group work of strictly 4-member teams. Students select the task from a list and develop a software solution. The main motto of the course is:

"One cannot go agile if he cannot deal with deadlines."

Which reflects the meaning of the known cite of Frank Herbert's Dune classics:

"Seek freedom and become captive of your desires. Seek discipline and find your liberty."

B. *Semester Schedule*

The schedule focuses on individual and teamwork too:

- Week 1 – introduction and task assignment.
- Week 2 – task assignment, team structure report, Moodle groups related to team tasks are shown in Fig. 5.
- Weeks 3-6 – individual presentations to the selected topics.
- Week 7 – first assessment in LMS Moodle, questions are defined from the presented content. In addition, team presentations take place to project ideas.
- Weeks 8-11 – teamwork to implement and

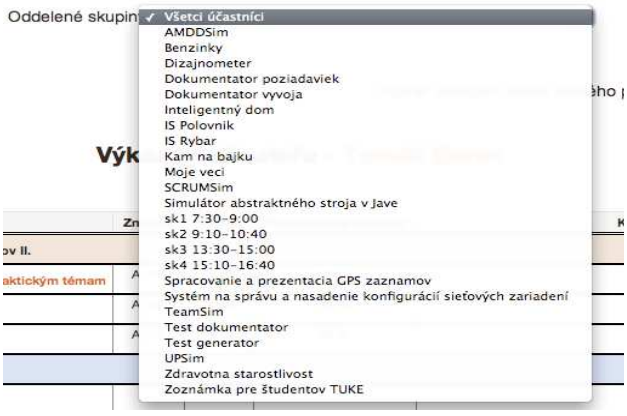

Figure 5. Moodle groups created for each team task to allow task-based assessment in Second Course

improve presented ideas.

- Week 12 – second assessment in LMS Moodle using the same questions and structure as in the first assessment. In addition, second team presentations take place; the topic is the final product and its evaluation.

VI. Assessment Method in the Second Course

Students can collect up to 100 points from the course. Point distribution is presented in Fig. 6:

- First, the individual task is evaluated by a maximum of 20 points.
- Other two presentations are related to the teamwork, these are evaluated by maximum of 15 points each.
- Two tests are realized in the course. To measure learning capabilities of the students, these two tests have the same structure and question base. The question base is built of question regarding the topics individually presented in the labs before. Maximum test score is 15 points – in both cases.
- There is a last evaluation step, which is aimed to grade the quality of the product independently on the quality of presentation. Maximum score is 20 points.

To avoid possible problems caused by failing in one single task, students are allowed to upload their solutions after the deadline one time. Teamwork results need to be handed in only once, i.e. it is enough when one of the team members uploads the team result into LMS Moodle. The solution using separate groups for each team task allows easy assessment of these tasks. The question bases are different for each of the groups.

VII. Results in the Second Course

The presented course structure has been applied in the actual semester having 80 enrolled students, more precisely 79, because one student was on Erasmus exchange. Approximately 40% of students were at least partially employed in the software industry.

Položka známkovania	Známka	Rozsah	Percentuálna hodnota	Komentár
Technológie softvérových projektov II.				
Upload prezentácií k teoreticko-praktickým témam	A (19)	0–20	95 %	
Upload prezentácií k zadaniu - 1	A (14)	0–15	93 %	
Upload prezentácií k zadaniu - 2	A (14)	0–15	93 %	
Testy				
Test pre 1.sk 7:30-9:00	-	0–25	-	
Test pre 2.sk 9:10-10:40	-	0–25	-	
Test pre 3.sk 13:30-15:00	-	0–25	-	
Úvodný test	-	0–10	-	
Test 7:30	-	0–15	-	
Test 9:10	-	0–15	-	
Test 13:30	-	0–15	-	
Test 15:10	E (8)	0–15	53 %	
Test 7:30	-	0–15	-	
Test 9:10	-	0–15	-	
Test 13:30	-	0–15	-	
Test 15:10	B (12)	0–15	83 %	
Kategória spolu	*D (20)*	*0–30*	*68 %*	
Aktivita	-	0–10	-	
Zadanie	A (19)	0–20	95 %	
Bonus z ankety	-	0–8	-	
Súčet kurzu	*B (86)*	*0–100*	*86 %*	

Figure 6. Grades table of the Second Course in LMS Moodle

TABLE II. STUDENT SCORES IN THE SECOND COURSE

	Maximum	Group 1 average	Group 2 average	Group 3 average	Group 4 average	Course average
Presentation 1	20	19	19	20	19	19
Presentation 2	15	14	14	14	14	14
Presentation 3	15	15	15	13	14	14
Test 1	15	11	12	12	9	11
Test 2	15	11	13	12	12	12
Implementation	20	19	20	17	19	19

Student feedback to the course organization was various, some students welcomed the strong limits, and others could not organize their team as required. The stressing situation was a simulation of real industrial circumstances with focus on the deadlines as mentioned above.

Tab. 2 concludes the student assessment results from the semester. Higher than average values indicate, that the course content is relatively easy to complete to average students. We assume that this is the result of the higher level of experience, which is partially resulting from the First Course.

Another important statement is related to the short-term and mid-term memorization capabilities of the students, which is shown by the difference in the test results for the first and second test. Fig. 6 shows that in the presented individual case the improvement was 50%. In other cases, it was quite different. We would not derive any statements from these results.

VIII. CONCLUSION

We presented the renewed structure and content of our "Technologies of Software Projects" courses. Our experiences with the new courses are based on work with more student groups with changing personal equipment. Students were not skilled in agile method application, but several of them are already employed in software companies.

We can state that two subjects are better than one when the goal is to gain practical skills in the field of software engineering. Our experience is, that there is also a difference between short and long memorization of presentation content (found in the Second Course using the same test twice in different time distance to the last presentation).

As missing property, we can select the lack of integrated systems in LMS Moodle. To present student results, they needed to use several different editors and tools, which number could be reduced by integrating selected parts into the LMS. Usage of a special system is not a good idea, because that would lead to the situation that students would be familiar with only that one specific system.

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REFERENCES

[1] Cs. Szabó, I. Tonhauserová, and T. Kotos, "Feature driven information system development," Egyptian Computer Science Journal, 35, 2, 2011, pp. 104-111.

[2] J. Genči, "Methods to ensure higher variability of knowledge tests in the Moodle LMS environment," Emerging Trends in Computing, Informatics, Systems Sciences, and Engineering, Springer-Verlag, 2013, Lecture Notes in Electrical Engineering, 151, pp. 447-453.

[3] I. Sommerville, Software Engineering, 7th ed. Harlow, UK: Addison Wesley, 2006.

[4] R. Elmasri and S.B. Navathe, Fundamentals of Database Systems 3rd ed., Addison–Wesley, 2000.

[5] J. Bowen, "The ethics of safety-critical systems," Communications of the ACM, 43(4):91-97, April 2000.

MOTIVATION DYNAMICS IN THE CONDITIONS OF MIXED (ELECTRONIC AND TRADITIONAL) FOREIGN LANGUAGE EDUCATION

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Abstract - Contemporary behavioural theories define two components which determine behavioural patterns: associative and motivational. The motivational component is crucial to the design and realization of the educational process. The task of conceptualizing motivational patterns in the educational process and using these to develop a sequence of activities that can increase students' motivation contributes to their efficient cognitive functioning and social adequacy. The mechanisms that regulate foreign language learning can thus be exposed by revealing and analyzing basic motivational factors. The paper discusses an attempt to direct, maintain and regulate the individual motivation for learning in the conditions of mixed foreign language education with students majoring in Education Science. The results presented are related to the motivation dynamics of students in this context.

I. INTRODUCTION

Over the past decades education has turned into a strategic task for the postindustrial society and its successful completion depends not only on the development of the modern individual, but also on that of humanity as a whole, its creative, social, and economic improvement. The 21st c. is a time of changes in all ways of life; higher requirements are being raised to the individuals and the types of competences they master generally viewed as opportunities for the establishment of new cultural values and algorithms for quick and successful realization in a dynamic environment. This imposes certain personality- and activity-oriented goals as priorities of modern education which is mostly defined as continuous and open for all and turns into a main prerequisite for the solution of long-lasting controversies of ethnic, religious, and social character. This time-honoured quality of education and its ability to solve conflicts gives grounds for the search of new ways to turn it into a conscious, active, motivated, and creative activity pertinent to the personality. Its orientation to the free development of the individual and his creative initiative, self-dependence, competitiveness, and mobility requires a change of the educational paradigm – a process whose development lies at the basis of a variety of studies and serves as a hallmark for the present research.

The vision of the necessity for the student to participate actively in the cognitive process is certainly not a novelty. Contemporary conditions, however, demand that it should be transformed into a basic life philosophy and a 'highway' of personality development, which in turn has to match the continuous changes and innovations characterizing the development of society in the 21st century. These changes affect the contemporary individual and redefine his/her personality development and the educational paradigm as whole as it is related to the formation of new consciousness and value orientation for everyone. The search for new approaches to the improvement of higher education and an adequate utilization of information and communication technologies is thus a necessity directly related to the improvement of the quality of education and students' motivation and interest in the process of its realization.

The development of the creative potential of students is associated with the application of different technologies, forms, and methods. The problem of the utilization of electronic education with Education majors is topical and important in contemporary didactics of higher education. The issue of using electronic education in the teaching of Education majors is topical and significant to modern didactics of higher education and to university practice. The importance of these issues, their conceptualization and methodological

grounding orient the present study in the following planes of research:

- **social** – search for opportunities to solve the existing controversy between the objective social requirements to education and their realization by applying mixed (electronic and traditional) education;
- **theoretical** – theoretical grounding of the necessity of efficient application of the platforms for electronic education and their integration in traditional university education;
- **practical** – contribution to the improvement of educational practice and its orientation towards the formation and development of skills for life-long learning as a personality quality and a necessity.

II. MIXED EDUCATION IN HIGHER SCHOOLS

The growing requirements to the preparation of Education majors and the necessity to improve the quality of higher education on a continuous basis demand that more efficient educational technologies and practices should be applied. The development of information and communication technologies facilitates their successful integration on different levels of university education. Using electronic education platforms, students can determine the pace, place and duration of their studies themselves. The platforms are exceptionally flexible and facilitate the individualization of education with respect to the needs of the student and the specific character of the course. They give students an opportunity to study in big groups but at the same time make it possible for them to evaluate their achievements individually. The immediate communication between the instructor and the students through the electronic portal gives valuable feedback and evaluation of the adequacy of the education, its usage rate, as well as valuable points of orientation for its improvement. The students, on their part, have quick, easy and timely access to the course content, the inventory for evaluation and testing, and an opportunity for direct contact with the other participants in the education or with the instructor. Contemporary educational platforms for electronic education present the course content in an attractive way and adapt it so as to increase students' motivation. The present project is oriented to the search for opportunities to integrate and adapt electronic education platforms to the traditional university education of Education majors as an opportunity for increasing the quality of their achievements and motivation for learning.

Earlier studies characterize mixed (electronic and traditional) education from the point of view of students as its subjects and foreground important issues such as the following:

- Mixed education implies a mechanical link which is of low social and scientific order;
- Mixed education is a type of new rather than innovative education, which denudes it of its real heuristic power and creative initiative as not all novelty is a patent for innovation;
- Mixed education is supposed to change the structure of educational content, which is a component of the technology of education rather than an overall change of education and the social interaction with students;
- Mixed education implies information environment and sources as a prerequisite for turning the educational platform into an algorithmic rather than human space;
- Mixed education is impossible outside certain resources but only as a type of economizing of time, means and efforts rather than investing them;
- Mixed education and its potential results demonstrate the information level and the way it can be acquired rather than a spiritually motivated change in the communication with students [1].

Such research, without claiming to be comprehensive and conclusive, and regardless of the overlap between speculative thinking about the concept of *mixed education* and the opinions of students as its users is concentrated in the following basic fields:

1. **Concept and technology** are only complementary and education is a suitable social milieu for the scientific grounding of their difference to be clarified;
2. **The conceptual defense** of one educational idea is a vision of a pending future which brings with it not only expectations for change but constructive criticism as well as a part of its denunciation but as an opportunity for us to be realistic in our ventures without denying our will of inventors;
3. **The algorithmization** of educational ideas is part of their essence of reproduced

knowledge, but the desire to be innovative is only contained in the mission educators serve;

4. **The philosophical interpretation of education** is a path to its occurrence as concepts which can be put to practice but may not always be proved because measurement is a marker in technology but only the immeasurable can be ahead of time [1].

In the context of these issues, the realization of mixed education at universities seems to be highly dependent on the level of motivation and interest on part of the students as its subjects as well as on its potential for information processing within the integration of elements of electronic and traditional education.

III. MOTIVATION AS A BASIS FOR A HIGH QUALITY OF EDUCATION

Students' motivation and interest is a basis for the efficient realization of educational activities.

Motivation lies at the basis of all human activity, it is "a process and a state characterized by a variety of interactions and diverse variables (needs, intensity of penchants, stimulating value of the goal, expectations of the organism, habitual behavioural patterns, conflicts and controversies of the motives, factors of the unconscious) which functions as a regulator of behaviour" [2].

It is unquestionable that the efficiency and "the quality of learning as an activity and as a process is goal-oriented, active, constructive, situational, adaptive, cognitive, practical and is thus a function of the motivation of the subjects, the learning strategies they use, their learning inventory, their participation in the methods, technologies, and forms of education, as well as their self-dependence" [3].

Modern theories of education present learning motivation as "a state and a complex of diverse incentives which serve as grounding and prerequisites for human learning" [2], while the motive for education is viewed as "a construct with its own referents: the things that provoke the students to learn and the significant reasons, causes and goal-setting factors which orient the individual to studying" [2]. In other words, motives occur on the basis of needs, experiences, perceptions, concepts and persuasions and are subjectively presented in feelings, proclivities, desires, aspirations, interests, ideals and dreams [4]. For this reason "the educational and cognitive process is a major cognitive motive for learning [4], while "the cognitive motive is a component of a cognitive activity that is conducted in the presence of students' interest" (Бабалова 2000: 85). Studies in didactics and psychology define interests as an important motive for human activity. Drawing of Merdzhanova [5] and her understanding of interests within the personality structure, "interest itself includes a cognitive element; an active cognitive orientation commensurate with the goals of the individual. Interests are a dynamic and complex structure; they change, accrue and interact in the course of time". Interest lies at the basis of the subjective realization of the needs, motives, and proclivities of the individuals and their attitude to the activity performed and the results obtained. This leads to the conclusion that motivation and interest are fundamental constructs whose referents are directly related with students' attitude to the educational and cognitive activity and its results (educational products).

Recently, attitudinal studies have come to be associated with a concept of *attitude* as a basic component of the structure of competence (as a personality property) integrated in the overall system of competencies. This preeminently operational level of attitude is directly related to students' motivation for achievement. The motivation for achievement in turn is a construct with the following referents: aspiration to success in one's actions and a fair appreciation of that success; inclination to solving difficult and challenging tasks; aspiration to the overcoming of higher-order difficulties; aspiration to receiving feedback on one's own skills and abilities; aspiration to high standards [2]. This construct (motivation for achievements) is crucial to the efficient realization of mixed (traditional and electronic) education at university, for the specific character of its organization, and for its potential to form and develop key competences.

Thus, forming positive motivation, interest and attitude in students with respect to the activity, we can give meaning to cognitive situations related to the formation and improvement of basic transversal competences.

IV. FOREIGN LANGUAGE TEACHING AS A TARGET AREA OF STUDY

During their first two years of study Education majors at South-West University are supposed to master a complex of skills, competencies and

theoretical knowledge of linguistic categories at three levels:

- **communicative level, reading and listening comprehension** (abilities to perceive and get ideas across, present attitudes and points of view, discuss topics of social and cultural nature, express preferences, attitudes and opinions);
- **structural level** (master language categories such as tense, aspect, voice, possessive case, number of the noun, expressing gender at the morphological and syntactic level; noun-pronoun and noun-verb agreement; forming different types of messages – declarative, interrogative, imperative, exclamatory);
- **semantic (vocabulary) level** (acquiring knowledge of the correct use of lexical units both on word and phrase level, learning to differentiate between commonly confused words; learning to make relevant noun-noun, noun-verb, adjective-noun, and adverb-verb combinations; making correct use of lexical units with dependent prepositions and of polysemantic words; learning how to place groups of words in their relevant categories).

The educational content of the Moodle English course as an object area of this study is entirely oriented towards the mastering of the above skills and competencies. It is divided in two modules. Module 1 treats problems with word groups, words commonly confused, correct use of prepositions, synonyms, antonyms, phrasal verbs, fixed phrases employed on certain social occasions; phrases and expressions necessary for day-to-day communication. The types of exercises which present these lexical categories include cloze tests (the students complete a missing word to form a sentence or phrase); multiple choice exercises (a single target word out of a choice of three or four is selected to form a sentence); synonym and antonym exercises (students are invited to pick the most suitable synonym or antonym of a specific word); word group exercises, which invite students to categorize lexical items according to a certain criterion; matching exercises in which students have to combine nouns and verbs, nouns and adjectives, adjectives and adverbs or verbs and adverbs to form meaningful phrases which are then used in sentences.

Module 2 combines lexical and grammatical exercises. The lexical exercises are of the same types employed in Module 1 but the lexical items practised here are of a higher order of complexity and imply a more proficient use of English. They are complemented by grammar drills which exercise students' competencies in the following fields:

- the English tense system (the present tenses, the narrative tenses, the future forms in their proper contexts);
- passive transformations (active and passive voice);
- quantifiers and determiners (using the correct article of quantifying adjective in specific contexts);
- forming questions to specific words in the sentence (interrogative messages);
- subject – verb agreement (changing the narrator of a text);
- using the correct pronoun (subject, object, possessive or reflexive) in the sentence based on contextual clues;
- modal verbs (choosing the correct form of the modal verb to complete a sentence expressing request, permission or obligation);
- turning base forms of adjectives into comparative or superlative degree (sentence completion);
- reading comprehension exercises with *True/False* statements to check understanding;
- connecting ideas (expression of cause and effect, contrast, similarity, concession, etc. through conjunctions and conjunctive adverbs);
- summary skills (summarizing the key points of texts).

V. DESIGN OF THE STUDY

The basic components of the methodology of the study are directly related to its design and realization. The object of the research is *mixed (electronic and traditional education) at university level*. The specific research issue the paper addresses is *motivation dynamics and students' interest of Education majors* in the process of this type of education.

The exploration of their motivation and interest is conducted in the context of foreign language teaching. The contingent of the study includes 35 students in the professional sphere Education Science. The goal of the study is to diagnose the learning motivation and interest of students in the course of mixed education.

To achieve the research goal and solve the issues it poses about the survey of students' attitudes to mixed education (their claims, motivation, and interest) and its results, we use a *Study chart of the level of motivation* in the process of the activity and a *Test of learning motivation*.

The inquiry into the educational and cognitive motivation, students' claims and interest is conducted on two levels:

- During the solving of a foreign language drill, diagnostics is conducted through the study chart of the level of motivation in the course of the activity;
- Students' motivation level with respect to English is explored in a course of studies during which the research is conducted.

The study chart for the level of motivation consists of an introductory part with instructions for the evaluation and the completing of the questionnaire containing 42 statements which are handled with the help of a 7-stage evaluation scale in which the answers vary in the following sequence: completely agree (+3), agree (+2), agree rather than disagree (+1), neither agree, nor disagree (0), disagree rather than agree (-1); disagree (-2); completely disagree (-3).

The questionnaire is designed by V. K. Gerbachevski [7] to diagnose the components of the motivation structure related to the level of students' claims directly during the activity. The questionnaire meets the requirements for objectivity, reliability and validity. It is completed by the students in the course of doing a specific task via the electronic educational platform. The researcher proctoring the experiment determines a specific stage of the tasks upon whose completion the students fill out the chart and continue working on the other tasks.

The aim to be achieved in using the questionnaire is to study the level of students' motivation in the course of the activity.

To accomplish this goal and to receive a more comprehensive picture of the motivation dynamics, we also use a Test for learning motivation designed by T. D. Dubovitskaya so as to evaluate the level of motivation to study the specific discipline [8]. Rather than explore the motivation for educational activity as a whole, this test inquires into the specific character of educational motivation manifested in studying concrete courses. The methodology consists of twenty statements with four possible answers for each one of them (correct; fairly correct; fairly incorrect; incorrect).The content of the questionnaire does not offer statements concerning the personality of the instructor. Students are only supposed to describe how they feel during a class. The target audience of the methodology consists of learners after 12 years of age, who are eligible for self-reflection and self-evaluation of the type suggested by the author. The test is translated and adapted for Bulgarian students by S. Stoyanova and its validity and reliability (criteria and constructive) have been substantiated. In the author's own words, "the adapted test has good psychometric rates and can be used to measure learning motivation" [9].

VI. MOTIVATION DYNAMICS IN THE CONDITIONS OF MIXED EDUCATION (EXPERIMENTAL STUDY)

The goal of the diagnostics is to test the degree to which motivation in the process of mixed education (as registered by testing and observation) affects the motivation for studying English language as a university discipline.

In the course of several classes, students are assigned tasks and tests of their own choice. In the meantime they fill out the chart (questionnaire). The person proctoring the experiment determines the stage of their work upon whose completion the students fill in the chart and continue working.

The extent to which the students manifest their reactions to their success or failure in solving the tasks (high, moderate, low) and the increase or decrease in their desire to continue working are the basis for determining their level of motivation during the activity. The experiment prioritizes the analysis of the motivation for achievement, which occupies an important place in the motivational regulation of the process of education by strongly affecting the goals, the content of the activities, the efforts made by students and is thus crucial to the individual behavior of the learner in the specific situation.

The analysis of the results shows that 65% of the students studying English as a foreign language are indifferent to their results at the beginning of the experiment and only 25% of them are interested by the tasks. More than 65% would do anything else rather than participate in the experiment. At the end of the experiment, only 10% are indifferent to their results and 78% are intrigued by the tests and tasks presented in the electronic platform of English language education. At the beginning of the experiment, 65% of the students are indifferent to their achievements, while 84% of the contingent at the end of the experiment find it important to succeed. There is a clear-cut tendency in the analysis of the results according to which 82% of the students at the beginning of the study have a presentiment that they would fail, but at the end 90% of them think that they have a chance to succeed. These results are partly related to the emotional attitudes of the students in the course of the activity and are indicative of their motivation in the course of mixed (traditional and electronic) education.

76% of the informants show indifference at the beginning and they are not interested in whether their results will be better than those of the others. This indicates that they are not inclined to search for alternatives to real success in solving the tasks and tests assigned to them. All this is also linked to students' desire to avoid low results after solving the tasks – 86% of the informants at the end of the study want to avoid having low results, while only 16% think this is important at the beginning. What is also of importance is the aspiration for high results of 75% of the students at the end of the experiment, while only 15% of their peers want their achievements to be among the best at the beginning.

Despite the fact that at the beginning and at the end of the research as many as 35% of the students consider the tasks and tests difficult, at the end 65% of them are motivated to do their best to accomplish the goals, while at the beginning only 19% are willing to do so.

The results obtained in the course of the experiment measuring the motivation rate in the process of mixed (traditional and electronic) education of Education majors are thus statistically significant and give a comprehensive presentation of its influence upon the motivation for achievement in general, which is of crucial importance to the overall educational motivation at university. Although the study of motivation is quite a complex process incorporating a variety of factors which regulate and lead individual actions in the course of education, its exploration in the context of mixed education leads to conclusions about students' attitudes towards the activities they perform and their results.

To establish the correlation between students' success in solving the tasks assigned as part of the experiment and their motivation rate, we use the χ^2 method because the empirical data are presented by variables of two scales – ordinal (success) and nominal (the motivation rate which is preeminently characterized in terms of its quality). If we formulate a zero hypothesis (H_0), according to which there is no correlation between students' success and their motivation rate in the course of mixed education, then the alternative hypothesis postulates that such correlation exists. The empirical characteristics of the hypothesis is $\chi^2_{emp} = 7,32$, while $\chi^2_{т} = 4,28$ ($\alpha=0,05$). The comparison between the theoretical and the empirical characteristics of the hypothesis, $\chi^2_{emp} > \chi^2_{т}$ (7,32 > 4,28), gives grounds to reject the zero hypothesis to the advantage of the alternative one, which means that there is a correlation between students' success in the context of mixed education and their motivation for achievement.

The diagnostic motivation test designed by Dubovitskaya is not intended for the study of motivation as a whole but for the character of the learning motivation in the context of specific disciplines. As indicated above, the methodology comprises 20 propositions with 4 possible answers: correct; fairly correct; fairly incorrect; incorrect [8]. To simplify the analysis, we have reduced the possible answers to two: correct and incorrect.

The factor analysis of the test preceded by a substantiation of its validity and reliability in Bulgarian conditions [9] shows that the items it contains can be generalized in three categories. The first one includes items related to self-awareness, self-realizations, and self-dependence in the study of the discipline as it corresponds to the proclivities of the individual and a tendency for serious dedication to the subject during the students' leisure time. This category can be entitled "I study because I like it when I cope with difficulties and learn more about myself". The second category includes items pertinent to the students' interest in the course, the study of difficult problems, the desire to understand the essence of the educational content and the

importance, value and necessity of the knowledge it gives. The third category incorporates items associated with the requirements of the instructor, the unwillingness to study, working under the supervision of the instructor alone, lack of anxiety when the student is not prepared for class, difficulties in the study of the discipline which imply a necessity to work harder.

The analysis of the results of the survey demonstrates that at the beginning of the experiment only 23% of the students consider learning as something they like because they want to succeed by themselves in the venture. All this is related to self-knowledge and self-realization, as well as to coping with their foreign language education on their own and the interest that accompanies the process as it corresponds to both the proclivities of the individuals and their studying in their free time. The percent of the students who do not consider studying to be likeable is rather high at the beginning of the survey – 89%. Employing the opportunities offered in the course of mixed education, students show a tendency to increasing their interest. At the end of the experiment 60% of them study because they like it.

The second category of items is related to the interest in studying a foreign language when supported by electronic platforms, the solving of difficult problems, an aspiration to understand the essence of the educational content and the value of the knowledge it contains. An increasingly higher number of students become aware of the efficiency and usefulness of learning – 92% at the end of the experiment as compared to only 39% at the beginning.

The application of electronic educational platforms at university also leads students to a re-evaluate the role of their instructor. At the beginning of the experiment 75% of them consider studying to be forced by the instructor while at the end 85% of them think the opposite is true.

The third group of items is associated with the requirements of the instructor, his/her supervision, lack of anxiety when the student is not prepared for class as well as difficulties in studying the discipline, which imposes a necessity for the student to work harder.

The results obtained in the course of the study correspond to a new vision of the design of the educational environment, a different role of the instructor in this environment and a change of motivation for studying the subject within which the exploration of the opportunities of mixed education at university is conducted.

Taking into consideration the goals of the research, the criteria presented above are reflected indirectly in an observation protocol specifically designed for that purpose. The results are thus processed and reduced to the following indicators:

- students' interest;
- their positive attitude and readiness to participate in the process of mixed education;
- their attitudes and emotional experiences in the process of solving the foreign language tasks using electronic platforms as well as their desire to use them at home while studying for the subject.

Figure 1. shows the dynamics of students' interest in the course of mixed education. It is clear from the graphics that there is a steady tendency for it to increase and adapt.

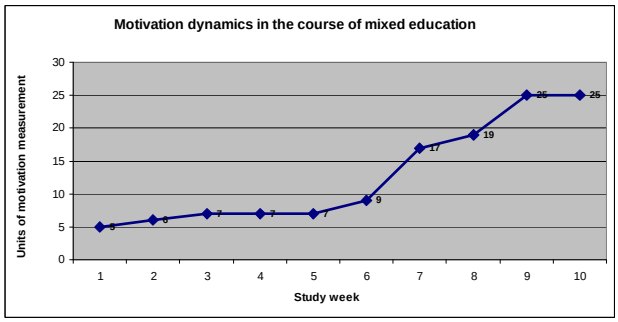

Figure 1. Motivation dynamics in the course of mixsed education

In summary we can say that during our pedagogical observation and in the context of the conclusions made in the process, an increase in students' interest to foreign language education is registered in the process of mixed education. This indicates that by employing this type of education it is possible to positively affect the students' readiness to participate, to study on their own and to develop a positive attitude to their educational activity and its results.

REFERENCES

[1] В. Гювийска, Н. Цанков. Концептуализация и/или технологизация на идеята за смесено обучение (класическо и електронно) във висшето училище. В: сп. Стратегии за образователната и научната политика, №5, 2012, (383-396).

[2] Пл. Радев. Обща училищна дидактика. Университетско издателство „Паисий Хилендарски, Пловдив, 2005.

[3] Пл. Радев. Основи на вътрешния училищен мениджмънт. Университетско издателство „Паисий Хилендарски, Пловдив, 2008.

[4] Л. Десев. Педагогическа психология, Аскони, София, 1996.

[5] Р. Бабалова. Интересът в структурата на възпитателните отношения. УИ „Св. Климент Охридски", София, 2000.

[6] Я. Мерджанова. От динамичен профил към холограмен модел на интересите. Университетско издателство „Св. Климент Охридски", София, 2008.

[7] Практикум по общей, экспериментальной и прикладной психологии. Под ред. на А.А. Крылова, С.А. Маничева, 2-е издание, дополненное и переработенное, Питер, Санкт-Петербург, 2000.

[8] Т. Д. Дубовицкая. К проблеме диагностики учебной мотивации. В: Вопросы психологии, № 1, 2005, (73-78).

[9] С. Стоянова. Адаптация на тест за мотивация за обучение сред ученици. В сб.: Приложна психология и социална практика, (Съст.) Г. Герчева-Несторова, Варна: Университетско издателство Варненски свободен университет "Черноризец Храбър", 2007, (111-128).

ELECTRONIC MULTIMEDIA TEXTBOOKS: EXPERIENCE AND PRACTICE DEVELOPMENT

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Abstract The graphic interface and the structure of developed and examined multimedia tutorials on training areas of the institute are described and presented in details. The advantages of using electronic means of learning are studied.

I. INTRODUCTION

The law "About Education in the Russian Federation" (Federal Law № 273 from 20.12.2012) gives the following definition of "e-learning" (EL): "E-Learning is an organization of educational activities with the use of information contained in databases and used in the implementation of information and educational programs that provide processing of information technology, hardware and information and telecommunications networks, providing the transmission on the communication lines of this information, the interaction of students and teaching staff" (Article 16) [1].

E-learning environment greatly expands the range of methods and forms of organization of the educational process.

The main advantages of e-learning include:

- access to education: there are no obstacles in the form of geographical distance, the possibility of training in all educational institutions;
- opportunities to get education without leaving the job;
- opportunities to get education for people with disabilities;
- choice of the individual rate of learning the material, receiving individual consultations with the teacher;
- the possibility of organizing and participating in conferences, topical webinars, group discussions, group projects implementation;
- the possibility of organizing and passing through the master classes by leading experts;
- the possibility of organizing and conducting corporate training, etc.

To up-to-date, it is impossible to imagine a class without the use of information and communication technologies (ICT). Accompanying the process of training with presentations, animations, multimedia (audio and video), demonstration the results of processes modeling and phenomena, the use of interactive textbooks and reference books, dictionaries, work in the systems of distance learning is becoming the norm and even the requirement of modern education system.

The use of e-learning in the educational process is not just a requirement of the time, but an unlimited possibility in improving the quality and effectiveness of educational process.

To prepare materials, scenario development and structure of electronic multimedia teacher education, in our opinion, should have the following competencies (Fig.1).

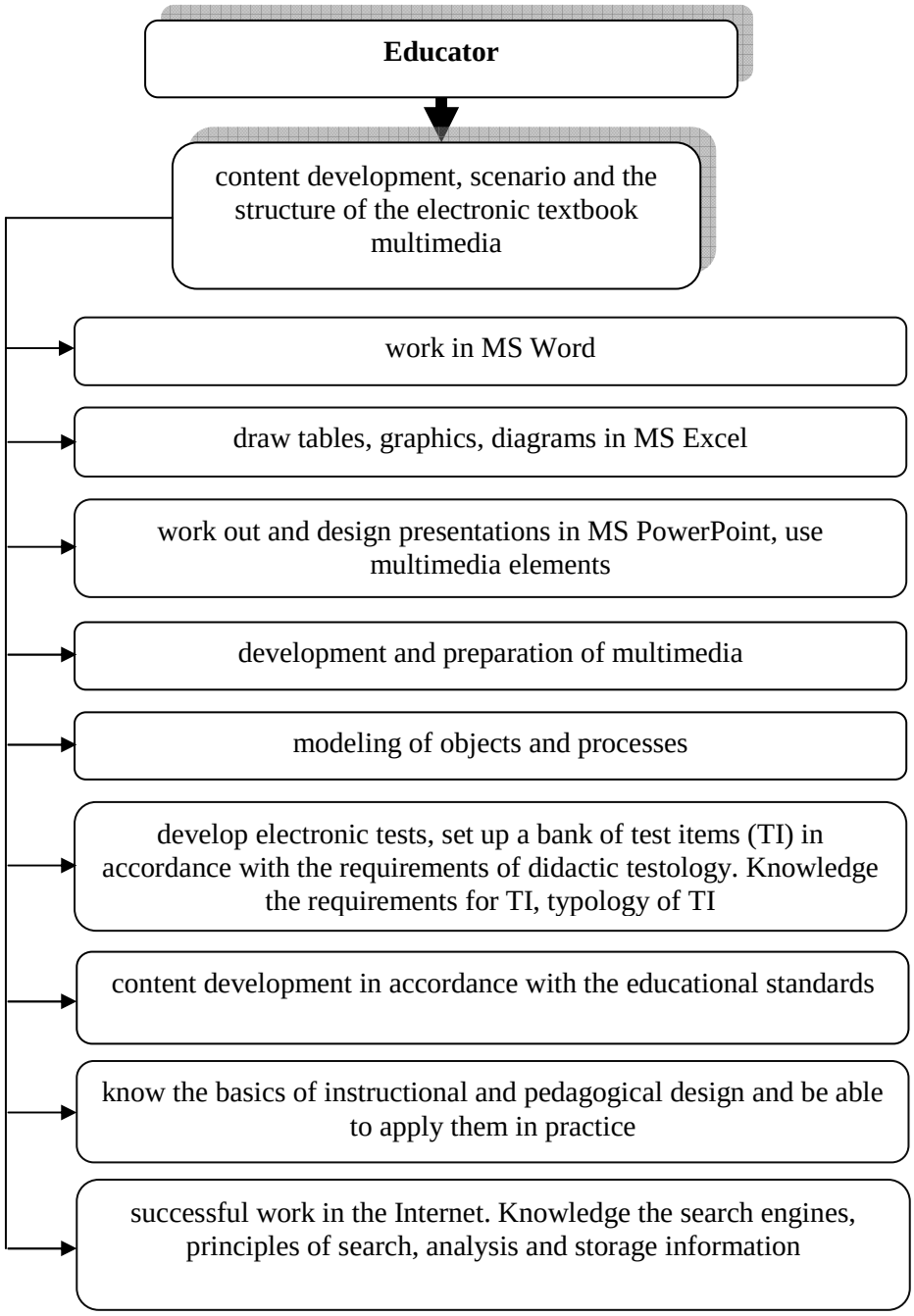


Figure 1. Set of competencies required to develop electronic multimedia textbooks

In order to address issues related to the use of information and communication technologies in education, VPO "TGPI Chekhov" in April 2011 was a laboratory problems of informatization of education (Laboratory).

The main directions of the Laboratory are:

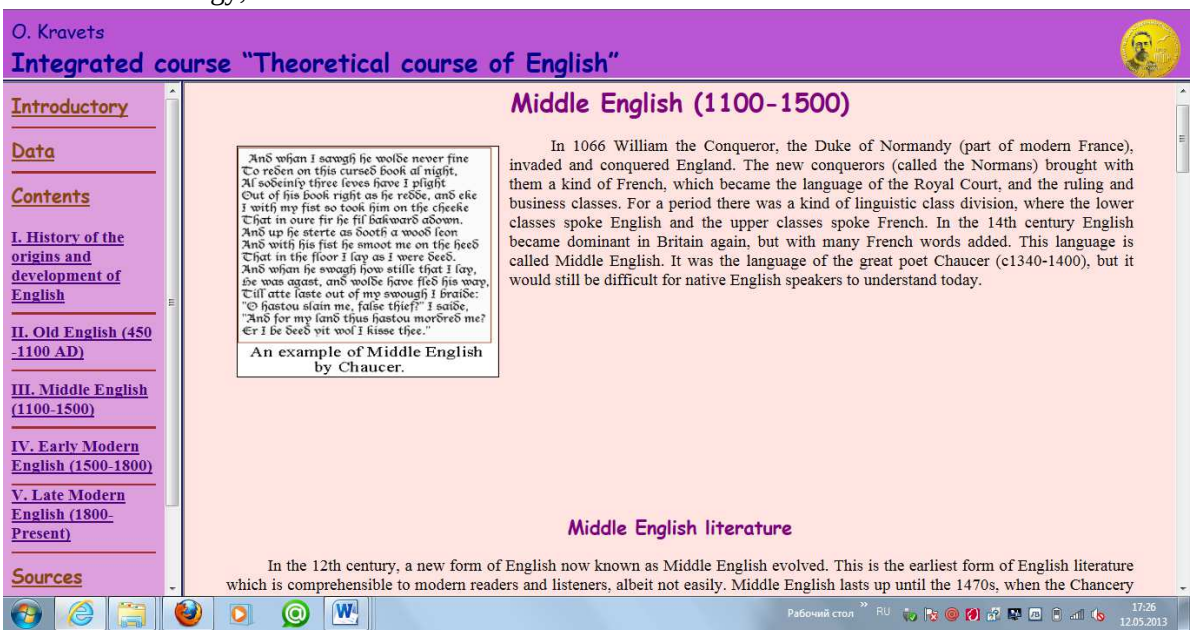
- carrying out research work in the field of education informatization;
- training of teachers, educators and students of educational organizations opportunities to use information technology in the educational process;
- assist faculty in the development of electronic multimedia training materials and courses;
- formation information educational environment of the university.

The modern system of training students can not rely on the use of traditional textbooks and manuals on paper due to their loss of a number of didactic properties.

The introduction to the educational process of e-books allows:

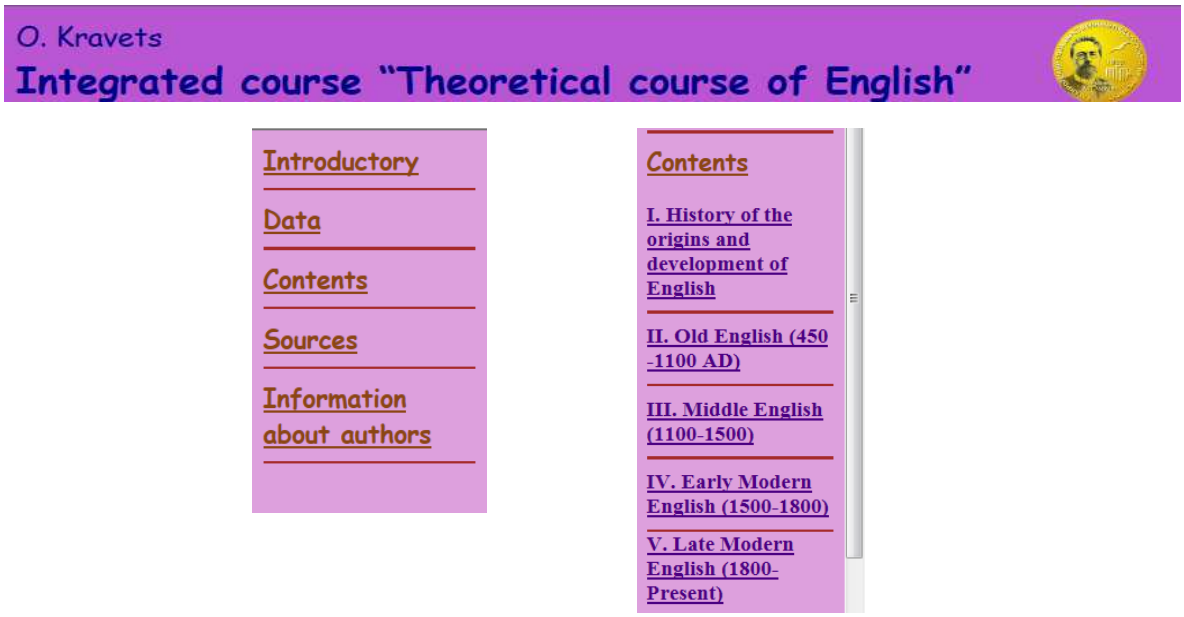
- to improve the quality of education through the use of innovative training tools;
- to increase students' interest in the studied subjects;
- to provide students with access to additional sources of information;
- to increase availability of training materials (for example, for students who combine study with work);
- to update the content of teaching material based on the latest achievements of science and technology;
- to set multimedia materials (presentations, video, audio);
- to develop fund assessment tools that allows you to value the quality of educational material development(intermediate, final test).

Developed by professors and members of the laboratory of the Institute multimedia electronic textbooks have a unified interface which are presented by three areas [4].



On the top of the screen there is a title of an electronic manual and the author's names.

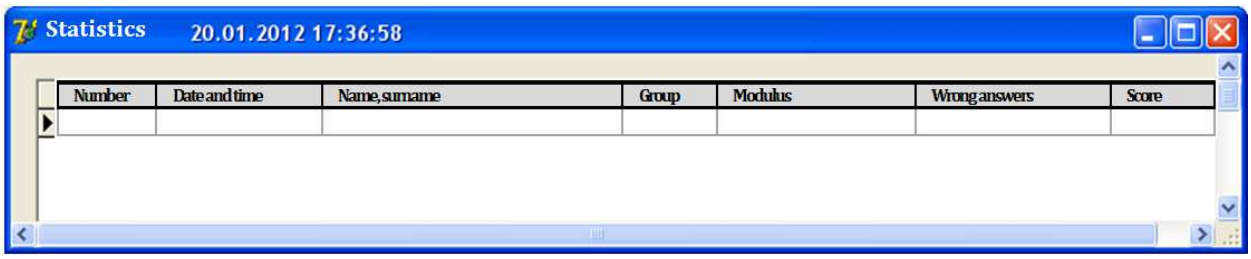
On the left there is a content in which the student can choose a specific section by clicking on it and the left mouse button. "Table of Contents" contains a drop-down list of notes to sections of educational material.



In the central part of the window there is information of the chosen section.

The presence of a testing unit allows control of the knowledge and includes:

- modules offered for topic study ;
- bank of questions to the modules;
- database "Statistics" which fixes:
  - surname, first name, middle name of the student;
  - date and time of the test;
  - the number of a group;
  - the name of the module;
  - the numbers of questions that have been given wrong answers;
  - final score.



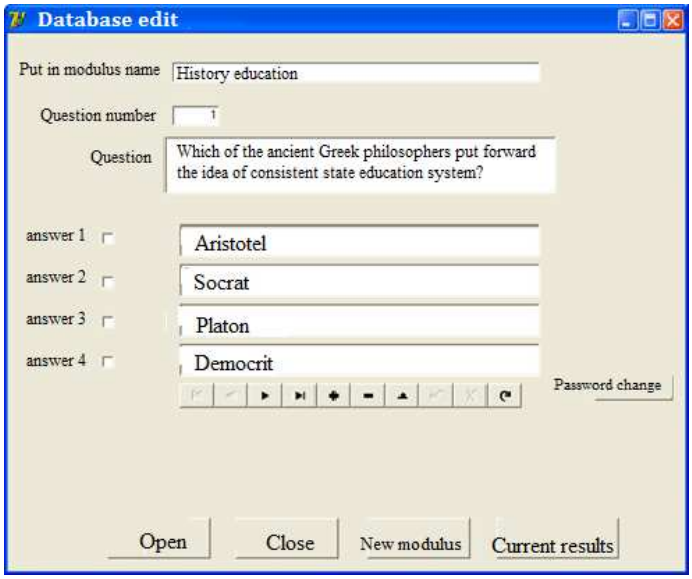
"Wrong answers" allows the teacher to define topics which caused difficulty while studying them.

The work with test programme is realized on two levels:

- for students (doing the test);
- for the administrator/teacher.

Teachers can :

- create new modules;
- edit banks of questions;
- analyze the results of the test through access to the base of data "Statistics" and also delete it when complete work with the course;
- change password if it`s necessary.



Developed manuals contain media blocks in which authors place audio, video, presentations corresponding to the subject of studied discipline.

One of the advantages is an ability to attract students to the development of e-learning. For example, the most interesting are presentations, modeling results, animations, showing physical, chemical and other processes can enter the structure of the corresponding edition from the point of view of design and presentation content. This approach allows to stimulate research activities of students on the one hand and forms information and communication competence of future specialists on the other hand.

All developed electronic publications are assessed by experts in the field of e-learning and are registered in the Federal State Unitary Enterprise Scientific-Technical Center "Informregistr" by assigning the state registration number.

Development of electronic multimedia training is one of the stages of information formation educational environment of the university which will improve quality, effectiveness and accessibility of education.

REFERENCES

[1] Federal Law from 29.12.2012 № 273-FL "About education in the Russian Federation".

[2] Zankova E., Yashchuk E. Informative culture formation of a modern teacher in higher school. Vestnik of Taganrog State Teacher Training Institute. The Humanities, № 1 2012, p. 24-28.

[3] Stetsenko I., Kornienko O. E-manual as a means of students readiness forming to vocational activity// Psychological pedagogical basis of personal forming under conditions of transfer to two-level education model: International science conference. – Penza: Privolzhski House of knowledge, 2008

[4] Stetsenko I., Sereda D., Yashchuk E. The use of informational communicative technologies in the process of teaching (on the example of elaboration of e-manual "History of pedagogics and education"). Modern social study success, № 9 2012, p. 83-87.

[5] Stetsenko I., Sereda D., Yashchuk E. Increase of effectiveness of educational process using informational communicative technologies (on the example of elaboration of e-manual "History of pedagogics and education"). Pedagogics in XXI century:synergetics , modeling and applied research, electronic, mega-projecting and mutual education: materials of International science practical conference/main editor Gorbatyuk V –Taganrog: Taganrog State Teacher Training Institute of A. P. Chekhov, 2012 – text 898 p., - 1,1 GB.

ON INTRODUCING IMPROVEMENTS INTO THE "SOFTWARE ENGINEERING BASICS" COURSE CURRICULUM

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Abstract – Our department is responsible for teaching about 100-150 students at each subject a year. In this paper, we propose the improvements of learning and exercising processes introduced with emphasis on student project assessment and UML language skills. The improved content consists of the basic course structure implemented in LMS (Learning Management System) Moodle and the extensions (supporting material) implemented as external course material located in our knowledge transfer project depository.

I. INTRODUCTION

Teaching software engineering is a task for the teacher, where the improvement of the learning content is a daily routine. We also agree with Liesbeth Debruyn, who expressed the following thought on twitter:

"As one thinks differently so one practices differently."

For us, the above sentence expresses the freedom of the teacher to adopt the course material to the students' skills. On the other hand-side, the goal of each teaching subject is to provide the students with new skills. The general goal is to have students with comparable skills in the selected field at the end of the course.

As Sommerville presents in his book [1], software engineering (SE) is a wide discipline, so only a selection of topics could be presented during one course. To avoid significant incompleteness, lower detail is used to have the larger set of the topics covered, mainly using [2], [3], [4] and [5] as referred resources. The selection is based on the broad topics coverage presented in these sources.

We also need to teach abstractions to the students, i.e. to make abstractions while understanding the problems. This will help to state the right goals of the project and also to state these goals in a proper way. About abstraction, authors of [10] present a brilliant description:

"In the software development process abstractions play a central role. An abstraction focuses on the essence of a problem and excludes the special details. Abstractions depend on many factors: user requirements, technical environment, and the key design decisions."

Abstraction is one of the key skills we focus on, because without abstraction one is unable to model either software architecture or software behavior. A software engineer (beginning with the most basic level) cannot miss these skills.

As many other subjects, our SE basics course is also implemented using automated assessment tools such as LMS Moodle. We decided to assign several tasks to the students to make the semester colorful.

Classical features of the LMS are:

- Course material management,
- Assignments and
- Tests.

Management of enrolled students is also possible, one can create groups based on the schedule, e.g. a group for Monday 7:30 AM, but a reasonable grouping would be the one based on team membership when solving the software engineering project.

Our motivation is to use but also to extend this system by e.g. new types of questions. In this paper, we show our improved course and point out the possible extensions of our concept.

The paper continues with the introduction of our SE Basics course. Next, Section III presents an insight to an editor based on the jsUML2 library [6], [7]. Finally, we point out possible merging points between the LMS Moodle and the jsUML2 editor and suggest an even newer improvement to the course.

II. THE SE BASICS COURSE

Familiarization with the methods and tools used in software projects is the goal of the subject, which is expressed by the content of Fig. 1 where several course materials are shown in the 7th week of the semester related to UML modeling and diagrams, and the (Rational) Unified Process.

A. *Course Objective*

Students gain skills and basic knowledge about the software lifecycle, and processes, methods and tools of software engineering used/applied during this lifecycle. Students also gain skills related to modeling and working with CASE tools and with tools for software project management support. Absolvent will be able to work in a team in software development during requirements gathering and -processing, design and implementation, testing, maintenance and writing documentation. The skills are required to understand the role and responsibilities of project managers in a software project. This last aspect increases the adaptability of the absolvent in the practice.

There is no objective related to programming skills, because there are another subjects, which will do that. Our previous experience with teaching programming is included in our works [8] and [9] related to the Java programming language, other authors are mainly focusing on programming too such as Simon et al. in [11]. Software engineering is not programming, or at least not only programming. Software engineers should have a generic and complex view on software.

B. *Lectures*

Lecture topics are as follows:

1. Software life cycle models, use and importance.
2. Structured analysis/design tools and methods.
3. Modeling of data, processes and control.
4. Structured methodologies of analysis and design.
5. Object modeling, UML, static and dynamic models, methodologies based on UML.
6. Dependences between models, consistency of models, model driven architecture (MDA).
7. CASE systems, classification and use.
8. Software physics, cost and time estimation, methods for cost estimation, Constructive Cost model – CoCoMo.
9. Project management, planning and development of software systems, formal methods for project planning and evaluation.
10. Project team structure and management.
11. Project documentation.

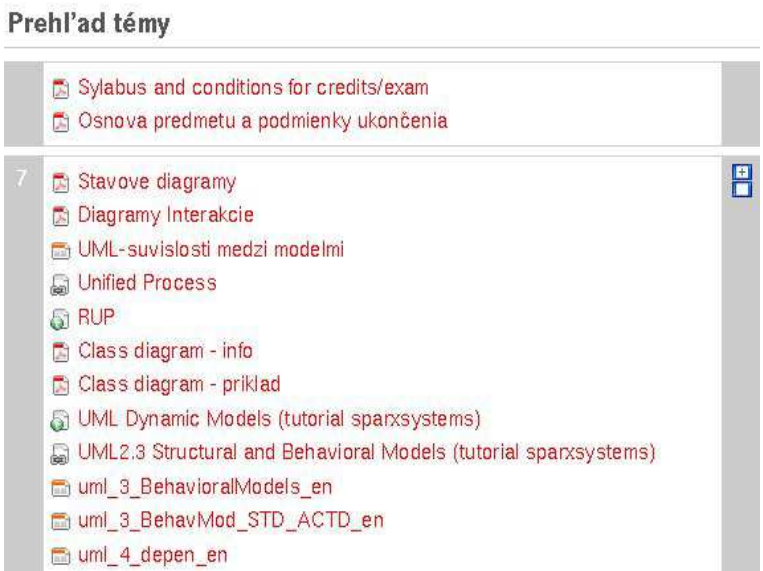

Figure 1. Sample part of the SE Basics course

C. Content of Seminars and Lab Works

1. Analysis of the existing system – specification of user requirements, model of the environment of the system.
2. Introduction to the CASE system - user interface, main functions.
3. The use of modeling tools for creating a data model. Conceptual data model.
4. The use of modeling tools for creating and managing functional and control models of systems, dependences between models.
5. Introduction to the unified process modeling with use of object-oriented CASE system
6. Object analysis of user requirements - use case model.
7. Objects and classes, modeling based on class diagram.
8. Modeling object behavior - interaction diagram and state diagram.
9. Consultations and presentations of projects.
10. Final presentation and defense of the project

D. Tasks

1. The project system or subsystem using a CASE tool, create a prototype system or subsystem (team of 3-4 students).
2. Essay on specific topic with the issue of software technologies in the form of presentation (electronic format only) with the mandatory sections:
   a. Introduction,
   b. Basic concepts,
   c. Bibliography,
   d. List of three questions on the topic and three questions to the lecture topic before exercise, which will showcase award. Questions will be drawn up a draft response to the 3-5 test, with at least one answer is correct and at least one wrong.

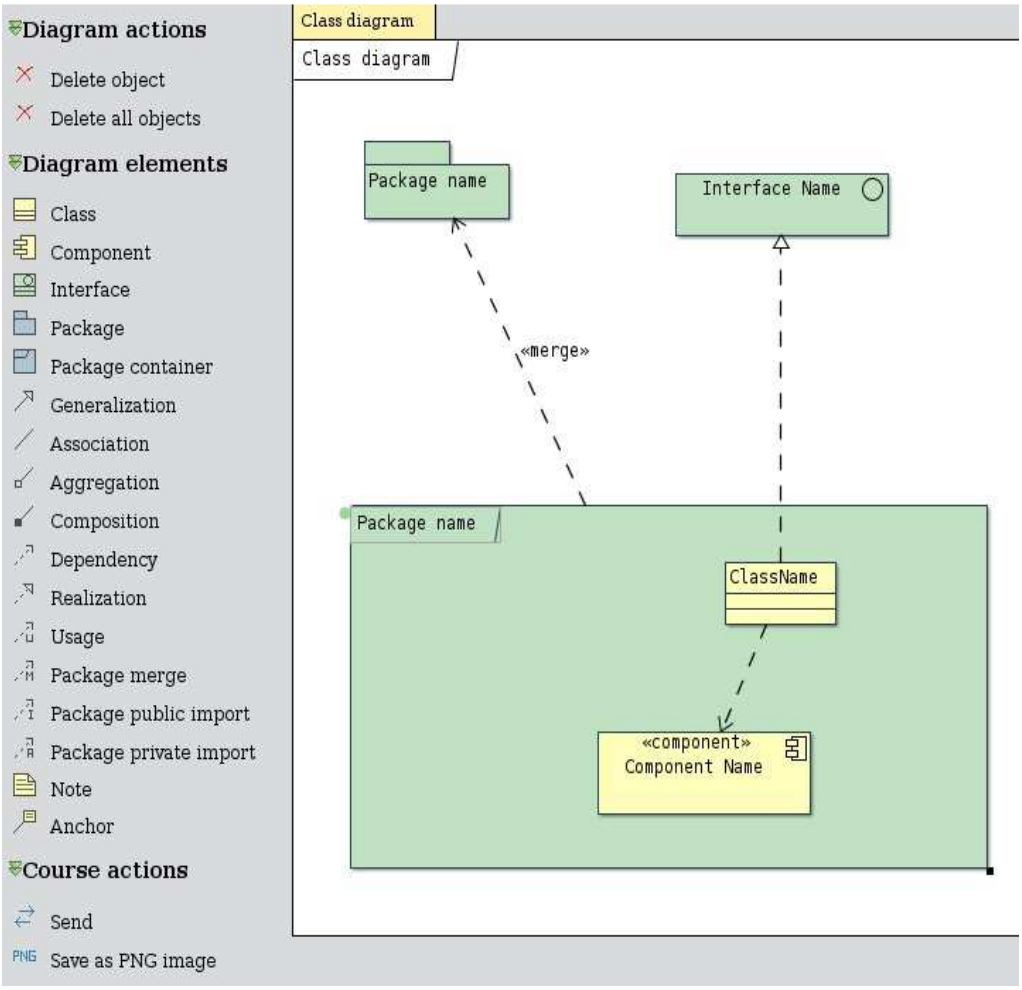

Figure 2. Our version of the jsUML2 editor for UML Class Diagrams

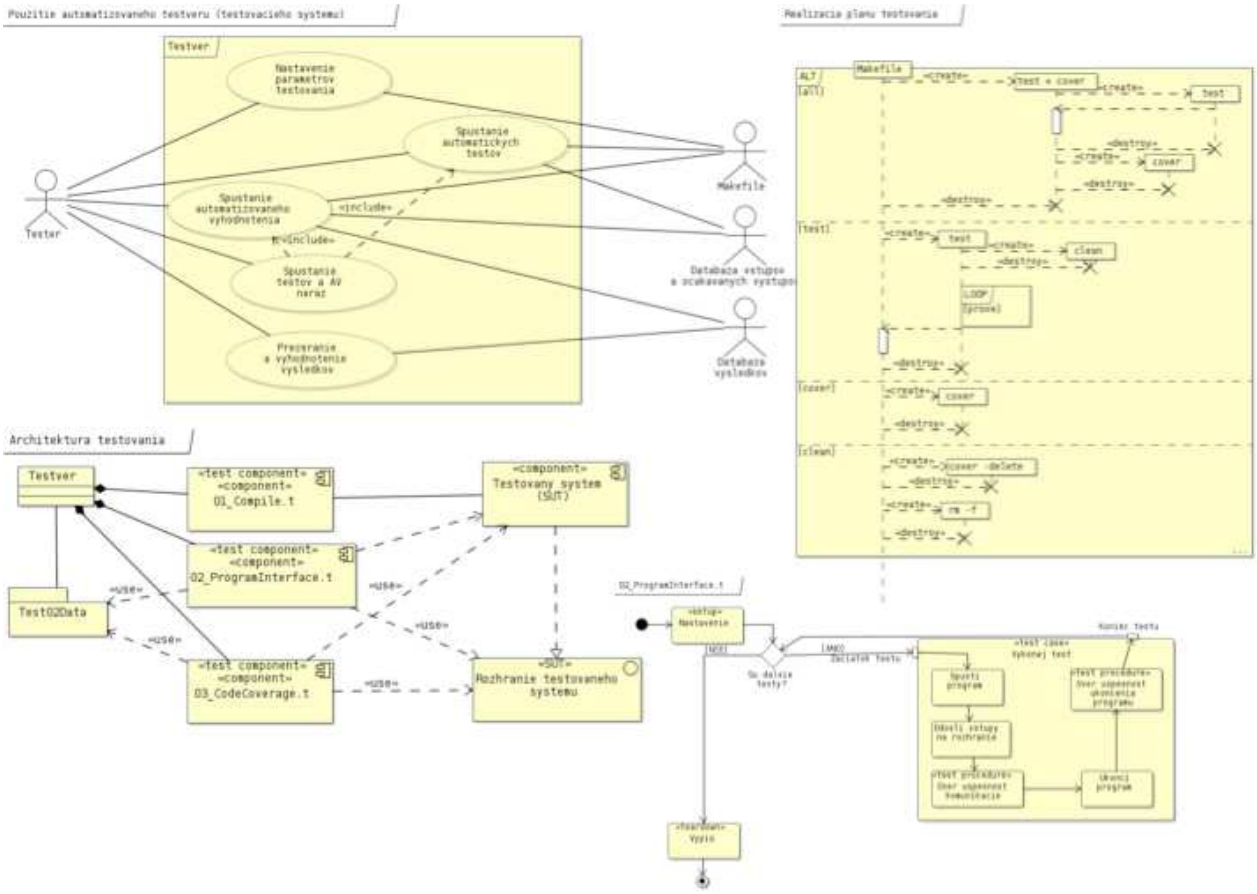

Figure 3. Outputs of our version of the jsUML2 editor in the form of different UML Diagrams

III. THE JSUML EDITOR

This editor is developed by a small group of programmers in Cordoba, Spain [7]. Our contribution is in the personalization of the editor interface to the needs of the integration into LMS Moodle. The actually modified interface is presented in Fig. 2 and Fig. 3.

There is no diagram type selection but a selected one is shown to the user with the corresponding toolboxes:

- Diagram actions – delete single object and delete all objects (clear diagram).
- Diagram elements [7] – represent type-specific menu.
- Course actions – the part, which will be redesigned and reworked in the close future.

IV. RESULTS AND POSSIBLE IMPROVEMENTS

The editor is already a result of our teaching process evaluation, which comes from the experience with student assignment reports. These reports usually include UML diagrams drawn in different tools. Some of them are results of reverse engineering instead of being the result of the design process, which is a bad habit and should be avoided. The unified editor would solve this problem.

Another results are the results of the software projects, which are aimed to be used in different subjects for analysis and measurements.

The content and structure of the lectures could be also improved by adopting new and sound fields of software engineering and software development such as agile development and project management methods. Some of these methods are described in the book of Abrahamsson et al. [12].

We discussed renewed lecture content for the course, which is still in discussion process, but after finishing that process, the new course structure will be sent for evaluation within the accreditation process for the Informatics Bachelor Study Programme for the next accredited teaching period.

The renewed lecture topics are as follows:

1. Introduction to software engineering, contents, problems and goals.
2. The software lifecycle, its models, processes and tools of software design.
3. Agile methods in software lifecycle.
4. Requirements engineering and modeling, analytical and design models.
5. Relations between structured models, SSADM.
6. Relations between object-oriented models, OOD.
7. Testing in the software lifecycle.
8. Manual functional testing.
9. Non-functional testing and test automation.
10. Software documentation and installation.
11. Maintenance, version control, service packs, patches.
12. Software evolution and aging.

V. CONCLUSION AND FUTURE WORK

We presented our improved course structure that aims to involve students into the teaching process by writing and presenting essays about hot topics in software engineering.

The most important goal is to implement a version of the jsUML2 editor into LMS Moodle as new question type and/or student assignments. This will need interface changes, because the location of the menu (actually on the left side) significantly shrinks the editing area. In the future, the “Send” action will close the question or test, respectively, and the “Save” button will serve as saving without closing the test.

In the second alternative representing new type of assignment, similar functionality could be associated with the buttons.

ACKNOWLEDGMENT

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REFERENCES

[1] I. Sommerville, Software Engineering. Addison-Wesley Pub Co; 6th edition (August 11, 2000), ISBN: 020139815X (or Pearson Education; 7th edition (May 10, 2004), ISBN: 0321210263).

[2] I. Sommerville, Software Enginering, available online at: http://www.comp.lancs.ac.uk/computing/resources/IanS/SE7/index.html

[3] R. S. Schach, Classical and Object Oriented Software Engineering, IRWIN 1996.

[4] J. Whitten, L. Bentley, D. Barlow, M. Victor, Systems Analysis & Design Methods. IRWIN 1989.

[5] E. Yourdon, Modern Structured Analysis, Prentice-Hall International, Inc. Englewood Cliffs, New Jersey, 1989.

[6] J. R. Romero, J. M. Troya, A. Vallecillo, "Modeling ODP computacional specifications using UML," The Computer Journal, (51):435-450, 2008.

[7] The jsUML2 javascript/HTML5 library, available online at: http://www.uco.es/~in1rosaj/tool_jsUML2.html

[8] Z. Juhász, M. Juhás, L. Samuelis, Cs. Szabó, “Teaching Java programming using case studies,” In: Teaching Mathematics and Computer Science. Vol. 6, No. 2 (2008), p. 245-256. - ISSN 1589-7389

[9] M. Juhás, Z. Juhász, L. Samuelis, Cs. Szabó, “Measuring the complexity of students' assignments,” In: Annales Universitatis Scientiarum Budapestinensis de Rolando Eötvös Nominatae. Vol. 31 (2009), p. 203-215.

[10] Z. Porkoláb, V. Zsók, "Teaching Multiparadigm Programming Based on Object-Oriented Programming" In: 10th Workshop on Pedagogies and Tools for the Teaching and Learning of Object-Oriented Concepts, TLOOC Workshop, ECOOP 2006, Nantes

[11] M. Simon, G. Dévai, Z. Porkoláb, N. Pataki, “A Practical Comparison of the Structured and the Functional Programming Paradigms,” In: Proc. of the Twelfth International Conference on Informatics, pp. 110-115, 2013.

[12] P. Abrahamsson, O. Salo, J. Ronkainen, J. Warsta, “Agile software development methods: Review and analysis,” ISBN: 951-38-6010-8

THE IMPACT OF DIFFERENT SCIENCES TO UNDERSTANDING THE NETWORK OF INTER-FIRM RELATIONSHIPS

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Abstract – For better understanding of the complexity of the network of relationships, it is essential to know and understand the influence of different sciences as well as the actual contributions of respective theories within these sciences to the explanation and understanding of the theory of relationship networks. The paper presents a survey of essential findings in respective areas which have influenced the network of relationships on the inter-organizational markets. We have to be aware not only of the fact that it is the individuals who determine the relationships between the companies, but also of the limitations of such relationships, and consequently recognize the importance of the intersection of the relations between the companies and the relations between the individuals. This paper presents interdisciplinary approach to the network of inter-firm relationships by different sciences. It also gives us the basic information on how and with what tools should we start carrying out the analysis of the relationships network.

I. INTRODUCTION

It is becoming increasingly clear that we can not holistically analyze the relationships events on the inter-organizational markets by studying the individual relationships alone; the research of networks of relationships is much more appropriate. Dyadic relationships have to be studied in a context of a much larger group of relationships between the companies that form the business context of a dyad in question. Every company is nowadays included into a network consisting of 10, 20, 100, 200 and sometimes even more companies. Therefore, it has become much more difficult to identify a common goal. The possibility of potential disagreements increases the network's vulnerability, and there exists a larger number of interdependencies between the partners. A very complex network of relationships needs to be managed.

Personal relationships and reputation among actors play an important role in the simplification and improvement of interpersonal relationships. By working closely together, individuals from different companies create and change the developing partnership. In this process, various phenomena connect: individuals' behavior, their intentions, mutual communication, belief systems, ideologies of different groups, that is, the widest possible range of aspects of a society and its individuals. In the course of social interaction, the characteristics that lie in the very core of human nature are expressed in: individuals' behavior, social values and norms shared by the individuals, as well as the subconscious psychic structures that are reflected in the individuals' emotions and motivation. The system of interpersonal relationships develops through social interaction characterised by trust, loyalty, collaboration and an exchange of information. In turn, the interpersonal relationships strengthen communication and make it possible to resolve a functional conflict and learn from it. This also has a positive effect on the strengthening of trust between partners. We deal with constant interactional influences among the aforementioned socio-psychological variables.

To understand the network of inter-firm relationships, it is essential to know and understand the influence of different sciences as well as the actual contributions of respective theories within these sciences to the explanation and understanding of the theory of relationship networks. The main purpose of this paper is therefore to present a survey of essential findings in respective areas which have influenced the network of relationships on the inter-organizational markets. We have to be aware not only of the fact that it is the individuals who determine the relationships between the companies, but also of the limitations of such relationships, and consequently recognize the importance of the intersection of the relations between the companies and the relations between the individuals. Next, we shall focus on the interdisciplinary nature of inter-firm relationships.

II. NETWORK OF INTERPERSONAL RELATIONSHIPS FROM THE VIEWPOINT OF DIFFERENT THEORIES

We posit that economics, organisational science, sociology, social psychology, politics and law are not the only sciences that research the nature of relationship networks, as it is generally stated by researchers in the business literature [1], [2], [3] but contributions made by exact sciences have to be added to the aforementioned concepts of the interfirm relationships research. Mathematics, for instance, makes the analysis of a relationship network easier by providing suitable mathematical methods; statistics and its models enable us to understand the present state as well as the dynamics of the network of relationships; and computer science contributes to the research with its advanced packages designed for the analysis of large relationship networks.

What is therefore the interdisciplinarity of the an interpersonal relationships network? This is schematically presented in Figure 1.

The inter-firm relationships network is rooted not only in economics, organizational sciences, sociology, psychology or law, but also in exact sciences. These are becoming increasingly important, since they provide suitable methodologies for the research into inter-firm relationship networks.

Agency Theory is one of the subfields within the so-called new institutional economics. It is the research direction of new institutional economics that focuses on the ex-ante mechanisms presumed to guarantee the efficient functioning of a company. The other research direction of the new institutional economics is *transaction costs economics*, which focuses on the ex-post aspect of transactions between the two sides. These two theories have in common that they both substantially contribute to the explanation and understanding of efficiency of the marketing relationships organisation. In addition to the aforementioned theories, we shall present the sociologists' contribution to the analysis of interpersonal relationships network through *equity theory*, as well asthe contribution made by *social psychology*.

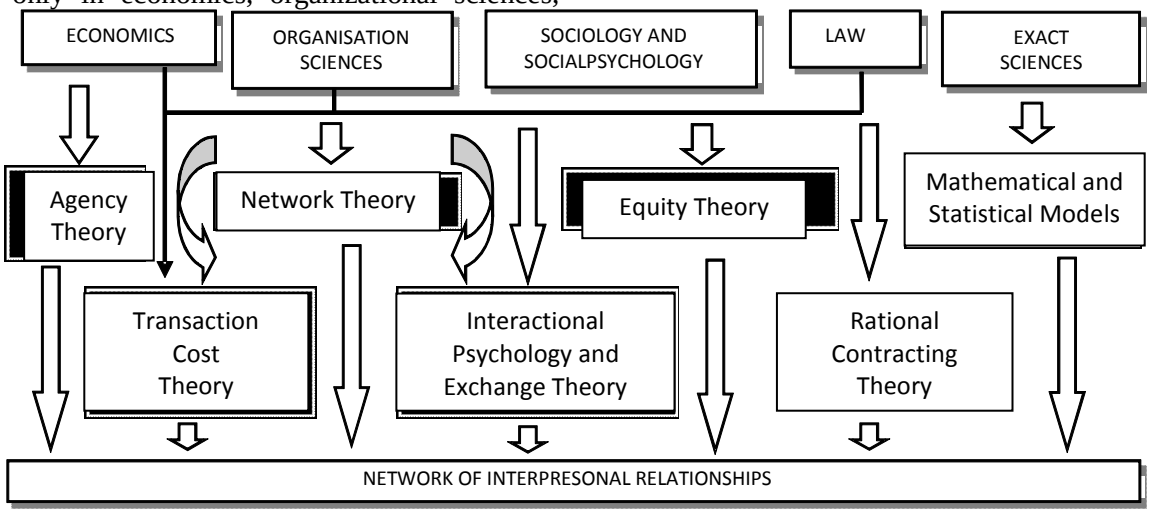

Figure 1. Interdisciplinarity of the Network of Interpersonal Relationships

Moreover, we shall talk discusses *rational contract theory*, which is closely connected to the fields of law, economics, organisation sciences and sociology. In the sequel, we shall describe *network theory*, whose research starting points are predominantly taken from sociology as well asfrom organisational sciences and economics. All these theories have in common that they are based on the assumption that units, meaning individuals, create a network on the basis of their conscious decisions about which relationships they will establish and which they intend to break. The importance of different social processes (in this) is the point of disagreement between the aforementioned theories. In the last section of this paper, we shall present the tools for analysing social network relationships in the form of computer programs with the help of mathematical and statistical methods.

A. Agency Theory

Agency theory has its starting point in the problem of separation between ownership and control. The main reason for the agency relationship develops when the principal and the

agent do not follow the same goals, with the principal trying to make the agent act in accordance with the principal's own interests. However, in this process he does not have access to all the information concerning agent's behavior. The agency relationship is a significant component of almost all exchange transactions. From the viewpoint of interpersonal relationships, the critical agency constructs are the uncertainty of economic operations, the individuals' minimal benefits and goals as well as their risk performance [4].

Agency relationships play an important role in marketing. The essence of marketing is the exchange and, as Arrow [in 5] says: »The agency relationship is... a significant component of almost all exchange transactions«. The fact is that most products and services reach a consumer through the intermediaries: they play the role of an agent in relation to the manufacturer. The final buyer is also included into an agency relationship. Through the information about the product and desired benefits from the product the final buyer influences the supplier who, in this case, acts as his agent. With the help of agency theory, we can explain relationships especially in the following three areas:

1. Salesforce management. It does not suffice to study the salesforce behavior and to search for the optimal rewarding. The influence of the additional exogenous variables has to be researched: for instance, different goals and risk preferences that sales personnel exhibits in different stages of their careers; different efforts and different results displayed at specific sales activities (e.g. servicing current accounts versus prospecting for new customers); differences in social norms (trust, organizational commitment). In short, there is much to be done on the operationalization and measurement of critical agency constructs, like the uncertainty of economic operations, the individuals' minimal benefits and goals as well as their risk performance.

2. Channel coordination and control. Agency theory focuses on the use of contractual conditions for the *coordination and control of relationships*. The efficiency of control mechanisms is also influenced by the *social norms* shared by the participants [6]. Cooperation norms express the partners' expectations concerning their collaboration and behavior in order to achieve common and individual goals. These norms act as a general protection against the opportunistic behavior. By creating common norms and standards of behavior, the partners set the rules of behavior for the future exchanges [7] and contribute to diminished inclination towards opportunistic behavior [45, 4]. Authors Heide and John [8] emphasize three dimensions of behavioral norms in the interfirm relationships: flexibility (which describes common expectations from both parties that both partners would not hesitate to substitute basic mutual commitments for some others, if the business environment demanded such a shift), the exchange of information (which encompasses common expectations that all the information useful to the partner side would be available to both sides), solidarity (defines mutual expectations that both partners would act in order to serve the best interests of both partners).

3. Market communication and real quality signalization. Market communication helps buyers to gain benefit in the form of information about company's products and services, as well as of their prices and quality. Market communication consequently leads to greater company's competitive position, and therefore to lower prices of goods as well as to their improved quality. Sellers of high quality products can use market communication to inform buyers about the high quality of their products, but the problem about the credibility of their statements arises. Would it not be possible that even the seller of low quality products claimed that their products were of exceptional quality? The answer is: theoretically and partly in practice – yes, but a somewhat surprising fact remains that the producers of higher quality products show greater desire for market communication than the others. The fact is that suppliers of so called »lemons« can convince and mislead the customers only once, but their sales after a certain period cease to grow, and consequently they invest an increasingly smaller part of their income into market communications [5].

To summarize, the agency theory focuses on the individuals' interests, explains the dyadic principal-agent relationship and uses control mechanisms for the description of exchange. We can say that these are the crucial starting points which have to be included in the analysis of the interpersonal relationships network. Our reproach to the agency theory is that it pays too much attention to the research of the dyad principal-agent, instead of, in our opinion, to a more important issue relating to the embeddedness of

this relationship into a larger interfim network context.

B. Transaction Cost Theory

Coase [9] explained the relation between the two forms of economic bargaining (on the market or within the company) with the transaction costs. Namely, in both forms of bargaining certain costs emerge in connection with a transaction: on one hand we have the costs of the make and of the execution of contracts between the seller and buyer on the market, on the other hand we have the managerial costs arising from the organization of transaction within a company.

In order to develop the relationship between the buyer and the seller in the course of time, the sellers as well as the buyers have to invest into the relationship. Joshi and Stump [10] argue that a company invests into a partner relationship by investing into partner's learning, by investing into company's own production process change in order to be effectively included into the partner's business, and to the change of location in order to get physically closer to the partner and rationalize the transportation costs, further, by investing into production capacities, tools, machines, into knowledge, experience, technological processes, access to rare commodities, etc. However, the partner does not carry out these investments only to show his clear interest for the development of a long-term business relationship, he also acts in hope that the other partner will reciprocate in the same way.

The transaction cost theory is the intertweaving of two analytical aspects: one stemming from institutional economics and the other from organisational sciences and law. The transaction costs are the cost of search, negotiation, control and enforcement of exchange agreements [2], [8].

The transaction theory can also help to explain the creation of the *companies' network* as well as their network inter-organizational structure (the dynamic networks, for instance). The essence of company's existence and growth as well as the reason for the creation of a corporate network, lies according to this theory (also called the internalization theory), in the company's aspiration to diminish or at least partly avoid the market transaction costs. Social networks reduce transaction costs, since the information asymmetry is substantially lowered by a higher level of information within a network [11]. The opportunistic behavior in a network proves to be more expensive, since the actors understand that the loss of reputation negatively affects not only the actual relationship, but can also influence all the existent and potential partners.

The transaction cost theory is complementary to the principal-agent theory. Both approaches have in common that they contribute to the explanation and understanding of the relationships among actors.

C. Equity Theory

The definition of this theory is a problem in itself, and so is its evaluation, since each individual has his/her own subjective measure of certain usefulness. According to this theory, people in their interpersonal relationships seek interactional results proportional to their inputs and efforts for the preservation of interaction. These inputs can be a psychical or physical effort, talent, attractiveness, kindness etc. If there exists an inequity between the inputs and the results of interaction, dissatisfaction appears and the possibility of a relationship interaction break-up grows.

Sometimes people stay in relationships that offer them no satisfaction. According to Thibaut and Kelley [12], we can explain this with the notion of dependence in relationships. The level of dependence is defined with the difference between what we get and what the sociologists Thibaut and Kelley call “the comparison level for alternatives”. The comparison level for alternatives denotes the best possible results that could be achieved in the first relatively best possible relationship after the break-up of the previously existing relationship. If we lose more than we get in the long run, we become unsatisfied. Why do so many people stay in relationships which bring them nothing but dissatisfaction? That happens because they are dependent on the relationship. In this case, dependence means that they cannot get something better elsewhere.

Research on the equity theory deals with collective processes and a fair distribution of benefits [13], [14]. We can use several different measures for the diminishment of inequity in an interpersonal relationship (see Figure 2). We can increase the inputs, if they are too small in comparison with the results and inputs of comparable individuals; we can decrease the results, if they are too high in comparison with the results and inputs of comparable individuals. We can increase the results, if they are too poor in

comparison with the results and inputs of comparable individuals; we can decrease the results, if they are too high in comparison with the results and inputs of comparable individuals. We can abandon exchange; we can distortedly present the inputs and results of each comparable individual. And finally, we can change the choice of a comparable individual.

The equality in a relationship is defined as the equality of ratios between what an individual invests into the relationship and what he gets out of it. If such ratios are perceived as roughly equal by the individuals involved in the relationship, the relationship should be perceived as an equal relationship. We are dealing with the relationship between the »outcomes« (O) and »inputs« (I) which we mathematically describe with the following formula:

$$Equality = \frac{O_a}{I_a} = \frac{O_b}{I_b}$$

From the viewpoint of social psychology, we have to distinguish between the categories of "outcomes" and what is "perceived as an outcome" in an interpersonal relationship [15]. The problem is similar to the problem of how to distinguish between "benefit" and "perceived" benefit. The aforementioned distinctions also indicate a very important division within psychology: the division between the so-called objective (benefit, profit) and subjective (perceived benefit, perceived profit). The equality in the relationship should be discerned from the equality of rights, because the equality in the relationship is essentially characterised by the state of balance.

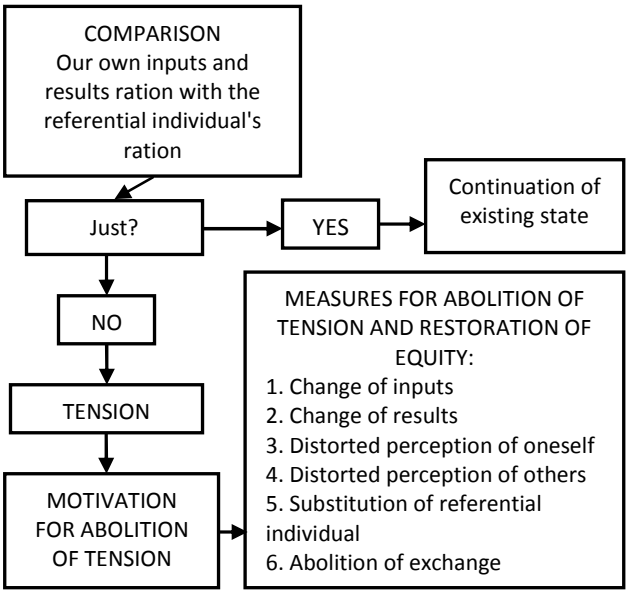

Figure 2 Equity Theory

If one of the relationship partners gains more profit from the total income while investing more at the same time, the partnership is still fair and balanced. Equality in interpersonal relationships should be such a form of social balance to which social interaction would aspire. The equality relationship is also considered a "fair" relationship or the equity relationship.

The equity theory or the exchange theory, according to some researchers, contributes to the explanation of the dyadic nature of relationships. In addition, it brings the following concepts to the social network: the concept of strength in the exchange need for the adaptation to partners, trust, the relationship equality, reciprocity and, last but not least, the importance of values shared by the relationship partners.

D. The Social Psychology Contribution

The inter-firm relationships on the inter-organizational market are essentially the relationships between people. The relationships among individuals were abundantly studied in sociology, psychology, and communication sciences.

Interactions are socio-psychological processes that are present in human relationships. These processes take place between two or more people, between an individual and a group, or among different groups, connecting them into a network of mutual dependencies. The most important

process of social interaction is the information exchange, meaning *communication*. By communicating, we convey messages, simultaneously define our interpersonal relationship and, by doing so, also determine the behavior of communication participants. We can speak of a content aspect and a relational aspect of communication, which means (1) what we communicate, and (2) how we do that, or in other wors, how we define the relationship by communication. The research and therapeutic experiences show that the relational aspect is surpressed in interpersonal relationships, including a lot of spontaneity and few communication errors. On the other hand, in interpersonal relationships with little spontaneity and many communication errors, there is a constant battle going on between partners concerning the nature of their relationship, whereas the content aspect of their communication is placed in the background of their attention [12].

In the frame of buyer-seller relationships on the inter-organizational market, the most important feature of social interaction is the following: all the participants act in such a way that they constantly react to partners' actions by adapting their behavior to their own intentions as well as to the perceived intentions and expectations of their partners. Each individual holds his own systems of judgment, own values, capabilities and needs that help him/her to determine the result of interaction. The creation and maintenance of interaction depend on three kinds of factors [3]: firstly, the benefits and loses expected from entering a relationship; secondly, the possibility of choosing alternative relationships; and thirdly, the decision and belief that the expected intearction is the best possible alternative for both partners. The assessment of these criteria depends largely on the individual's past experiences (this criterion presents a measure of the relationship's attractiveness) and on knowledge about the existence of other possibilities (this criterion presents a measure of partners' dependence on relationship).

To be able to claim that somebody is bound into a relationship, three components have to be present: a relatively high level of participants' inputs, a relatively long lasting relationship and a relatively high level of stability of the participants' inputs. All forms of mutual dependence are not constructive and do not bring mutual benefits. Authors [17] emphasize that in many cases the existence of unsuitable interdependence and unsuitable interaction causes unsuitable resource exchanges. Such unsuitable exchanges can impede the project finalization, due to the disturbances in the working process and information flow. This all reflects in costly and unnecessary diminishment and loss of productivity. All the inter-organizational network relationships are therefore not characterized by close connections and cooperation productivity, nor they are expected to be. The dyadic relationship will without exception also include the attempts of *social influence* from the buyer's or the seller's part. Such attempts of social influences can manifest in very different ways and will include the use of strategies such as promises, threats, recommendations and/or control over information.

The core message of the *social exchange theory* has the following implication for the understanding of a social network: in the event of mutual respect and reciprocal exchange, trust can be expected among participants. This is the basis for a long-term and ever-increasing exchange connected with a friendly relationship among the participants. The philosophy of a network of interpersonal relationships is therefore encapsulated in a belief that satisfaction in a partnership can only be achieved if the satisfaction of exchange partners is also achieved. Such a procedure is a direct result of empathy for the needs of other participants, the respect of their equality, mutual trust and willingness to adapt as well as, of course, the promise of fulfilment.

The aforementioned constructs are the cornerstones of social psychology. Every cooperation and the establishment of relationship can only derive from an interpersonal relationship. A company's employee (e.g. professor), who is more or less successfully involved in social interaction with students, other professors and the company' representatives, plays the central role.

E. Rational Contracting Theory

Contractual relationships have already been mentioned in this paper, which only corroborates our hypothesis that the field of interpersonal relationships is intertwined with many fields, including law. Legal and formal relationships are precise and binding contractual relationships which specify the obligations and roles of the two relationship partners [6]. The general obligations (for instance, the international convention on sales contract) that regulate the area of commercial transactions (buying and selling processes), regardless of whether the parties sign a formal

document or not, are not under consideration here. Legal-formal relationships create two basic benefits; they ensure protection that can be realised through the country's legal system and regulate the partner relationship by creating a plan for the next period. However, the legal relationships can also present a limitation, if they diminish the partners' flexibility in adapting to the changing business environment.

In the modern firm theory, a firm is predominantly a complex group of mutual contractual relationships between the resources' owners. Two or more companies develop a partnership with the aim of sharing and jointly using their unique resources and capabilities, all for the achievement of competitive advantage. In this form of relationship, the cooperating companies do not found an independent new company and do not have capital inputs. That is why the noncapital relationships are less formal and do not demand such a high level of partners' loyalty as do the common investments or the capital relationships. Such relationships are essentially projects in which two or more companies decide on a contractual relationship in a specific business field, for instance, the license contract, franchising, production cooperation, common marketing, distribution agreement, supply chain, research and development partnership. A long-term contractual cooperation demands a very high level of the involved parties' mutual trust, and also demands mutual investments in the phase of contract execution [18].

F. Networks Theory

The networks theory, also called the social networks theory or the actors' networks theory, can be broadly categorised as a structural sociological theory [19]. Social networks are defined as groups of people, companies or other social entities that are bound together by a number of socially important relationships; for instance, friendship, cooperation or the information exchange, or other mutual actions undertaken in order to more successfully achieve desired goals by means of experience, information or resources exchange. *A social network* is an ongoing revolution whose participants are its audience at the same time [20]. We can view a complex inter-organizational market as a network, where companies are nodes and the relationships between them are threads. Each node or company, with its specific technical resources and people, is in many different ways connected with several other nodes (companies) through relationships. The network approach uses the social network theory as a tool to monitor how relationships among several participants develop and how the relationship ties strengthen in networks [21]. The network researchers in social sciences therefore study participants, dyads and the network structure [22]. In the study of organisational networks, the following questions are becoming more and more important. How can an interactional structure ensure a concerted action directed towards the achievement of common goals as well as the goals of each individual organisation? How do network characteristics influence the characteristics of an organisation? [23].

We have to bear in mind that, apart from the choice-making and transformation processes in the exchange, there is always a human interaction process built by individual actors from the companies involved in exchange. We also cannot ignore the fact that the membership in the network is dynamical [24] and that the network is embedded into the environment and therefore subject to changes [25].

Social networks analysis is a separate research approach within the framework of social and cognitive sciences. The approach is based on the supposition that relationships, or the connections, meaning the connections among the participants of a network, are of utmost importance. Apart from the importance of connections in social networks, the following principles are important for the analysis of social networks [26]: participants and their actions are mutually dependent, the connections among the participants serve as a means of the transport of material and non-material resources, the network's structural environment is a source of opportunities and/or limitations for the individual participants' actions, the structural environment of the network determines the permanent patterns of connections among the participants. *Social capital* emphasises the value of interrelationships among people within a company as well as among the company and other companies [27]. Trust, mutuality, common values, network and norms are those that present added value within a company or among companies in a sense that they promote the transfer of information and the development of new knowledge. Bourdieu with co-authors (in [28]) speaks about social capital as the interpersonal relationships among people as well asd the sources embodied in these interpersonal relationships. According to the structural holes

theory [29], social capital is defined as a level to which an individual is the only connection between two individuals or groups. The aforementioned theory emphasises that the benefits of social capital stem from the access to different knowledges and opportunities, meaning the asymmetry of information created by the lack of connections among the individuals or the groups in a social network. The more of such unconnected relationships an individual has, the bigger the access to information. Controlled with the measure to which a certain connection represents a "bridge", strong connections are more important for the actors in order to acquire resources in comparison to weak connections, since they encourage the extent and quality of information, based on greater trust.

Oh, Labianca & Chung [30] add a new aspect to social capital, defining it as the "group social capital", which is a set of resources made available to a group through the social relationships of group members. The group has relationships within a social group as well as broader formal and informal relationships within the organisation structure. Of course, the group also has relationships without the structure of its own organisation (e.g. social network), using the Internet [31], and it is exactly these relationships that are of crucial importance for the development and maintenance of the social network relationships.

Therefore, social capital represents the contribution or the capital of people to which individuals have access via their social connections and networks. The adjective "social" denotes the relationships or the interactions among the people, whereas the noun "capital" can be understood as the asset of an individual or a group which is formed by cooperation and communication with others.

The network research background. The notion of network is common to numerous research disciplines. The network analysis was used by anthropologists for the research of kinships and relationships within communities, by social psychologists as an approach to the analysis of communication patterns in small groups, by sociologists for the research of opinion leadership and diffusion of innovations and by the consumer behavior researchers for the research of the suitability of brands in interpersonal relationships. The network analysis has also proved to be useful for the research of newly emerging social structures in organisations (For more, see [32]).

In social sciences, there are two main approaches to the study of networks, according to Powell and Smith-Doerr [33]; namely, the networks can be either used as analytical tools or as a form of management. The former group of research includes the Industrial Network approach (IMP group network approach). However, the IMP researchers disagree with such a categorization, since they think that management is achieved through relationships and that a network is a way of understanding the general connectedness which prevails in relationships on the inter-organizational markets. Besides, the IMP approach does not see networks as some preexisting structures forced upon companies. They posit that networks are formed through the formation of connections, ties and relationships between the autonomous participants. In opposition to the sociological and more structural approaches (the social network analysis), the IMP group researchers put more attention to the content of relationships and their dynamics.

Because of *dynamical nature of interactions in the network*, the researchers encounter conceptual as well as empirical challenges [34]. The research approach should take into account not only the definitions of networks and networks' structures, but also the social processes that take place within the social context of the network. The structural theory sets out the theoretical cornerstones for such thinking, since these cornerstones study the interplay between structure and action in creating and maintenaning social systems. "Structuralists see social interactions as a prism, through which the individuals' goals as well as the common goals break and by doing so create the social reality. The organization of society is an unresolvable dialectic between the authonomy and mutual dependence, between action and restraint" ([35], p. 949). This inseparable connection between structure and action is known in the structural theory under the term of structural duality. A great theoretical and methodological contribution to the forms of the network organisationwas made by Contractor, Wasserman and Faust [36]. "The network is an organisation", they posit (p. 681), and claim that research into networks should be based on "multiple theories" (e.g. theories of self-interest, theories of mutual interest and collective action, cognitive theories, theories of network evolution and coevolution), as well as on the multi-level analysis (actor, dyad, triad and a global level).

The need for the *longitudinal network research* is expressed in the work [36], [34], [37], we can also find it in the Granovetter's [24] early call for research on the consecutive development phases of the network. By saying this, we do not want to posit that no other study has ever addressed the question of development in time. We can find an extensive research survey on the structural and functional field of networks in the paper by Newman [38].

With the advancement in technology, social networks have gradually outgrown the framework of personal interaction amon individuals as well as the technological infrastructure that connected all these individuals. Social networks have evolved into *online social networks* connected by computer networks. Interaction among individuals which has traditionally taken place at the level of personal connections now functions online. By doing so, the individuals benefit from convergent sinergy of online conferences, direct and fast computer communication, common online working space and interactive tables on the internet, such as the HTTP protocol [31]. The online networks play a significant role in business activities, the economic development and education. This type of virtual communities provides an arena where people from different communities can collaborate, interact and exchange knowledge, experiences and common interests.

G. Mathematical and statistical models

To present a full scale extent of relationships networks, we must also take a look into exact sciences. At this point, we would like to emphasise, in our opinion, essential findings, achievements, models and tools developed in the fields of mathematics, statistics, physics, computer science, as well as biology and chemistry, which we can use for the analysis of networks of interpersonal relationships. However, we shall not provide detailed explanation of these approaches.

Most models for network evolution deal with the definition of parameters that influence the network structure [39]. These parameters are roughly divided into the networks characteristics and the characteristics of a singular network unit. However, these models pay little attention to the influence of the network structure on the individual's characteristics. This problem is addressed by the model of contagion and selection, presented in [40], which also explains changes in the network structure as functions of the characteristics of network units, and changes in the characteristics of a singular unit as a function of the network structure. This model is a member of the family of stochastic models. Although the use of loglinear models is a prevailing approach, modeling with the help of Markov models for social networks presents a very useful alternative [41]. For the analysis of interaction and the analysis of cross-over effects in the network of interfirm relationships, we can use widely spread logit models, such as the *p* models* ([41], [42]). An extensive survey of approaches to networks in the research field of physics can be found in [43], [44], [45].

We can carry out the analysis of interpersonal relationships by using the type of social network analysis based on the method of *block modelling*. The aim of this important mathematical method is to alleviate the analysis of studied relationships and connections. The block modelling enables researchers to focus their study on a smaller network or a block model in which the constituent units are clusters of equal units, instead of directing research into a large, too complex network. The obtained structure is much more manageable and suitable for interpretations as well as the checking how well the model structures chosen in advance match with the real network [39].

A very useful software for such an analysis is the PAJEK programme [46], designed especially for the analysis of large networks. It is based on quick algorithms and has a very well designed graphical presentation of the networks. The UCINET [47] package is also very useful for the network analysis. This package is less powerful than the PAJEK package; however, it has a lot more functions. Among other interesting packages for the network analysis, let us also mention the GRADAP and STRUCTURE packages, which have similar working powers than UCINET.

The observation of a network in a certain given moment or in a given time interval gives us very important information about the status of the network in that particular moment as well as the position and meaning of each individual unit within the network; however, it offers only little explanation about how and why the structure evolved. For the explanation of the network structure and its evolution, we have to broaden the notion of network to dynamic or the so-called longitudinal networks. *A longitudinal network* is composed of at least two consecutive observations of the same network with constant or changeable

membership [48]. With these networks, the focal point of interest is the understanding how the network develops and changes through time, as well as finding new ways for developing the models of social processes, which would help explain the observed structures [39], [40], [34], [49], [50]. Therefore, the core of interest is the dynamics of interpersonal relationships, which is very important for the understanding of a social network. The following problem arises: this dynamics cannot be presented solely with a static presentation in a satisfactory way. The solution is a *dynamical presentation of networks in time*, which opens the door for researchers in the following fields: discovering the characteristics of the network's evolution, monitoring the evolution of selected parts of the network and discovering the outstanding parts of the network. In recent years, the network analysis and graph theory has been one of the hottest research fields not only in mathematics, but also in physics, biology and chemistry. Almost every complex system can be presented as a graph ([51], [38], [39]). The graph theory does not only show how the individual units connect between themselves, but much more; for instance, what patterns emerge and what laws hold when networks and graphs develop and change in time. Computer modelling has quickly replaced traditional approaches in mathematical theory and experiments.

H. A survey of existing programmes for dynamical presentation of time networks

The SoNIA [52] programme was designed on purpose for a dynamical presentation of time networks and takes into account the following special characteristics of time networks: continuous changing of nodes' coordinates; nodes and threads disappearing; new nodes and threads appearing in accordance to whether a node or a thread is present in a certain moment of time or not; changing of colors and thicknesses of threads; presentation of multiple networks in the same nodes.

A useful approach to the analysis of dynamical networks is also the SIENA programme which uses modeling by means of Markov models and is a member of the family of stochastic models for the coevolution of network and the units' properties. The SIENA programme is a part of the StOCNET project whose authors are Snijders, Steglich, and Schweinberger [53].

In the field of dynamical presentations of time networks there is also a very active German group which has created a web service called GAML [54]. This service has integrated quite a few algorithms for dynamical presentations of time networks which also meet the esthetic criteria, like denseness, the smallest possible number of tie crossings and dynamical stability of network in time.

By the means of a very powerful computer programme Pajek (already mentioned above) it is possible to draw and analyse complex networks in very different scientific fields, from very complicated neuronic nets, organic molecules (DNK), political, economical and transport connections, to family trees, phone networks, world web network and, as we firmly believe, the inter-firm relationships network. A dynamical presentation of time networks is made possible by using the programme add-on PajekToSvgAnim [53].

III. CONCLUSION

In this article, we presented the widest possible theoretical base for the study of inter-firm's relationships network that range from economics, organisational sciences, sociology, social psychology, law to exact sciences. We outlined contributions made by different theories to the development of the theory of interpersonal relationships as well as the interconnectedness of these theories. Each of them is deficient in itself from the pint of view of a network of interpersonal relationships; however, put all together, they complement one another. Only a complete overview of all the theories will give us a good explanation of what is going on in the network of interpresonal relationships and a sufficient understanding of these processes. At the same time, it instructs us about all the factors we have to take into account, if we intend to study a social network. It also gives, the basic information on how we should start carrying out the analysis of the relationships network.

Simultaneously taking into account the latest developments from all the disciplines that study networks will give us sinergetic effects and, as we firmly believe, bring us closer to facilitated research into networks of interfirm relationships. The key question of contemporary management in the future will be the following: how to manage networks and, simultaneously, how to manage the internal relationships between partners. We think that the understanding of a buyer-seller relationship in the context of inter-organizational network connection is an extraordinary strategic development possibility whose full potential will

be revealed with a more active role of the companies.

REFERENCES

[1] L. O'Malley, and C. Tynan, "Relationship Marketing," in M. Baker and S. Hart, ed., The Marketing Book. 6th edition. Amsterdam: Butterworth-Heinemann, 2008.

[2] V. Eiriz, and D. Wilson, "Research in relationship marketing: antecedents, traditions and integration," European Journal of Marketing, vol. 40, No. 3/4, 2006, pp. 275-291.

[3] M. Ule, Socialna psihologija. Ljubljana: Fakulteta za družbene vede, 2009.

[4] G. Buevas-Rodriguez, L.R. Gomez-Mejia, and R. M. Wiseman, "Has Agency Theory Run its Course?" Corporate Governance: An International Review, vol. 20, no. 6, pp. 526-546, 2012.

[5] M. Bergen, S. Dutta, and O. C. Walker, Jr. "Agency Relationships in Marketing: A Review of the Implications and Applications of Agency and Related Theories", Journal of Marketing, vol. 56, no. 3, pp 1-24, 1992.

[6] W. B. Tayler and R. J. Bloomfield, "Norms, Conformity, and Controls", Journal of Accounting Research, vol. 49, no. 3, pp. 753-790, June 2011.

[7] R. F. Dwyer, P. H. Schurr, and S. Oh, "Developing Buyer-Seller Relationships", Journal of Marketing, vol. 51, no. 4, pp. 11-27, 1987.

[8] J. B. Heide, and G. John, "Do Norms Matter in Marketing Relationships", Journal of Marketing, vol. 56, no. 2, pp. 32-44, 1992.

[9] R. H. Coase, "The Nature of the Firm", Economica, vol. 4, pp. 386–405, 1937.

[10] A. W. Joshi, and R.L. Stump, "Determinants of Commitment and Opportunism: Integrating and Extending Insights from Transaction Cost Analysis and Relational Exchange Theory", Canadian Journal of Administrative Sciences, vol. 16, no. 4, pp. 334-352, 1999.

[11] R. Gulati, N. Nohria, N., A. Zaheer, "Strategic networks," Strategic Management Journal, vol. 21, pp. 203-215, 2000.

[12] J. W. Thibaut, and H. H. Kelley, The Social Psychology of Groups. New York: Wiley, 1959.

[13] J. W. Huppertz, R. H. Evans, and S. J. Arenson, "An Application of Equity Theory to Buyer-Seller Exchange Situations", Journal of Marketing Research, vol. 15(May), pp. 250-260, 1978.

[14] J. A. Hess, L. H. Pollom, and A. D. Fannin, "How much do we really know about equity's impact on relational communication? Issues in measuring equity in communication research." Communication Methods and Measures, vol. 3, pp.173–194, 2009.

[15] P. A. Fadil, R. J. Williams, W. Limpaphayom, and C. Smatt, "Equity or Equality? A Conceptual Examination of the Influence of Individualism/Collectivism on the Cross-Cultural Application of Equity Theory", Cross Cultural Management, vol. 12, no. 4, pp. 17-35, 2005.

[16] P. Watzlawick, J. H. Beavin, and D. D. Jackson, D. D. Pragmatics of Human Communication. A Study of Interactional Patterns, Pathologies, and Paradoxes. New York: W. W. Norton & Company, Inc, 1967.

[17] W. J. Johnston, L. D. Peters, and J. Gassenheimer, "Questions about network dynamics: Characteristics, structures, and interactions", Journal of Business Research, vol. 59, no.8, pp. 945-954, 2006.

[18] S. G. Lazzarini, and T. R. Zenger, "The strength of Churning Ties: A Dynamic Theory of Interorganizational Relationships", 2002. URL: http://www.olin.wustl.edu/faculty/zenger/churning9.doc.

[19] G. Ritzer, Sociological theory. 7th edition. Boston: McGraw-Hill, 2008.

[20] L. Bih-Ru, Y. Wen-Bin, M. Nisha, and M. Nichols, "Enhancing business networks using social network based virtual communities", Industrial Management & Data Systems, vol. 106 no. 1, pp. 121-138, 2006.

[21] J. N. Sheth, J. N., and A. Parvatiyar, Handbook of relationship marketing. London: Sage Publications, Inc, 2000.

[22] J. Galaskiewicz, The "New Network Analysis" and Its Application to Organizational Theory and Behavior. In Iacobucci, D., ed., Networks in Marketing: pp. 19-31, 1996, Newbury Park: Sage.

[23] G. R. Salancik, "WANTED: A Good Network Theory of Organization", Administrative Science Quarterly, vol. 40, no. 2, pp. 345-417, 1995.

[24] M. Granovetter, "Economic Action and Social Structure: The Problem of Embeddedness", American Journal of Sociology, vo. 91, no. 2, pp. 481-510, 1985.

[25] B. R. Koka, R. Madhavan, and J. E. Prescott, "The evolution of interfirm networks: Environmental effects on patterns of network change", Academy of Management Review, vol. 31, no. 3, pp. 721-737, 2006.

[26] S. Wasserman, and K. Faust, Social Network Analysis: Methods and Applications. 18th printing, Cambridge University Press, 2009.

[27] M. W. McElroy, "Social Innovation Capital", Journal of Intellectual Capital, vol. 1, no. 3, pp. 30-39, 2002.

[28] A. M. McFadyen, A. M., and A. A. Cannella, "Social Capital and Knowledge Creation: Diminishing Returns of The Number and Strength of Exchange Relationships", Academy of Management Journal, vol. 47, no. 5, pp. 735-746, 2004.

[29] R. S. Burt, Structural Holes: The Social Structure of Competition. London: Harvard University Press, 1995.

[30] H. Oh, G. Labianca, and M-H. Chung, "A multilevel model of group social capital", Academy of Management Review, vol. 31, no. 3, pp. 569-682, 2006.

[31] C. Steinfield, N. Ellison, C. Lampe, and J. Vitak, "Online Social Network Sites and the Concept of Social Capital", For presentation at The Internet Turning 40 Conference School of Journalism and Mass Communication Chinese University of Hong Kong, 2012.

[32] N. M. Tichy, "Networks in Organizations". In Nystrom, P.C. & Starbuck, W.H. eds., Handbook of Organizational Design. Oxford: Oxford University Press, 1981.

[33] W. W. Powell, and L. Smith-Doerr, "Networks and Economic Live". In Smelser, N. J., ed., The Handbook of Economic Sociology. Princeton: Princeton University Press, pp. 368-402, 1994.

[34] W. W. Powell, D. R. White, K. W. Koput, and J. Owen-Smith, "Network dynamics and field evolution", American Journal of Sociology, vol. 110, no.4, pp. 1132-1205, 2005.

[35] N. S. Contractor, S. Wasserman, and K. Faust, "Testing multitheoretical, multilevel hypotheses about organizational networks: an analytic framework and empirical example", Academy of Management Review, vol. 31, no. 3, pp. 681-703, 2006.

[36] A. Larson, and J. A. Starr, "A network model of organizational formation", Entrepreneurship Theory and Practice, vol. 17, no. 2, pp. 5-15, 1993.

[37] J. M. Hite, and W. S. Hesterly, "The evolution of firm networks: from emergence to early growth of the firm", Strategic Management Journal, vol. 22, no. 3, pp. 275-286, 2001.

[38] M. E. J. Newman, "The structure and function of complex networks", SIAM Review, vol. 45, pp. 167-256, 2003.

[39] P. Doreian, V. Batagelj, and A. Ferligoj, Generalized Blockmodeling. Cambridge university press, 2005.

[40] R. T. A. J. Leenders, "Longitudinal behavior of network structure and actor attributes: Modeling interdependence of contagion and selection", 1997. In Doreian, P., & Stokman, F. N. Evolution of social networks, Amsterdam: Gordon and Breach: 165-184.

[41] G. L. Robins, T. A. B. Snijders, P. Wang, M. Handcock, and P. Pattison, "Recent developments in exponential random graph (p*) models for social networks", Social Networks, vol. 29, no. 2, p. 192-215, 2007.

[42] C. J. Anderson, S. Wasserman, and B. Crouch, "A p* primer: logit models for social networks", Social Networks, vol. 21, pp. 37-66, 1999.

[43] R. Albert, and A. L. Barabási, "Statistical mechanics of complex networks", Reviews of Modern Physics, vol. 74, no. 1, pp. 47-97, 2002.

[44] S. N. Dorogovtsev, and J. F. F. Mendes, "Evolution of networks", Advance in Physics, vol. 51, pp. 1079-1187, 2002.

[45] S. H. Strogatz, "Exploring complex networks". Nature, pp. 410: 268-276, 2001.

[46] V. Batagelj, and A. Mrvar, 2013. PAJEK, ver. 3.14. Available at: http://vlado.fmf.uni-lj.si/pub/networks/pajek/.

[47] S. P. Borgatti, M. G. Everett, and L. C. Freeman, 2002. UCINET for Windows. Columbia, SC: Analytic Technologies. Available at: http://www.analytictech.com/ucinet/ucinet_5_description.htm.

[48] C. E. G. Steglich, T. A. B. Snijders, and M. Pearson, 2004. Dynamic Networks and behavior: Separating Selection for Influence. Available at: http://stat.gamma.rug.nl/snijders/

[49] J. J. Suitor, B. Wellman and D. L. Morgan, "It's About Time: How, Why and When Networks Change", Social Networks, vol. 19, pp. 1-7, 1997.

[50] E. P. H. Zeggelink, F. N. Stokman, and G. G. Van de Bunt, "The Emergence of Groups in the Evolution of Friendship Networks", Journal of Mathematical Sociology, vol. 21, pp.: 29-55, 1996.

[51] S. Bornholdt, and H. G. Schuster, Handbook of Graphs and Networks: From the Genome to the Internet, Weinheim: Wiley-VCH, 2005.

[52] S. Bender-deMoll, and D.A. McFarland, SoNIA (Social Network Image Animator), 2007. Available at: http://www.stanford.edu/~skyebend/.

[53] T. A. B. Snijders, C. E. G. Steglich, and M. Schweingerger, Modeling the co-evolution of networks and behavior, 2005. Available at: http://stat.gamma.rug.nl/snijders/chapter_coevol.pdf.

[54] S. Diehl, C. Görg, A. Kerren, M. Pohl, P. Birke, S. Zimmer, and S. Zacher, Graph Animation, 2007. Available at: http://rw4.cs.uni-sb.de/~diehl/ganimation/.

[55] D. Brvar, A. Mrvar, and V. Batagelj, PajekToSvgAnim, version 1.10.6.3., 2007. Available at: http://vlado.fmf.uni-lj.si/pub/networks/pajek/SVGanim/default.htm).

THE SHORT HISTORY OF THE DEVELOPMENT OF TECHNOLOGY, LIFE MANAGEMENT AND PRACTICE AND ITS ROLES IN HUNGARY IN THE BEGINNING OF THE 21ST CENTURY

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Abstract: Today there is a transformation in education. Technology, life management and practice, being an interdisciplinary subject, requires a special approach. In the present study we are delineating the goals and roles of this subject and we are giving an outline of the developments it needs.

I. INTRODUCTION

In the school education the subject of Technology, life management and practice has gone through some remarkable changes in primary education. The new vocational education law necessitates the revision of this subject. The government is encouraging young people to turn to technical courses, it is trying to make education more practical, and after assessing shortage occupations, it is promoting vocational education.

In the documents of training and education, in addition to the problem centered topic acquirement, the material conversion that requires manual creativity has been given more and more emphasis. These two areas are connected, and they can strengthen each other. Technical knowledge is part of our general knowledge. Technical knowledge means the application of engineering and social sciences in the process of creating products, the craftsmanship that has been accumulated during history.

II. HISTORICAL BACKGROUND

Work and practical education has been a problem for centuries. In history, in the ancient societies, passing over the experience was a central activity in the tribe. In slaveholding societies working was a "privilege" of the slaves, while in the feudal era it was something that only villeins would do. In this era, education was a duty of the church.

In the modern era handicraft boomed together with embourgeoisement, and work education was given an outstanding role.

In Apáczai Csere János's scientific course book[1], The Hungarian Encyclopedia (1653), the title of the eighth part was "technology and agriculture".

The goal of this subject was to develop the skills and knowledge that are necessary for human life, or in other words to prepare the students for practical life, farming, work, handicraft, independent life management, taking care of the family, practical housekeeping, the division of labour, choosing a profession, and getting a job. At the same time it was meant to help private and professional life to support individual, social and economic development.

In 1777 Maria Theresa issued the first Ratio Educations. From this moment on, education, which had been an internal matter of the churches, became a duty of the state.

For the first time, this document integrates the whole system of education (from primary school to universities). It prescribes a syllabus, defines the development goals and briefly describes the curriculum. The latter was divided into subjects and school years, but the order was not defined.

In the guilds, which were founded by the artisans of the different crafts, students could learn to read and write, and at the same time they were practicing the profession. After they have learnt all

[1] Pedagógiai Lexikon I-IV., ed.: Nagy Sándor, Akadémia Kiadó Budapest, 1976

the phases, they made their masterpiece, proving their competence in the profession.

It had been a long time before the so called Scandinavian *szlöjd* movement (szlöjd in Swedish means handwork) started in the second half of the 20th century, according to which the development of the homecraft was a social issue. It was realized that the curriculum of the schools of the period did not contain subjects that would improve manual skills. The newly introduced subject prescribed work with paper, wood and clay as well as needlework.

At the same time Karl Marx encouraged education allied with productive work, according to which students had to learn all the principles and tools of the basic production branches. The three main factors of education were defined: physical, intellectual and polytechnical education.

Polytechnical education meant a wide general knowledge, awareness of the different industries.

In Hungary the proposal for the foundation of the polytechnical was first raised in the parliament of 1832-1836 by the Public Education Subcommittee.

From 1820 bookbinding, paper and woodwork were taught in the Protestant-Lutheran College in Debrecen.

In 1868, the first Hungarian law of public education made it possible for students to choose between industry, agriculture and housekeeping. If the school did not have a demonstration farm, the required knowledge was shown on a nearby farm: truck farming, viticulture, pomology, apiary, stock breeding and arable farming.

According to the public school curriculum of 1879, students had to learn a branch of the local industry in the workshops.

From 1921 public education was controlled by Act. XXX. The goal was clear: “an educational system that is based on practice, which starts at the elementary school, and by workshops it is trying to raise the interest in children towards the joy of work, develop their intellectual and practical skills and an aptitude towards crafts, and make them honor handiwork”. Education was defined according to the principle of stimulation, a training that was based on the activity of children. The new public education law came into effect in 1941, and different curricula were prepared for urban and rural schools.

In 1946 a subject called workshop practice contained the following: the students should learn the most important raw materials and tools, they should be inventive and resourceful, and they should experience the joy of creation. Education was practice oriented. This subject was unique among the others because of its characteristics. From the ages of 6 to 14 a unified school system was developed with unified curriculum in the elementary schools.

From the fifties a curriculum type educational program was used, which described education as a process, from the goals to evaluation. There is a centralized educational system, where the succession is strictly prescribed; only one course book is allowed on which the education is based.

The 1958 education reform defined the name of the subject: practical lesson. Its two varieties were the industrial and the agricultural program, twice a week. The principle of polytechnics prevailed. Its goals were to teach processing and fixing methods, and to improve the intellectual skills, the constructive, productive and reproductive fantasy, and technical thinking. The boys and girls were divided into groups, and in secondary schools, in the form that is known as 5+1, the students spent a whole day every week in a production plant. Teaching is supported by visual aids and the development of educator’s guides.

In 1978 the subject was introduced with a more modern content under the name of Technology. Its task was to develop skills and crafts that were considered to be necessary for the practical aspects of everyday life, and for the professionalism that was defined by the rapid developments in technology and science. For the workshops and demonstration farms, the raw materials were provided by the central workshops. The teachers were given bigger freedom, and the curriculum was modernized. Grouping by gender was abolished and boys and girls worked together.

In the ‘90s the NCC (National Core Curriculum), as it was based on cultural fields, restructured the contents of the subjects, which can be clearly seen from its name: Life management and practical skills. The topics of this subject are connected to human environmental transformation, focusing on architecture, transportation, housekeeping and professional guidance. There were a few new components, and topics like health education, healthy diet, the basics of child-rearing, environmental protection, consumer protection, self-understanding, and preparation for the labour

market came into view. Information technology got separated. Unfortunately, at this time, the workshops were liquidated for lack of tools and materials.

The 8 § 1999 LXVIII Act. on Public Education amended the 1993 LXXIX Act.: "In the section of school education and teaching laying down the foundation of general knowledge the unity of the contents of school education and teaching, the interchangeability between schools are ensured by the skeleton curricula based on the areas of general knowledge included in the National Core Curriculum". In other words, the National Core Curriculum defines the development goals, while the curricular frameworks, which became necessary, delineate the content of the educational program, and with the local curriculum the schools could develop their own image.

Lower lesson numbers were prescribed to prevent overstress on students, but the contents remained the same.

Currently the name of the subject is Technology, life management and practice.

III. EDUCATIONAL TASKS

The task of Technology, life management and practice is to familiarize the students with the connection between nature and technology, to teach them environmental awareness, and to show them the productive work of people.

Technical knowledge is part of our general knowledge, so by improving one we can improve the other too, directly or indirectly. Students will understand that with social development the needs of the people have increased, which have fostered the creation of new technological solutions, and their historical and technical comprehension will also improve. They will know the composition of materials through system approach and the hierarchy of the system. However, the same elemental compositions may result in systems that are completely different in their characteristics and structure, as characteristics depend on the methods by which the different elements are connected to each other and on their structure as well as on the components. The composition-structure-characteristics-function chain applies to all systems. By composition we mean the proportion of the components, while by structure we mean the connection between them.

The technology, life management and practice subject aims to the direct and consistent development of a system approach, which would reveal the complex relationship between man, living in nature and in society, and the technological environment that he created. Furthermore, the subject wants to present the context and the requirements of sustainable development, and the methods of environmental management that understand the system and the core of problems.

When students create a simple tool based on a natural law, their technical knowledge improves and at the same time they deepen their scientific understanding. At the same time, when they see the beauty and harmony in the finished work-piece their aesthetics also improve. On the lessons of Technology and life management, besides learning the correct use of simple tools and procedures, students also learn technological thinking and system approach, and their problem solving techniques and creativity can help them in other aspects of their lives.

Another goal of the subject is to show the students the use and developments of technological tools, equipments and systems in the household, living environment, workplace, transportation, which would teach them on correct life management. This means that the subject must be in constant development, to be up-to-date with the developments, to be able to present and teach these modern machines and tools.

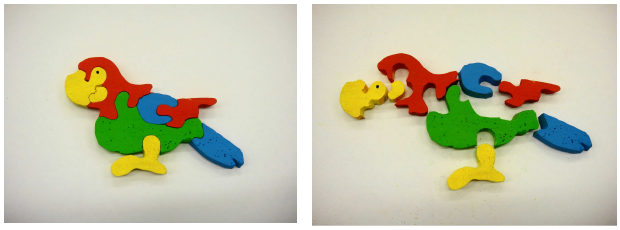

Figure 1. Creativity and games. Three-dimensional puzzle, student's work (wood working)

The subject area set as target the following developments:

- The recognition of needs, requirements and possibilities: to recognize the needs and possibilities of designing and technological processes, by studying activities at home, at school, at social environment, in free-time, in business, in industrial and agricultural context.
- Designing: forming ideas into projects, thinking through the necessary theoretical basis, and based on these the elaboration of a real, appropriate and feasible plan.

- Organization and implementation of work: means doing the work according to the plans; environmental transformation, creating simple objects, devices and equipments, implantation after planning and preparation, and familiarity with the necessary processes and resources, and their skilful use.
- Evaluation: means understanding and discussing proper and each other's plans, planned technologies and technical systems, and the assessment of their results and effects; evaluation of the plan and the work-piece; comparison of systems from other cultures or ages, recognition and utilization of common characteristics[2].

To achieve the above mentioned goals, two lessons per week and group division (ideally 15 students per group) are necessary.

The objects made on Technology, life management and practice lessons are not valuable because of their usefulness, but because they are the product of the students thinking, planning and creating together. These work-pieces are not goals, rather tools, by which students learn about materials, tools, and work phases.

The government is trying to direct students towards technical professions and to make education more practice based. These goals should be grounded in elementary schools.

As we understand it, the environmentally friendly nature of sustainable life (style) can only be obtained if our behavior is environmentally friendly, we know the technical environment and we can evolve an orientation skill in the environment. The current contents and development goals of the core curriculum show a greater cooperation between natural and social sciences, and a development of technology. This way we can arrive to work, family and community life education, the acquisition of healthy lifestyle, transport culture and professional guidance. The complexity of practice can only be obtained by the cooperation of the fields.

[2] www.nefmi.gov.hu/letolt/kozokt/ii/technika2.rtf (Access: 20/03/2013

Figure 2. Measurement with TIC

IV. THE CONTENTS OF THE CURRICULUM

Analyzing the topics of the subject we can see some big groups.

The subject of Technology, life management and practice plays a great role in the presentation of different materials. It deals with different materials, starting from natural ones, knowing the plasticity of clay and plasticine, students examine, shape, process and apply other materials as stone, paper, wood, plastic and metal. The topics are not broadened in the different age groups, rather deepened, especially in the case of fuels, metals and building materials. With the processed materials the notion of technology comes into view.

The topic of energy deals with the knowledge about mechanics, kinetic energy, power plants and electricity.

The preparation and examination of mock ups and models provide an opportunity to study and know the technical systems.

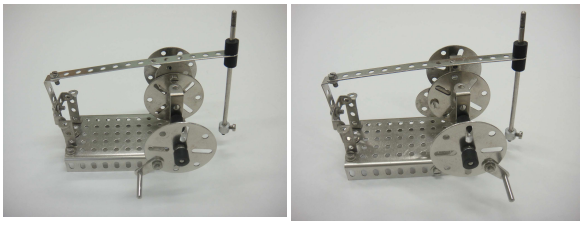

Figure 3. Movement transformation mechanism (modeling the eccentric mechanism) students' work

Planning, putting ideas down to paper and technical representations as a form of communication are important in creative work and they undoubtedly get an important role.

Information technology is present in the topics of primary school education from the notion of information to modern communication devices as

systems of technology. It shows students the application of information technology through control, guidance and regulation.

The topic of transportation includes traffic systems, the rules of pedestrian, bicycle and public transportation, and it also concerns the history of transportation. In the upper classes it is worth having a few lessons about bicycle maintenance and fixing.

The topics of housekeeping and life management are the household, clothing and farming. In this topic emphasis is put on the value creating aspect of work.

The agro-technologic part includes the basics of plant care, forming small gardens, plant guides, and the practical presentation of the learnt material in the school garden if possible.

The processing of the different topics is always supplemented by the history of technology, through which students can understand the development of human civilization, and by passing through all the steps, they themselves can become drivers of the development.

V. TEACHERS WHO CAN MEET THE CHALLENGES OF THE ERA

Even when teacher training colleges were founded it was obvious that work and handwork education were necessary, however, this need was not formulated explicitly.

As a precursor to the technology department, in Szeged, handwork (szlöjd) was present from 1928 as an additional study group only for men, and from 1940 it was housekeeping and farming only for women.

After the World War, in 1947 the Teacher Training College started its work in Szeged. In the ten-years development plan, discussed in December 1958, besides the organization of other faculties, the polytechnics was also mentioned. In September 1959 there were two majors to choose from: Agricultural studies and practice and Technology studies and practice.

The historical departments were founded: the Department of Agricultural studies and practice and the Department of Technology studies and practice.

In 1987, after the unification of the two historical departments, a new modern department was founded, that of Technology.

The environment of the people is in constant change, so knowing the laws of nature and applying the technological rules is essential for everyone.

To teach students, we need teachers who, by adapting to the current needs and according to the needs of the students, are capable of giving effect to their professional aspirations and building their subjects independently to offer a differentiated education based on a common ground.

Today, the institutions of higher education are trying help their students become such teachers, who would be able to follow the modern developments in technology, to be absorbed in the different topics, and who are capable of self-renewal, of the rational use of the results and of the development of the students' creativity[3].

VI. CONCLUSION

"Technology is the total of those methods and processes with which people can apply the laws of nature for their own benefit[4]". It is important for this subject to be of integrative nature, to involve ideas, planning, organization, economy, and system approach. Developing the ability of engineering and innovation, the students are capable of individual and community creation according to the instructions of the teacher.

The topics of the subject Technology, life management and practice, can be presented and endeared to the young generations by the description of technical systems, knowing and analyzing their characteristics, and creative planning and work.

REFERENCES

[1] Szűcs Ervin: Rendszer és modell I. Nemzeti Tankönyvkiadó, Budapest 1996

[2] Gion János - Kovács Sándorné - Németh László - Pitrik József - Pitrik Józsefné : Technika és életvitel. (5-8. évfolyam) Apáczai Kiadó, Celldömölk 2009.

[3] http://www.ofi.hu/tudastar/tanulas-tanitas/tantargyak-helyzete (Access: 28/03/2013)

[3] http://www.jgytf.u-szeged.hu/tanszek/technika/tortenet.htm (Access: 20/03/2013)

[4] Bakos Ferenc: Idegen szavak és kifejezések szótára. Akadémiai Kiadó, 2007. pp.657

ADAPTED INTEGRATED CURRICULUM (AIC) IN PRESCHOOL EDUCATION

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Abstract - Non-implementation of systematic observation and adjustment difficulties of children before going to school often results in school failure and behavioural problems. To avoid most of the problems that occur later in a child's development, diagnostics and adequate application of specific programmatic interventions must begin already at an early stage. The subject of this research is focused in this domain. A new model called "Adapted integrated curriculum" that is based on the needs, interests and capabilities of the child so that it reaches the full potential of its development even before they start school. Applying the adapted integrated curriculum the standards of the program would be determined and would prescribe what can children learn before they start school, and not what they need to learn before they start school. Such an approach would create a minimum and maximum level of knowledge and skill that every child adopts in the limits of their optimal development. Adapted Integrated Curriculum (AIC) includes three components that are an integral part of the case study: contextual and dynamic assessment of children's ability, knowledge and needs, development of individualized education plan (IEP) for each above-average and below-average child and the application of individual and individualized approach to work-based Montessori methodology.

I. INTRODUCTION

Basics of a healthy physical, intellectual, emotional and volitional development are formed at an early age. This period is very important in the early findings of moral development and acquisition of work habits that will later in life of individuals be a key factor in shaping his social behaviour. Preschool is a formative process that seeks to actualize physical and mental potential of children and direct positive trends to meeting their needs as a permanent source of development opportunities. In addition, education creates the conditions for a better and more successful expression and the use of these options. Using children's potential aims to reaching higher levels of children skills, expand and refine experiences, build character and attitudes. All of the above affect the behaviour of the child, which is formed and develops positive aspects of his personality. Pre-school education lays the foundation of the entire future of his personality and from its quality the success of further development and learning largely depend . A holistic approach to the level of pre-school education is an integral part of liberal theory and is based on the understanding that the body in the physiological and psychological sense can only work as a whole. In order to achieve a holistic development of the child within the educational work it is important to:

- Individualize the learning process;
- Enable constructivist approach;
- Develop developmentally appropriate curriculum through differentiation and adaptation;
- Provide conditions for progressive education.

Individualization of the learning process starts from the assumption that there are no two children who are included in the same way in the learning process. Individualized approach will enable gifted children and children with special needs to develop in accordance with their capabilities, capacities and interests. The constructive approach is based on the fact that the child seeks to design the world around him, bringing in the process of their prior knowledge and experience. Developmentally appropriate curriculum means that each child is a unique creature that requires a developmentally appropriate approach to working with him. It can be carried out only when good knowledge of the characteristics of each individual child is comprehended , and based on these findings, games and activities that are appropriate to the child's abilities, knowledge are planned. Progressive education is based on developmental and constructivist - interaction principles. In this process, an important role play adults (parents and professionals in the institutional education), as well as other adults and children from the environment. Understanding the importance of family involvement in the overall development of children, as well as the significance in relation to the dissemination of positive influences, we

advocate for the inclusion of the family in all aspects of life and work in preschool.

A. Starting Regulation of Curriculum

A word curriculum is of Latin origin and means competition, life. In pedagogy literature the word curriculum mark planned interaction of pupils with the teacher's content and resource, and teacher's process for accomplishing of educational goals. In some states an expression "curriculum" is identified with the idea "program" so in our dictionaries that notion is translated as teaching program or teaching plan. The past of curriculum offers good archive opuses of this material in certain phases of past. Frequent reform and suggestions for changing of curriculum, show that its modification is created by different changes in society. Each future conception of transforming and revolutionary pedagogy didactics change of traditional curriculum, had bigger results if was based on searching for possibility to find out and separate tasks and contents for each pupil what is in conformity with his individuality. Keeping in mind all these facts suggestions for reform of curriculum come from holder of teaching process, teaching association, creators of educational system, associations of parents, public media opinion…

When is word about range there are four reforms of curriculum:

- Aditive reforms: additional recourses are included and do not affect on organization's nature of school.
- External reform: focused on teachers who are members of school system and pupils who leave it.
- Regulate reform: reforms who gravitate to change the school, but mainly do not seize their basic element.
- Structured reforms: That demand changes in organization and work of school. They examine instantaneous school structure. (Marsh,C. 1994)

One of key dispute transformation of curriculum is directed to defining of relation-obliged scope and performed program for appointed teaching subject or class. There is actually word about question of obligatory scope program that can be understood as completely obligated or as scope for ensuring of appointed pedagogy standard of some school. State pedagogy institution organizes searching projects because of evaluation that are made in change of program. In our school practice it is usual that under expression of educational pedagogical program means a document in which are marked educational pedagogical tasks, then certain number of micro units, reference about relazation, and conditions that should be ensured for relaziation.

Change of curriculum at operalization of tasks are realized through:

- Goal of learning that should be gravitated to
- Contents subjects that are important for acomplishing of learning goals's
- Methods, means and ways for accomplishing of learning goal's
- Situations - grouping of content and method
- Strategy – planning of situation
- Evaluation – diagnosis of condition expression, measuring of learning success and teaching of objective actions.

Transformation of curriculum starts from notion definition of goal with of social and individual aspect. M.W. Apple (1988.) considers that reforms of curriculum should be concentrated between schooling and broader society on basic of inequality in society. The goals are primary basic of foundation to furthest goal that more concrete state ways precisely to objectively important values. They offer information about steps of this way.

The goals are pedagogical aims that we have in mind and that we can attain after fixed time of schooling, after allowing inspection in educational contents, contents of one group of subjects, fixed range of knowledge or complete inspection in contents of a teaching subject (Schiro, M. 1978) considers that there are four essentially different approaches to this problem:

- Representatives of science-academic orientation as goal of every program see introducing of children in some academic discipline. Everything worthy of including to world of knowledge is in some academic discipline.
- Other access is orientation on social efficiency. The society is one that determines purpose of education and upbringing. Creator of program is

authorized society that reveals and defines those needs.

- The third access of determination is orientation on studying of child that depend of interest and needs of child oriented on urging of natural growth and development.
- The fourth access is orientation on change in society as well as in personality of individual.

Social and individual aspects of upbringing aim and task are in function of affirmation of determined system of values and standards that are in harmony of needs of society. Curriculum-Teaching programs, stick to rule strive to consider needs, expectations of society and cognition of science. It makes sure further development of cultural and civilization accomplishments and in the same time insures satisfaction of cognition, experienced and psychomotor interest of individual. Transformed, adapted or in anyway modified curriculums are less or more close to one of following types (R.W.Tyler, 73):

- "Subject-centered curriculum" – curriculum is oriented on subjects and consists of traditional teaching subjects.
- "Discipline centered curriculum" – curriculum is oriented on science discipline, its organization derives from structure and content of science disciplines.
- "Core curriculum" – "core curriculum" represents practice when a profession, for example mother language or science of society takes as a central core that other professions grouped about.
- "Child – centered curriculum", curriculum is oriented on child. It put needs of child at first place.
- "Community – centered curriculum" – curriculum that starts from unique needs and characteristic of place in which the child lives.
- "Social functions curriculum" marks curriculum that is oriented on society and social structures. It put their functions in the middle.
- "Problem centered curriculum" – Problem oriented program, where a focus of studying is a problem that demands contributions from more teaching subjects.

The most usual transformation of curriculum of some school do not rely only on one of previous criterion but more of them crossed in it.

B. Criterion and Directives for Change of Content in Curriculum

Basic directions for selection, change or modification of content for some program are certainly goals of education and upbringing. The goal and task of education and upbringing are achieved by suitable contents and activities. The contents are more related on accomplishing of social tasks and activities on individual aspect of upbringing goals. So we can talk about change of content from existential, socially moral, science, art, technology and humanistic aspect. Schulc in Hamburg's model contents divides in three groups. It depend which element preponderance in them.

Those contents are:

- Contents in which experience about subjects are predominant
- Contents in which prevail emotional experience
- Contents in which prevail social experience.

According to him there is not "clean" content "filled" with only one element then all three intertwine and one of them prevails. The contents that are planed in curriculum should:

- Reflect specificity of school for it is determined;
- Give educational basis for further schooling;
- Be adopted to age level;
- That systematic knowledge from certain science are adopted through subject teaching.

Concerning that curriculum as concrete plan can be developed from completely overall didactic starting point, Marsh, 1994. contents in curriculum identifies with educational good so he classifies it as:

- Educational welfare classified after science that it comes fromThe pupil's own experience after activity. Needs and interesting determine preparations of educational welfare.

- According to essence or heart of matter of educational good – problem determination of welfare
- According to correlation – connection with other educational goods.
- Situation of educational welfare inside broader scope – interdisciplinary.
- According to forms of life and aspects of problems.

The criterions of educational welfare mentioned above in curriculum, C. Marsh cites as usable for easier choice of valid goals, while Bruner emphasizes that educational welfare in curriculum should:

- Be scientifically structured because through structure mental capabilities of pupils are developed.
- Be scientifically directed because in such way it faster understands basic notion and more complete perceives contents that are easy remembered and later more successful learn.
- Work out with contents goals, methods and teaching means.

C. Aimed Directed Curriculum

Christine Moller in her Curriculum's theory, the goals of teaching in curriculum put in the middle of didactic theory. Through aimed directed access, proposed model gives instructions for planning, leading and analysis of curriculum. In scheme drawn below Miller shows that planning of curriculum contents statements about goals of learning, organization and control of learning, that go well in three mutual depend processes.

Model "Aim of directed access". Moller was urged by behavior's oriented work (Skinner, B. F. 53, Tyler, R.73, Bloom 79.) and especially programmed education that is based on foundation of behavior's theory. Key demands in programmed education are worked out and concretized programs with clearly set up aims. Miller places process of setting up of aims in producing of curriculum as one of important tasks. Programmed education as scientific theory basement of Skinner's operative learning is urged by Miller to create above presented scheme. It is especially expressed in third step in which are composed control actions that have an aim to check accomplished aims. Very similar to that in programmed learning, where criterions are built on the basis of those the pupil can pass a resolution how much it has progressed. Miller valorizes accomplished aims through checking control actions of previously set up aims.

D. Planning and Programming

Planning and programming of curriculum is integral part of entire long-term planning of every state and plans of development are mainly concentrated on satisfaction of education conditions for everything. Application of modern education technology and upbringing of free and responsible person will help him successfully to integrate in society. In respect of suggested regulation reform that include inclusive education in our state, on the basis of frame program every school should work out performed program of work. That program should be concretization of frame program, considering material and personnel needs of school, specific environment in which school works. Performed program of work should be sum of next programs:

- Obliged programs, selected programs, optional courses, program of different interest groups (researching, sport, music, producing)
- Every educational subject will be obtained for performed program for a school year, and sum of whole subject's program for a class.

With this aspect of operative program subjects will be determined and will be obligatory for children that are integrated in regular school. As well as in regular GPP, this program will plan certainly number of subjects and hours in week and year schedule.

E. Individual Programming

If obligatory programs are created, on the basis of them it will be approached to individual and adapted programs for determined pupils. Those programs for appointed pupils a team of experts will work out starting from specific development of every pupil.

It will take into consideration noticed specifics in development of pupil (talents, some difficulties, psycho-physical condition, quantity and quality of adopted material, process of adoption, grade of socialization). The parents are necessary here. They consult themselves and program changes during the work dependently to noticed changes in development of pupil.

During the individually planed curriculum it is very important a work of teacher. In process of school teaching the most important role belong to his meditation between educational contest and the pupils. Scope contest of education subjects, and obligation placed in realization of goal and task of educational program; bring the teacher in situation that in front of pupils he puts demands that they should accomplish.

F. Dynamic Assessment in the Development of the "Adapted Integrated Curriculum"

Dynamic assessment in constructing a "Adapted integrated curriculum" is not a single activity or a procedure but a complex model of implementation procedures based on the following:

- that every child, regardless of individual characteristics, is capable of some kind of learning;
- that teaching with the parallel evaluation and adjustment creates favorable conditions for quality education for children with special needs in regular environment;
- estimator actively intervenes during the evaluation process with an aim to deliberately or planned alter the current level of the child's functioning (learning, knowledge acquisition, execution of activities);
- assessment focuses on the child's problem-solving process through meaningful and real life situations trying to contribute to the successful progress,
- the most important information for this type of evaluation is how the child responds to intervention (to contents and support presented in the individual educational program);
- assessment provides information on what types of activities or interventions produce the best results in the process of support to a child;
- this type of assessments reveals possible shortcomings in the planned support represented in the individual educational program, and the same will further be elaborated, changing or adapting to the individual characteristics of a child

G. Methodology of Making the "Adapted Integrated Curriculum"

"Adapted integrated curriculum" aims to in accordance with the capabilities and the general characteristics of the individual child, assess appropriate steps that will help to develop and enhance the knowledge and skills, and acquire quality education in an inclusive environment. Planning and programming of all activities that implies the realization of educational goals is a complex and challenging educators obligation. If in the educational group there are gifted children and children with disabilities all becomes more complex and more sensitive. The basic question is how to adopt the program for children who vary in ability, experience, motivation, emotional and social maturity, and other relevant characteristics (quality of attention, perseverance in work, self-control). adapted development curriculum is based on an individualized program that includes the following assumptions:

- knowledge of the real level of the child's knowledge and his ability;
- knowledge of the child's personality, which could affect the faster or slower progression (sensitivity, indifference, irritability, a tendency to unpredictable reactions);
- knowledge of children's desires, what is s/he good at;
- defining the objectives of the educational process in accordance with the characteristics of the educational groups and individual needs of children;
- Setting short targets, order of priority (socialization, very simple contexts, a sense of security and then increase of requirements);
- prediction as how much a child is participating in the implementation of obligations under the basic program, and where a special approach is required;
- determination criteria, methods of evaluation and the final outcome.

H. Methodology Based on Developing Individualized Curriculum

In this sence the educational content is taught along with all children. Monitoring to determine the acquisition of knowledge of children with disabilities. Change the approach and operation of the teaching content the way it suits the individual/

simplify. Find interesting content that will be interesting for children and correlative approach for the teaching subject, for example, to explain through music, interactive game, drawing. The thematic area is viewed from several angles to get closer to each child in the group so that practically all children regardless of their capabilities will be found in the same situation. When it comes to communication, regardless of whether it is between educator-child or child-child is always good to establish rules and monitor. A child with special needs should not be set aside in any way when it comes to communication, it is able to interact with peers who are already accustomed to its specific needs.

There is a possibility for dissent within the group and in principle these children find themselves a model "avoidance" that rarely disturbs other interrelationships. If there is a more complex problem then there is a need for support team intervention, educators and parents of children whose interests do not coincide. Practice has shown that children alone build relationships that suit them, and that the group is always "finds" a child who approaches a child who has special modifications. In to checkindivialn work we can adapt program through assessment and observation, by monitoring the child and achieved results.

II. METHODOLOGY

A. Basic Goal and Tasks of Researching

Basic goal of this researching has got intention to critically evaluate possibility of practical realization in application of interactive methods based on (AIC) in the inclusive class and to examine its influence on the pupils in respect of grade of acquired knowledge, capability, motivation and socialization.

B. Hypothesis

Starting from subject of research, goal and determined tasks in our work hypothesis are established on this way.

- On the basis of theoretical cognitions that affirm up to date pedagogy, it is possible that on the basis of application of interactive methods based on (AIC) in educational-upbringing work increases level of quantity and quality of pupil's knowledge that reflects in persistence, logical and critical opinion, factor of fluency and capability of problems formulation.
- It is supposed that application of interactive methods based on (AIC) will influence on the preparation of the pupils for individual learning, interest and motivation for active participation in the teaching process.
- It is supposed that application of interactive methods based on (AIC) will influence better acceptability of the children with special needs and that it will positively reflect on the socialization of the pupils.

C. Methods

- Experimental method (used for deliberate taking of experimental factor and following of cause and effect reaction. An experiment with parallel groups is used. The experiment enabled control of independently changeable variables and in the same time provides control of dependence of changeable variables.)
- Survey research method overcame interviewing, polling, testing which was used during equalizing of the groups and establishing of differences between control and experimental group.
- Method the studying of children's works (We used for getting of date about child's emotional, psychophysical, educational-upbringing and creative development
- Analysis of pedagogy documentation (We used for clearer getting of picture about the grade of collaboration between the family and school, the grade of acceptability of children with special needs and results of learning. (In that purpose we used daily records of tutors, portfolios, records from parent's meetings and work register of tutors)
- Descriptively–analytic method (we used it on the occasion of description and interpretation of data research)

D. Pattern

As pattern two kinder gardens have been chosen from Ze-Do canton. One was as experimental kindergarten, second was as control garden. Six-year-old children have presented patterns that prepared themselves to enroll the first grade of the primary school. After the groups had been equalized it was established a pattern of 120 pupils which made the experimental and control

group. During the implementation of the program a girl gave up for reason of health so that the pattern presented 59 pupils in the control group and 60 in the experimental group. Each of these groups were divided into three smaller groups that have in average 20 pupils in which was included a child with special needs. Characteristic of pupil's pattern were based on the results of test intelligence, sex and parent's education. Except the pupil's pattern we took care about the pattern of educational staff. On the occasion of teacher's selection it was taken care about that it was a person that accepted itself firmly, sharply and realistically, that it was the person aware of others and empathetic to them, and that also reacted in good time to ideas and events and that it was the person of safety and confidence. Taking into consideration all mentioned facts so far we decided to take teachers who approximately distinguished themselves in educational-upbringing work and quality.

III. RESULTS & DISCUSSION

The main purpose of our research is aimed to examine, analyze and scientifically find the meaning of use of interactive methods in classes where children with special needs are included. In that context the function of actions was observed of these methods on education and level of acceptance of those children by their friends of same age. The exact information's were obtained by following and comparing results of traditional way of work in which we used classic methods and results of innovation model in which interactive methods were realized. Based on the quantitative and qualitative analyzes the conclusions and generalization were conducted. The given quantitative information's gave us a complete picture about the results of those two models that were viewed in adopted facts from mother tongue, mathematic plays, and perceptive abilities and general intellectual abilities. Qualitative information's gathered from opinions and attitude of teachers, parents, volunteers and specialists completed and encircled the final picture of influence of the methodic procedure on understanding the level of facts, duration of memorized content, factor of fluency, logical-critical formulation and problem connections. They also clearly defined the effects of the use of interactive methods in independent learning, motivation, socialization and acceptation level of children with special needs. Before the realization of the whole experiment three teachers who were included in the experimental group attended series of tri-day seminars with a theme " Use of interactive methods in educational work". Teachers from experimental groups used their gained knowledge and experiences in experimental groups. Teachers from the control classes did not attend seminars no did they use any kind of innovative work with pupils. The teaching was conducted in a classic way where material was transmitted to pupils verbally. The space where classes were realized had desks, and from didactic material only a black board was used, a chalk and very small number of picture applications. The class was held in forty-minute terms without the use of any audio-visual materials. In three classes that were composed of 20 pupils there was one child with special needs in every class. Application of interactive methods was realized only in experimental classes. The classes were held every day in three-hour terms. Parallel with applying the interactive methods, individual treatments with children with special needs were held by specialists who were working two days in a week and last three days were ensured for individual treatments lead by parents volunteers and students with instructions given by the specialists. During these workshops the videotape and sound records were done with parents, children and educators. In the experimental classes, prior to every working week, the teachers were decorated the space for work that in every aspect showed current interests of children. Space for work and learning was arranged such as snug nook (botanic, mathematic, and lingual) and centers (music, drama, art). The furniture was specially arranged and special angles were placed so that enabled pupils' individual research that was held in pairs or smaller groups. The space organization was made so that noisy centers were placed next to one another and the other where close to the basin so that they can wash up after their activities. The peaceful centers were placed next to the others peaceful centers so that pupils and teachers could see each other. The entire space was arranged in a way that pupils could easily move through it. The material was available for pupils and its diversity suits their needs and way of work.

Results of influence of interactive methods on quantity and quality of pupil's knowledge and abilities

Based on the hypothetical frame of research and operational tasks it is necessary to strengthen differences related to the quantity of pupil's

knowledge that come as a result of work in traditional way and results of work based on applying the interactive methods. Connected to that our first hypothesis was that the use of interactive methods would enlarge the quantity of pupil's knowledge that can be seen in quantity of adopted facts, mother tongue, mathematics, better perceptive and intellectual ability. Prior to the use of interactive methods the initial testing of pupils was done that was composed of series of four tests (test in mother tongue, test in mathematics, test in perceptive abilities and test in intellectual abilities). In the table below the final results of the initial test are presented. Due to the statistical reasons, the pupil's success from both groups is divided into five categories (excellent, very-good, good, satisfying and unsatisfying).

After initial testing groups had showed balance in quantity of pupils knowledge. Almost identical results can be explained; with an aim to equalize groups a detail arrangement was made for research both in the experimental group and in the control group. It's about a fact that classes are equalized in number of previous pupils knowledge and in their intellectual abilities. From the graphic below the initial test shows that the tendency of grouping is around the middle value (good), which proofs the distribution of normal results. There is a very small percentage of those who belong to extremely small results or extremely large, which would remarkably influence on arithmetical value.

After processing the initial tests the difference between arithmetical centers in an amount of 0,03 was established. From the results that can be seen in table number 2 we can bring about that t-measurement is 0,16. It is not twice bigger than its own mistake, which in experimental group is 0,13 and in control group is 0,10. Such extremely small t is logical because the starting arithmetical centers in both groups are almost identical so the difference is not statistically important. Since it was earlier established that groups are equalized in results of initial knowledge test, also in the intellectual abilities, our next assignment was to investigate is there differentials between these groups in quality achievements which can be seen in level of understanding the facts, lasting of memorized content, fluency factor, logical-critical formulating and problem connecting. We wanted to investigate if the model of interactive method that we brought in (introduced) as experimental factor contributed that the pupils from that group realize better success in compare to the contrary control group or the situation is opposite. After applying the experiment, precisely a year after, again a knowledge testing was performed and pupils abilities in experimental and control group. In one-year period interactive methods were implemented only in the experimental group excluding the control groups. Observing the working effects of the experimental and the control group we established quantitative demonstrations in knowledge and abilities tests. Relaying on information's from this list we can say that more pupils from experimental group gets points from III category (28-40 points) 28 pupils, 46,6% in regards to pupils from control group (25 pupils, 42,3%). From this we can make a conclusion that the result representation "good" from experimental group is significantly larger than in control group. But, if we look at differences in IV category that has (21-27 points) the situation is different, we can see that pupils in control group had double larger number of pupils with passing marks than in the experimental group. This result had influence on arithmetical center and standard deviation, which shows compared results of the initial and the final test. As we already mentioned the differentiation of arithmetical centers in final measuring is a bit more important than in first initial measuring. It is 0,36 and differences that are confirmed by the t-test on proportions is 1.89. Due to 119 degree of freedom (in list circled to 100), by selection of importance level of 0,05 (it is 95%) limited value of 1,98 is not realized, in spite of its largeness we can't consider statistically important the given difference. Importance in our experiment is achieved on level of 10%. Considering that in education we usually use levels from 5% and from 1%, the level of 10% we won't take in consideration. Based on the given hypothetical frame of research and presentation of elaborated statistical results on quantity information's which represent the success of pupils, we can conclude that pupils from experimental group didn't in principle realize better success in final test in compare to the pupils from the control group (this is related to the difference that is obtained by the test on proportions in V category that are expressed through number of achieved points on the final test). In regards to that, the first hypothesis which was said that the group in which the interactive methods are used will enlarge the quantity of pupils knowledge based on the results of applied interactive methods wasn't confirmed, meaning that the given and explained results of pupils success in the quantity of adopted knowledge in math's operations and literacy

denies the first given hypothesis, that the work with interactive methods will significantly influence on results and learning issue. In order to get to the more relevant data on influence of interactive methods in regards to quality achievements in education, individual variables from measured instruments were checked. Investigation was done individually without time limit, with formal verbal instructions on solving tasks using of small breaks. With verbal checking we investigated the quality of adopted knowledge that was reflected in understanding the level of learnt facts. Having in thought that the re-test in the view of quantity adopted facts showed that there is not difference between control and experimental group, the results of investigated quality of adopted content showed completely different results with pupils who followed material using interactive methods. High level of understanding the facts was noticed, which the pupils were explaining easily. On asked questions the children gave logical explanations where fluent factor was expressed. In control group children memorized large number of facts, which was proved in the result of the test, but their understanding level was lower in compare to the experimental group. During this examination drawings on given and free theme were used. In below example of analyzing the free drawing we will show how we investigated influence of interactive methods on quality of learned material. After realization of educational unit in mother tongue "The Fox and the Cock", in experimental and control group, the pupils are offered in smaller groups to draw with watercolors by free choice. External encouragement or any kind of intervention was not present during the group work, because we wanted their story experience to be emotionally expressed and put on paper. In the experimental group the educational unit is realized using the interactive method, which was expressed through drama. It included direct children cooperation in small theatre play where every pupil had a chance to identify with the characters in the story. Analyzing the work of the experimental group almost 90% of pupils draw the character that they represent in the play. The works of the pupils were multicolored and very bright. Children painted the costumes they were wearing almost identically. The next day the pupils were given again to draw in-groups a free theme. Analyzing these drawings showed that children again directed the free theme to the educational unit " The Fox and the Cock". The drawings were full of characters from the fairy story, environment in which it was played, and many details mentioned in the story. "Music instruments which the Cock played"). In the control group after processing the fairy story "The Fox and the Cock" analyzes were done also. The educational unit was worked out in a traditional way (reading and narration of the text). Analyzed drawings show that 30% of the children were not in a mood to work. Others expressed a will to work but only 50% drew elements from the story, while 20% were occupied with the other themes. From conversations with the children the themes were connected to the cartoons and a children show "Hugo".

Based on the results of verbal checking of learnt facts and analyzing children drawings conclusion can be made that knowledge quality aspects are better in E-group than in K-group. So we can say that applying the interactive methods in educational process has significant effects on quality of pupils' knowledge that is seen in length of knowledge, fluency of idea, creativity and clear understanding of facts. In harmony with the above mentioned facts, we must say that our intention was not to represent the classical work as ineffective (taking in consideration solid results that most of the pupils made in this group especially in quantity of adopted facts) but our aim is to show that there is a different model of work that proved to be effective in a view of knowledge quality and success of all pupils.

Results of interactive methods influence on interests, motivation and active pupils participation in educational process

The second hypothesis was to assume that applying the interactive method will have influence on interests, motivation and active participation of pupils in educational process. This hypothesis is confirmed by results that were obtained from analyzes of two opinion polls conducted with pupils and teachers and based on the report from the researcher who was included in following the activities. In the first opinion pool the pupil could give more answers whose results were partly shown in percentage of pupils who gave that answer.

From obtained results it is obvious that pupils from experimental group are much more satisfied with the teachers work, selection of program and more actively participate in program selection than pupils from the control group. Satisfaction with some activity leads to conclusion that pupils in that activity express their need for freedom, fun

and in practice they realize their ideas. That conclusion is supported also with pupils answers related to adopting knowledge. The pupils from both groups quote that adopting the knowledge is an advantage of attending the program of "Small school". The pupils from the experimental group are aware of that. We consider that this is because the pupils are more active in the learning process, their needs and interests are followed, and their curiosity is supported. They adopt the knowledge as a part of their lifetime learning because they have a feeling that education satisfies their needs. They "Learn what they love" at school was their answer. We will give one part of the report of the volunteer that was following the work of the teacher's in the experimental groups.

"…Agreement is the first level that activity begins with. Children are motivated and encouraged for the topic that will follow. When the teacher estimated positively the situation in the group, only then he allowed the group leaders to participate in the selection of the workspace and the didactic materials. The whole realization of the educational unit is based on interactive game. From the beginning of the activities the children with special needs actively participate in the work with the other children. With attractive and spontaneous attitude they establish a contact with other children. The teacher sets demands, which they can solve. He transmits knowledge on pupils through indirect contact taking in consideration well-known didactic rule from concrete to abstract. The whole time he creates a positive climate in which every child cooperates and learns from each other. Every part of the thematic content is repeated in intervals of 5 minutes where children simply adopt material from the educational unit. Applying the organized learning forms through interactive approaches, it is noticed that in such work with children positive emotional state and pleasant moods are created. Children freely choose didactic materials and decide with whom they want to be in a group…" From the researchers notes mentioned above it can be seen that the pupils are spontaneously adopting the material they are studying. It's interesting to mention that the children's statements from the questionnaires in 97% answers expressed satisfaction in the way they are treated.

Such high percentage of pupil's satisfaction with teacher's relations with them can be confirmed with the notes made by the second researcher during the full time follow up of activities in the experimental group.

"… During the work with children the teacher creates warm and relaxing climate. His relation with pupils is heartily and without any kind of pressure. It is noticeable that such kind of relation has influence on pupil's motivation and his relation to learning. Children with special needs who are included in the inclusive classes come to classes with pleasure and other children help them. In such a relaxing climate, the relation teacher-pupil is mostly founded on mutual respect and understanding. Teacher has authority and pupils except it. In convenient moments he reminds the pupils to already arranged rules on behavior and stresses how he expects from them to respect those rules during the work. The teacher carefully observes their behavior and tries to prevent breaking the rule by examining the cause, advising and even criticizes without singling no one. With a good prepared methodic unit, he is succeeding to keep the pupils attention and active cooperation in the work. The pupils who are integrated in classes he is acting very carefully and follows step by step how they master the material…'In this note we can also see that the teacher is agreeing with pupils and he respects their individualities. In order to gain clearer pictures about the influence of the interactive methods on pupils in regards to the developed picture about themselves, a short inquiry with pupils was done, and which was related to children's attitude about attending "Small school". In the table below children's answers related to this thematic is presented.

From the above report and the answers from the questionnaires, it can be concluded that understanding of specific individualities in which the pupil receives constructive and useful reflexive information's about their progress follows two-direction communication between the teacher and the pupils. This positive reflexive information creates a real self-picture, which of course improves the possibility for empathy, which is expressed through sympathy, understanding and appreciation of others. This can be confirmed by one of the answers where pupils consider themselves equally important and cultural as other children. But, there are answers where children think that they are better than others who didn't attend the "Small school" program. This percentage is high in both groups. Regarding the pupils in experimental groups this percentage can be connected with the use of the interactive methods that were realized through workshops that included different learning forms. Experience learning dominated in those workshops that were

realized in special conditions that were ensured by didactic instruments from nearby environment. Situations in which pupils learned specific contents by method of experience were created, as to so called method of "own skin". One of those educational units we can see from the picture where pupils during the visit to a candy factory were introduced to the technology of making those products. In combination with learning experience the teacher uses a complete learning that demands a process of gaining knowledge where all psychophysical functions of a child are integrated (application of different kinds of games in which the child's sensitivity comes out, emotions, memories, the will, imagination and comprehension.). Through applying the interactive methods, both learning forms were connected with the social learning form (group interaction and communication in which children shares experiences, develop cooperation, empathy, responsibility and care for themselves and each other). Applying this kind of learning form enables all children to gain new knowledge that can be attached to their earlier experiences.

From pupils answers we can see that interactive application of the method influences on pupils interests and satisfaction. Pupil's answers were mostly connected to learning, playing, new friendships, even with the teacher. When they spoke about the teacher they stressed importance of grading.

Appraisal of the pupils work progress was performed through authentically grading over the time during the work of the pupils individually or in a group. During the activity the teacher was giving immediately reflexive information on how they adopted the basic material and how much more time they need to master it. Before giving the final judgment about the grade he would appreciate their interests for work, individual abilities, knowledge, learning style, esthetic and cultural value of every pupil. For this kind of grading the teacher used the control lists, written comments, audio and recorded notes that certainly enabled him to have better view about what they learned. This was a concrete proof for children that their knowledge and abilities enlarged.

Pupil's motivation to come to the "Small school" we assessed through direct conversation with them. We asked them to imagine the following situation: " Your good friend is thinking to join the "Small creative school" and he wants your sincere answer why is it good for you to attend that school. What would you say? After processing the answers the conclusion was that that only 65% of pupils said that it is a place where it is fun to learn and "play the computer". It is a place where you can meet new friends, 15% of pupils answered and 20% of pupils answered that it would be nice for them to sign in but they didn't say why. From the answers it is visible that pupils are looking forward to learning, because it's connected with fun and play. The feeling of progress (power) is important but friends also. Teachers are not neglected because they are treated as good leaders. All-important needs (by W. Glaser) are represented. It is interesting that the pupils build friendships in computer classes that are held twice a week. It's obvious that quantity is not that important as quality, i.e. intensity of experience. The activities in mathematics and mother tongue are mostly realized through interactive games in which pupils cooperated, shared experiences and mutually reached comprehension. In that kind of atmosphere a feeling of belonging is developed and expressed through interstice and extrinsic motivation. What is the relation between those two motivations we find out from following answers: "When I solve some tasks in mathematics it makes me happy" because I'm better than (extrinsic motivation) the others, because I made progress and I know more than I knew before (intrinsic motivation) because I will get a compliment from the teacher (extrinsic motivation).

Pupil's answers are shown in table below. Intrinsic motivation significantly predominates over extrinsic and success in mathematics and in mother tongue delights a great percent of pupils due to their own success, and for a smaller number of pupil's the teacher's compliment and comparing with others is very important. The relation between intrinsic and extrinsic motivation is significantly enclosed to internal motivation. That is a very good result especially when we consider that psychological development of kindergarten children depends on external compliment and competitively. By comparing two groups its visible that intensity of motivation is bigger in mother tongue class. Pupil's realistic judgment of self-effort and success is obvious in comparing marks they gave each other and marks given in the test (which the pupils don't know).

Correlation between a grade in mathematics and self-judgment is r=0,45 while correlation of a grade between mother tongue and self-judgment is much lower r=0,15. From these results we can

conclude that pupils are overestimating their success. We think that non-grading gave them a chance to be happy with themselves. Such high self-judgment shows that less successful children have a subjective feeling for success. Based on achieved results on assessment of motivation, we can conclude that levels of motivation in classes in which interactive methods are used are very high (on scale 1-5 about 4,7). The factors of motivation are certainly necessities that satisfy activities at school which are learning needs through play and fun, socialization, progressing and gaining new knowledge and skills, free expression of personal experience and creativity. Quality of knowledge gained through game with use of interactive method is better and last longer because the pupil is motivated to work. Because of better motivation the quality of practicing and learning is better. That difference is what we want to gain by curricular planning and pupils active inclusion in educational process. Even though, the application of interactive methods didn't show better results, yet for pupils this is very important because with this application the pupils are happier and what they learn will have great influence on their development, way of thinking and their attitude. In the environment where interactive method is used the children have a chance to feel how pleasant it is to be motivated by own progress, pleasure in playing and not by someone's mark, judgment and competition between same age groups.(Barth, R 1990). Due to this experience, later on in education and life they will rather choose relations in whom they can realize their needs and be intrinsically motivated and they will create those relations with others.

Results of interactive methods influence on socialization and acceptation level of children with special needs

Our third hypothesis was related to influence of applying the interactive method on better acceptance of children with special needs and positive reflection on socialization and individual progress of pupils with special needs. In aim to get adequate information's related to our third hypothesis, we made analyze of psychometric assessment with pupils from experimental and control group. The results of this test shows in which size the mutual feeling was developed, feeling of belonging, thrust and mutual solidarity and in which size it influenced on pupils socialization and acceptation of children with special needs.

Results of influence on children's socialization and social status of children with special needs

The basic purpose of psychometric questioning was to assess in which size the application of interactive method had influence on children's socialization and social status of children with special needs. Psychometric questioning was made in experimental and control groups. The questioning was conducted at the beginning and at the end of assessment. As an introduction in the questioning, we had a conversation with children about their socializing and mutual communication during the activities. The children were asked to give an explanation with which girlfriend or boyfriend they like to associate the most and with who they don't. The answers were noted in the table and beside every child's name positive or negative selection were written. At the beginning of questioning there wasn't a strong expression of cohesion in both groups and relations were "chaotic" because children were playing together and at the same time conflict. Most of the children didn't have a clear status. They were in a position to be unnoticed and often there were positive and negative ambivalent relations to other children who were marked with a wish to play and fight at the same time. These results are understandable considering that we formed fictive groups where there was no developed ability to cooperate and familiarity with social skills. In the table the results are presented on initial questioning of children's status. From the psychometric register we can see that the dynamic of the group is badly represented and the ethic point of view towards the children with special needs is on very low level. The initials that were marked with yellow color in graph icon represent children with special needs and have the largest number of negative selection. At the end of implementation of the program contents, again we made psychometric questioning with an aim to see if there were any changes made in some children's status, in complete relations and group climate. Social status in control groups was at the same level that was mostly based on competition and rival. A degree of fear from children with special needs was still present. Separation between boys and girls who prefer playing with only one sex was expressed. In aim to question mutual relations negative diodes were noted, what shows that intolerance is present and teacher's intervention is necessary to remove conflicts. All control groups had "stars" or leaders who were selected mostly by children. The groups

were divided except in selection of the most popular child.

Analyzing psychometric questions in experimental classes we noted high level of group cohesion manifested by large number of positive selection in relation to number of the group members. Children accepted rapidly group behavior and for that behavior other children happily accepted them as their friends.

In these groups communication was more intensive and emphatic. By mutual selection of members positive diodes were noted that show group stability based on attraction, wish for playing and association. In these groups cooperative atmosphere, cooperation and dynamic interaction was achieved that have positive influence on further socio-emotional development. Based on analyzed results we can conclude that experimental groups were more dynamic and that positive climate was present and there is connection between children where children with special needs are not taken out of the group. To get clearer and more understandable picture of interactive methods the influence on socialization level with children and acceptation level of pupils with special needs, the analyze of children's drawing on given theme was made. The theme was connected to class surrounding in which pupils had assignment to draw themselves, the teacher and their friends with who they associate every day in "Small school". In interpretation of this work we were observing the general impression of complete drawings. Combining all known information's about the child and meanings of symbol of their drawings as well as considering the child's explanation we have reached important diagnostic effects in social view of acceptations of children with special needs. Drawing upon given theme is given to both groups at the beginning of experiment implementation and at the end. Analyzing the first initial drawings the children have shown acceptance of children with special needs as their friends. In the group where a blind boy was integrated, the children painted his clothes in black color and color selection explained as something dark and scary. After the completion of the experimental research the drawing was repeated with the same theme. The pupils from experimental group showed this time their friends with special needs in bright colors, painted in situations in which they are playing with the other children. While they were explaining the drawings in which they drew persons with special needs they didn't express strong negative reactions and emotions as it was noticed and expressed in interpretation of the first work. Analyzing the work of children in control group this progress wasn't noted. Children still had repulsive attitude to integrated pupils. After psychometric analyze the questioning and analyze of children's work we can conclude that application of interactive method had effect on children's socialization which was manifested through adopting the rules and building social skills. Complete educational process with applying interactive method was performed based on conditions of interaction between children; educator and his friends that resulted with higher level of socio-emotional maturity and higher level of cooperative ability. Working with children from experimental group we used games for social learning that brought in new behavior forms (instead competition we used cooperative principle).

This kind of approach provided an opportunity to participants to mutually come closer not only to emotional and communicational but ethic too. Children with special needs in this group were accepted better and had more self-confident and self-respect and "Picture about you" with pupils with special needs was built positive. We will give an example of one boy who was integrated in the experimental class. It is about a six-year-old boy with directed mental retardation whose parents on doctor's initiative included him in " Small school" program. Beside the teacher, individual treatments were done with the boy by dialectologist and logaoedics. At the beginning the boy was not accepted by the children. In our psychometric questioning done with 16 children in the group, 13 children didn't want to play with him nor accepted him as their friend. Three girls showed a kind of sympathy to him but they also were not ready to associate with him. After six months of work by the expert team and mutual association with this boy applying social interactive games the attitude of other children of the same age towards this boy was completely changed. In regular work with this boy we made tape note from which we can see the way his friends helped him during the adaptation of the material he learned from (days in week and counting to 10). Encouragement by friends from the group stimulated the boy by applause and when he wrong interpretation they tried to help him. After the psychometric interrogation analyze of children's work and analyze of the tape we can say that application of interactive methods had influence on level of socialization and acceptation

of children with special needs which confirms our third hypothesis.

IV. CONCLUSION AND RECOMMENDATIONS

If we analyze the existing educational practice, we can conclude that the motivational theoretic orientation is missing, which would react in the world of changes faced with the progressive social development. The reasons for that we can find in insufficient sensibility and in pedagogic deficit of teachers motivation to avoid the established practice that is still based on glorifying the frontal way of work. The teacher accommodates the work to so called average pupil, unsatisfying the needs and possibilities of those recipients, who are above and under intended average. To find the best solutions which will be oriented to individual and it's needs, there is a need for a ceria of actions and practical interventions from the field of educational practice. Aiming to enrich the educational methodology, which would provide every pupil with progress towards personal needs, we oriented our research in that direction. We wanted to study and question the opportunity and the condition of the practical realization of interactive methods in the inclusive class so that the educational work could be refreshed with the new procedure in the process of acquiring quantity-quality of pupil's knowledge and the creative ability. Starting from the subject of research, aim and task definition in our work we came to accurate information's which are given by observing and comparing results of the traditional way of work and the results of the innovation model in which the interactive methods are realized. Obtained information's gave the complete picture about the level of adopted knowledge that was seen in quantity and quality of understanding the facts, duration of the memorized content, fluent factor, logical-critical formulation and the problem connection. They also clearly ordered the efficiency of the methodical procedure application on individual learning, motivation, socialization and the level of acceptance of children with special needs. Based on research results that was shown in this work the following can be concluded:

- The application of the interactive methods considerably influenced the quantity and the quality of the pupils knowledge that was shown in amount and duration of adopted facts in mother tongue and mathematic plays, improved perceptive and intellectual ability, fluency of ideas, creativity and clear understanding of the facts. Processing the statistical information's we came to the results that show us that the pupils from experimental group in view of quantity of the adopted facts did not manage to realize better success in final test in compare to pupils from the control group. By oral examination and by analyzing child's drawings, we questioned a level of quality of the adopted knowledge. The questioning results showed that pupils from the experimental group showed high level of understanding the facts and they were giving logical explanations in which the factor of fluency was expressed. In the control group's pupils memorized large number of facts, but level of understanding of some facts, logical explanation and the factor of fluency was much lower in compare to pupils from the experimental group.
- Application of the interactive methods considerably influenced the interests, motivation and active participation of pupils in the education process. The questioning results of pupil's motivation for attending workshops showed that relation between inartistic and extrinsic motivation is significantly enclosed to internal motivation. This is a solid result specially if we consider that psychological development of the preschool children depends on outside compliments and the competitiveness. Questioning the pupils reality of own efforts and marks they got on the test we came to the results which show that correlation between mathematic mark and their self-judgment is r=0,45, while correlation of marks in mother tongue and self-judgment was much lower r=0,15. From those results we can conclude that pupils like to give judgments to their success. But, so high self-judgment shows that even less successful children have a subjective felling of success. Based on latest motivation questioning results, we can conclude that the motivation level in classes interactive methods are applied is higher (on scale from 1-5 about 4,7) than in the control classes. So we can say that our second hypothesis is confirmed too.
- Our third hypothesis was that the application of the interactive methods had influence on better acceptation of children with the special needs and it will reflect positively on the socialization and

individual progress of children with special needs is also confirmed by socio-metric questioning results that were made at the beginning and at the end of the research. In initial questioning most of the children did not have a clear status. They were in a position of an unnoticed child and often there were positive and negative ambivalent relations to the other children who were marked with a wish to play and fight at the same time. Those results are understandable considering that we had artificial formed groups where ability of cooperation and knowing social skills was not known. At the end of the implementation of the program contents, again we made socio-metric questioning to see was there any change's in some children's status related to initial questioning. The social status in the control groups was nearly at the same level and was based on rival and competition. In aim to question mutual relations we marked negative diodes, which shows that rejections to children with the special needs is still present and teachers intervention is necessary. The groups were divided except in selection of the most popular child. By socio metric questioning analyze in the experimental classes we noted positive diodes that shows group stability that were based on attraction, wish to play and socializing. In those groups cooperation atmosphere is achieved, cooperation and dynamic interaction that positively influenced on their further socio-emotional development.

The teacher's experience in the experimental groups in view of bringing in the inclusive education and the interactive methods influence on educational level of the pupils are affirmative and we can confirm it by the results given by the question analyze, researcher's reports and interviews. The results that show positive attitudes of the teacher we can attribute to the professional qualification that is realized through a number of classes and trainings at the beginning of the research implementation project. After processing the questionnaires related to the teacher's reaction and opinion about application of the interactive methods in the educational work, teachers stated a general mark that was related to their efficiency. The questionnaire results lead to the conclusion that the application of the interactive methods has influence on faster and easier material overcoming, activates creativity and free thinking, develops ability on faster and durable memorizing and memorized knowledge puts on operative level. Based on the teachers statements and researchers reports we can conclude that they are pleased with the application of the interactive methods and with the influence on pupils who attend the inclusive classes.

The application of the interactive methods had influence on the parent's affirmative attitude in view of the inclusive education. The affirmative parents attitudes we can attribute the interactive methods activity that were used during the classes, seminars and the workshops for the parents from the experimental group. By the inquired analyze we found out that their parent self-confidence enlarged. They think that their active participation and cooperation with the school gives valuable contribution to their child and to the other children too. When it is about parent's attitudes about bringing in the inclusive education, we can conclude that the parents were skeptical and careful at the beginning from both groups, but after their education and inclusion in different kinds of activities, parents attitudes from the experimental group changed related to parents from the control group. Considering that the groups were equalized at the beginning in all relevant factors, especially in socio-economic parents status, differences that were present in attitudes can attribute to experimental factor activity, effectiveness of the interactive methods. From this we can conclude that our fifth hypothesis is confirmed and answered our aim and tasks that were in agreement with our subject and research.

Mentioned information's are obtained through different techniques, instruments and actions that were used in this research. The pedagogic experiment with parallel groups was the basic research method and was very successful. Having in mind the equivalency of the groups before the beginning of the research, we can conclude that the influence of the interactive methods effectively influenced the quality and quantity of pupil's knowledge, interests and pupil's motivation, socialization and positive reactions of teachers and parents related to the application of the interactive methods and bringing the inclusion into the educational system. In harmony with the above mentioned facts, we must say that our intention was not to represent the application of the classical methodical action as inefficient (considering the solid results that most of the pupils from this group achieved specially in quantity of adopted facts),

our aim is to show that there is a different working model which showed to be good in quality of knowledge and every success of the pupil. The application of the interactive methods can bring some changes into educational work, which will ensure creativity stimulation and achievement of individual maximum by pupils. But of course, it is necessary to stress that none of the models are a reflection that is good for itself and working based on it every individual can gain the same results. Different individuals will gain extremely heterogeneous results, no matter what they will have, mutual paradigms which directs to possible didactical-methodical way of work in educational classes.

Modern pedagogy in preschool education respects individual differences of children and their potential for comprehensive and healthy development of personality. Creating an "Adapted integrated curriculum" is an integral part of the program plan and program, without which we would not be able to follow the progress and development of every child who enrols in the educational process. Unlike traditional programs that are made in advance, adapted development curriculum is never planned in advance, without knowing all the relevant assumptions. It also is not a model that in all segments fit children of the same age in the same kindergarten, and in different groups. Checking, changing and improving the work can only be made through educational practice. Adapted program must reflect the nature of the child and their specific needs. Program, in terms of integration, is advisable to steer towards the following objectives: to meet the specific needs and the resources to meet those needs. It is important to learn what is important and crucial to the advancement and training of children for later life and concentrate the program content around that. Assessment of the level of children's knowledge of the content, and closest opportunities for learning and development should be based on continuous monitoring of the child's achievements and interests in respective areas. Based on what the child already knows it is needed to make a realistic assessment of what might acquire in the future, indicating that assessment should not go further than the next few areas, or even take one at a time. Practice has shown that when doing the assessment the rule is that the child be your guide, that the educator follows the child's interests and expands these interests through guided activities. In order to achieve this, it is necessary to make a dynamic, contextual and individual assessment of needs of children's interests and capabilities.

REFERENCES

[1] B.F. Skiner, „Science and human behavior", The free press New York ,1953 the Macmilan Company, USA

[2] Bloom, B. S. (1979). New views of the learner: Implications for instruction and curriculum. Childhood Education, 56(1), 4-11.

[3] Barth, R (1990): Improving schools from within teachers, parents and principals, Can Make a Difference (San Francisco, Jossey-Bass).

[4] Filipović, S. Nikola (1988): "Capabilities of reach and creativity of students and teachers", / page.140

[5] H.H Anderson, (1959): Creativity and its cultivation, New York, Harper

[6] Keverseski, Lj. (2000) : The gifted and talented: Creators of the progress, Newsletter of the world counsel for gifted and talented children, vol.19, number 1.

[7] Landon e. Bayer, Michael W.Aple (1988); The Curriculum, Problem, Politics and Posibilities, State University of New York Press, Albany

[8] Robbins, C-Morgan, C. (1995).: Human Resource management in Education, Open University Press,

[9] Runko, M.A. & Albert, R.S. (1996).: Theories of creativity, California,

[10] Schon, D (1987).: Educating the Reflective Practioner, Temple Smith, London,

[11] Slatina, Mujo (1998): "Teachers method", page. 65.

[12] Tyler, Ralph. Principios básicos del currículo. Buenos Aires, Troquel, 1973.

[13] Watson, D., Tinsley, D, eds (1995).: Integrating Information Technology into Education, Chapman & Hall, London,

[14] Wheeler, D,K (1971): Curriculum process, London, University of London Press

THE SOCIOLOGICAL THEMES IN FRENCH AS A FOREIGN LANGUAGE CLASS

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Abstract - This research study consists of two parts. Initially, we were focused on analyzing sociological themes in French language textbooks. Results showed that there is a basis for introducing sociological themes in French language classes. Namely, all the defined themes already appear in textbooks. The theme „Culture“ appears much more than any other theme. The theme „Religion“ appears the least. In the second part of the study, we were focused on examining students attitudes and preferences towards sociological themes in general, with a special emphasis on themes which, according to our texbook content analysis. It was shown that students mostly hold positive attitudes towards French language classes and sociology. Furthermore, it was mainly not difficult for them to understand and acquire sociology class content and there is no sociological theme they distinctly did not like. Of all the themes they could explore in French language classes, students would most like to explore the theme „Culture“ and they would least like to explore the theme „Politics“. These data are precious beacuse they give us objective information about students interests. This information can be useful to single out further goal of encouraging interdisciplinarity and a holistic approach to teaching and tuition.

I. INTRODUCTION

In the narrowest context, this paper aims to focus on the following topics: analyze and record the sociological themes in the books of French as a foreign language, and to examine the attitudes and preferences of students toward sociological themes in general, with special emphasis on sociological topics that appear in the books of French language. Introducing sociological topics in teaching the French language can help foster intrinsic motivation students (Vizek Vidovic et al., 2003), and when we talk about teaching French, she becomes more interesting to students introducing a sociological issue, gives students a richer vocabulary, goes solely linguistic content and be given the opportunity to students to demonstrate the right to the "I" in the class of languages that are so rarely show (Vrhovac, 2001). Similarly, if we talk about sociological topics in language teaching, until now, there was not conducted a study on students' interests in relation to them. Thus, the analysis aims to examine the current state of occurrence of these themes in the books of the French language, or condition that is objectively true for all students of French language. Specifically, the textbooks are the only means of teaching prescribed and equal for all students, as exclusive features and operation of the teacher and any additional documents and materials not covered by textbooks, but can be used in teaching French as a foreign language. We also want to examine the attitudes and interests of students. In this way we will get an insight into the topics that students want to cultivate during language classes, with the broader aim of determining their interests. The ultimate goal of this research is to create a foundation and guidelines for the enrichment of language teaching French language by tailoring interdisciplinary topics, taking into account the interests of students and their preferences for certain sociological topics. As far as educational policy in Croatia, the concept of cross-curricular topics in the National Curriculum Framework (2010) is plausible and is considered to be the goal for which to strive. Of the six interdisciplinary themes in the NCC, the introduction of sociological themes in teaching French as a foreign language could meet two: personal and social development and civic education.

II. THEORETICAL CONCEPTS, HYPOTHESES AND METHODOLOGY ANALYSIS CONTENT

For the purposes of this study, we took a sociological topic for the unit content analysis. How to define a sociological theme in this case? Sociological theme in this sense is understood as a backdrop or framework within which are designed activitys, tasks, etc. that allow ultimately adopting linguistic phenomena. In this sense, social issues in language textbooks are not direct or highly visible, because the adoption of the sociological phenomenon was not an objective of teaching a foreign language. Although the use of thematic units has serious drawbacks because categorization

is not unambiguous as it is based on the separation of phrases such as words or sentences (Milas, 2005), for the purposes of this study it was not possible to take "physical or syntactic unit of analysis" (Milas , 2005: 508), because only the appearance of a word in the textbook from a foreign language does not necessarily mean that it is treating the specific topics.

In determining the sociological themes in terms of content we used primarily the sociology textbook for high schools called Sociology (Fanuko, 2009) and a textbook in sociology called Sociology (Giddens, 2007). Emphasis is on topics that are largely covered teaching sociology in secondary schools. Thus, for purposes of this analysis ten sociological themes are provided. Socialization and identity, Gender, Family, marriage and kinship, Culture, Religion, Education, Employment and economic life, Mass media and technology, Politics, Social change. It is clear from the description of categories that they may overlap among subjects. It is therefore likely that the analysis of content we will experience lessons that contain more sociological themes at once. For the purposes of this content analysis, it will be taken into account everything a lesson in a foreign language can contain.

The main hypothesis of this study is: Of the ten defined sociological topics, sociological topics Culture appears in most lessons in the analyzed textbooks from French as a foreign language.

Samples of the content analysis are the textbooks from the French as a foreign language that are commonly used by the first to 4 grades in high schools in Zagreb. It's eleven books with which students encountered in the course students practice teaching of French in the Department of Romance Languages at the University of Zagreb: Le nouveau taxi 1 and 2, Alter Ego 1, Alter ego1, 2:03, Café crème 1, 2 and 3 and Forum 1, 2 and 3. For the purposes of this analysis, the most appropriate "way of quantifying the content is transformed into a binary variable, where the unit joins the content in which categories emerged, and one in which zero is absent (Milas, 2005). Listed and defined sociological themes are not mutually exclusive. It may happen that one lesson includes more sociological themes. The most appropriate statistical analysis of data and display the results of this content analysis is to display the percentage of sociological themes in the documents and textbooks.

III. Results And Discussion Content Analysis

Summing all the lessons of all 11 books lead us to the number of 536. Sociological themes occur in 85.26% lessons. As seen in Table 5 and Figure 2, the total number of lessons, theme Culture occurs most frequently, or 56.34% of the lessons. Followed by themes: Work and economic life, Politics, Mass media and technology, Social change, Socialization and identity, Gender, Family, marriage and kinship, and at least appears theme Religion.

TABLE 1. PERCENTAGE OCCURRENCE OF SOCIOLOGICAL TOPICS IN TEXTBOOKS FROM THE FRENCH AS A FOREIGN LANGUAGE FROM A GROUP OF TEXTBOOKS LE NOUVEAU TAXI, ALTER EGO, CAFÉ CRÈME AND FORUM*

	Sociological themes	%
1.	**Socialization and Identity**	6.9
2.	**Gender**	6.16
3.	**Family,marriage and kinship**	5.41
4.	**Culture**	56.34
5.	**Religion**	3.73
6.	**Education**	5.97
7.	**Work and economic life**	17.54
8.	**Mass media and technology**	14.55
9.	**Politics**	16.42
10.	**Social changes**	11.19

*Percentages are calculated from the total number of lesson book Le nouveau taxi 1 and 2, Alter Ego 1,2 and 3, Café crème 1,2 and 3 and Forum 1, 2 and 3, which amounts to a total of 536

The content analysis showed that in the books of French as a foreign language appearing all defined sociological themes: Socialization and Identity, Gender, Family, marriage and kinship, Culture, Religion, Education, Employment and economic life, Mass Media and Technology, Politics and Social changes. While all these sociological themes are presented in textbooks, they do not appear in the same frequency. In this sense, the content analysis confirmed the original hypothesis: of the ten defined sociological topics, sociological topic Culture appears in most lessons in the analyzed textbooks from French as a foreign language. It appears in 56.34% of the total number of lessons all analyzed textbooks. Language teaching in general, including the French, implies the involvement of different topics from social life, keeping in mind all the communicative situation in which one can find a student, a user and a speaker of French. Results of this study are useful for sociology, because it shows that objectively there is already a lot of sociological themes in the books of French as a foreign language, and that there is a good foundation for the planned introduction of sociological topics in teaching the French language.

IV. THEORETICAL CONCEPTS, HYPOTHESES AND METHODOLOGY SURVEY

This research is to examine students' attitudes about school subjects sociology and French as a foreign language, to examine which topics they like or do not like in the teaching of sociology, what topics were difficult to understand and adopt, what social issues and antisocial themes students want to process in teaching French, and finally, what sociological topics they are interested in general.

The instrument we used is conveniently questionnaire that was designed for this research and is titled Questionnaire on attitudes of students on topics in the teaching of sociology and French languages, and their general interest in the same and is located in the Appendices.

We chose eight thematic sections of the textbook (Fanuko, 2009), and we add themes Gender and Mass Media and Technology. We have designed and thirty indicators in ten sociological themes. All these indicators are taken either from the textbook Fanuko (2009), any textbook Giddens (2007). Although previous research has shown that of all sociological topics most commonly is theme Culture in textbooks, for survey, we assume that the interests of students will not coincide with this result. Specifically, we believe that third grade high school students are not interested in so many cultural issues, such as issues of media, technology and social change. Given today's lifestyle and the use of technology in everyday life, it is expected that young people, high school students, will be more interested in this topic. Thus, our first hypothesis is: Of all these social issues, students in teaching French language most want to cultivate topic Mass media and technology and their impact on society. As for the second hypothesis, we assume that: Students are generally most interested in the topic of mass media and technology. Our third hypothesis is: Of all these social issues, students in teaching French at least want to edit the theme Policy.

For the method of this study, we chose a survey. Non-probabilistic method we came to a convenient sample that includes students third grade four Zagreb gymnasium: IX., Classic, V and XVIII., who taught French at school. We can not claim that the sample is unbiased and that is representative of the population it represents.

V. RESULTS AND DISCUSSION SURVEY

Indicators are grouped into ten broad themes and we get, as we can see in Figure 1, the average general interests of students in relation to the same. We see that all threads are between grade 3 and 4, and that no single issue, on average, is very interesting to students. We can tell that, so to speak, in the broadest sense, that they are the most interested in the subject Culture, and at least Policy.

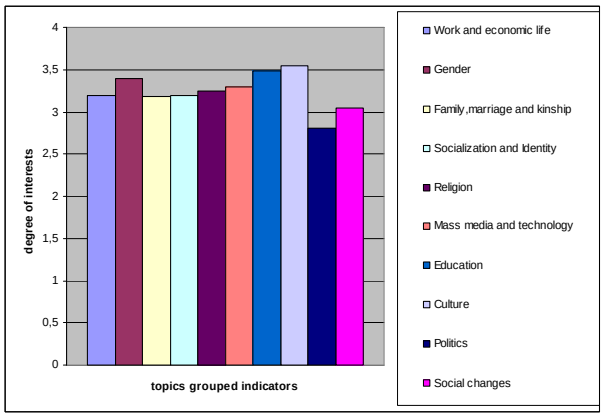

Figure 1. General interest of students to sociological topics grouped into ten broad themes

In Figure 2, we see the displayed results concerning the consistency of students' answers on the topics they want to cultivate in teaching French language and the topics that interest them generally. In most cases there are more topics they are interested in, more than they would like them to be processed in teaching French.

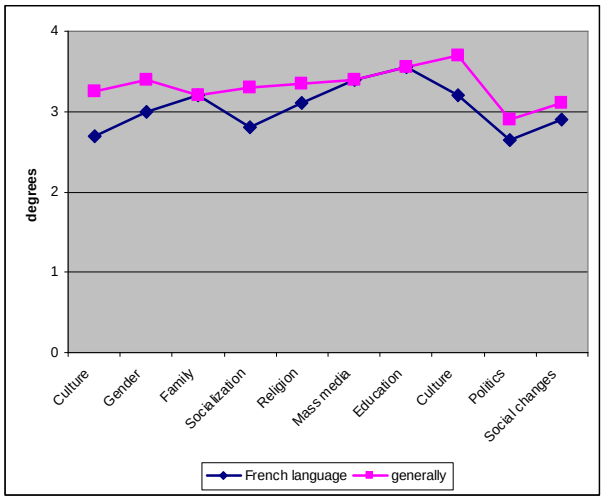

Figure 2. Consistency of students' attitudes about sociological topics they would like to edit the hour French language and their general interest in the same

Our first hypothesis (of all these social issues, students in teaching French language most want to cultivate topic Mass media and technology and their impact on society) has not been confirmed. In

fact, most students want to edit the theme Culture (Figure 2). Another hypothesis (Students are generally most interested in the topic of mass media and technology) was also not confirmed. The results showed that students and generally most interested in topics Culture (Figure 1). The third hypothesis was: Of all these social issues, students in teaching French at least want to edit the theme Politics, and it is confirmed (Figure 2). Also, it showed that students are generally the least interested in topics Politics (Figure 1). Finally, a major drawback of the study is sample. None of these findings can not be generalized.

VI. CONCLUSION

Further research on this subject should go in the direction of increasing the sample which is in our case simply too small to be somewhat generalized. With a larger sample it might be better to see the differences between the genders and between schools. We could also add more indicators to get more minutely insight into students' interests.

Finally, these data are very valuable because they give us a fair view of the interests of students. They can serve future and current teachers, textbook writers and everybody involved in teaching languages as a basis for the design and creation of models of teaching such content in teaching French language, in order to further encourage interdisciplinary and holistic approach to teaching and learning.

REFERENCES

[1] Fanuko, N. (2009) *Sociologija*. Zagreb: Profil

[2] Giddens, A. (2007) *Sociologija*. Zagreb: Nakladni zavod Globus

[3] Milas, G. (2005) *Istraživačke metode u psihologiji i drugim društvenim znanostima*. Jastrebarsko: Naklada Slap

[4] Ministarstvo znanosti, obrazovanja i športa RH (2011) *Nacionalni okvirni kurikulum za predškolski odgoj i obrazovanje te opće obvezno i srednjoškolsko obrazovanje*. URL: http://public.mzos.hr/Default.aspx?sec=2685

[5] Vizek Vidović, V., Rijavec, M., Vlahović-Štetić, V., Miljković, D. (2003) *Psihologija obrazovanja*. Zagreb: VERN

[6] Vrhovac, Y.(2001) *Govorna komunikacija i interakcija na satu stranog jezika*. Zagreb: Naklada Ljevak

PREPARATION OF TEACHING MATERIALS FOR A C# COURSE

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Abstract - We teach an introductory course in object-oriented programming for first year students of Mathematics at the Faculty of Sciences, University of Novi Sad. The course is taught in C# and aimed towards developing general programming skills and building a foundation for scientific applications of programming. Our main goal was to investigate how we can increase the students' motivation for learning, therefore providing for a high level of knowledge acquisition and retention. To this end we prepared an extensive set of teaching materials, and organized the course appropriately.

I. INTRODUCTION

At the Faculty of Science, University of Novi Sad, one elective course, named Programming 2, is taught to the students of the first year of Mathematics. The goal of this course is to teach the students object-oriented programming (OOP) in C# for scientific applications. From our experience and the polls, we conduct each year at the beginning of the course, we assume that the students are not familiar with OOP, or advanced procedural programming. Some of the students may have studied Pascal or C in high school. Therefore, we were met with a difficult task of guiding our students from the first steps in C#, through the basics of OOP, to building relatively complex programs which solve practical problems.

Good teaching materials should provide good coverage of course content, samples and exercises for self-study, references to other materials and textbooks, as well as samples of real-life problems. For students who are attending lectures, the materials are a form of backup for any information they may have missed; for distance learning students, the materials are the essential source of information. Quality of a course is directly affected by the quality of the accompanying materials [1].

We based our course on the first part of the book "Microsoft Visual C# 2012 Step by Step" [2], which is available in the Serbian language, and recommended "Mala škola programiranja u C#" [3] as the secondary textbook. While the scope of our course is wide, we were not able to cover all topics in detail, due to limited time. Therefore, we opted for a pragmatic approach; we introduced only the necessary concepts of OOP when they were needed, and covered only the necessary minimum. However, we provided references to textbooks, MSDN documentation and additional examples, and strongly encouraged students to use them for individual study.

The paper is organized as follows: Section I provides an overview of the course; Section II describes the preparation of teaching materials, and the software used; Section III contains our experience while giving the course in a traditional way and online; Section IV contains quiz results, and the conclusion is presented in Section V.

II. COURSE OVERVIEW

Programming 2 is a 14-week course, with 2 hours per week of lecture time and 2 hours per week scheduled for supervised and independent computer lab work. Two hours a week are determined as office hours for consultation, and the lecturers can also be reached via e-mail.

The course is divided into three parts, covering the following topics:

1. Procedural programming in C#
   - Variables and data types
   - Flow control statements, arithmetic operations, mathematical functions
   - Error handling, arrays and lists
   - Methods, parameters, value and object types
2. Object-oriented programming in C#
   - Classes, private and public modifiers, contructors
   - Inheritance
   - Class fields and properties, is and as operators

- WPF applications

3. Examples and projects for independent work
   - WPF calculator
   - Working with files
   - Generating a non-repeating list of random numbers
   - File system operations and classes
   - WPF graphics, plotting function graphs, timers and animations
   - Dynamic Link Libraries

It takes significantly longer than 14 weeks to learn object-oriented programming, especially if the students are expected to independently develop programs to solve practical problems. However, we assumed that the students would be able to learn even those topics which were not explained in detail in class, with the help of good teaching materials. Having the textbooks and many online sources of information, the role of the teacher has changed from the sole source of information to that of an advisor offering guidance.

III. TEACHING MATERIALS PREPARATION

There exist several approaches to instructional design. We chose a set of simple principles, which we followed when preparing teaching materials:

1. Learning goals must be clearly presented to students.
2. Organize the course and the materials from simpler to more complex topics; from theory towards practice.
3. Give assignments and tests after each topic; check whether learning goals are being achieved.
4. Provide feedback to the students, so that they can assess their knowledge and plan further learning.

For each lecture, we prepared appropriate text materials with C# sample programs, assignments for individual work, textbook, references, and links to web sites with relevant information. Furthermore, we created a set of instructional videos [4] and published them on a YouTube channel [5].

A. Text materials preparation

Text materials were prepared to be short and concise. Only the concepts that are essential for the lesson were explained, and illustrative examples provided. References to textbooks, MSDN documentation and YouTube videos were also provided, for students who may wish to explore the subject in depth and work independently.

Text was accompanied by examples prepared in Visual C# 2010 Express (VCSE). Important sections of code were commented and included in the text. Algorithms were explained, and suggestions for dividing the work into smaller units included. Traditional topics on algorithms, such as searching, sorting and recursion, were introduced as needed.

We used PrimoPDF [6] to convert the text into the PDF format. VCSE projects were cleaned by removing all temporary and executable files, and packed into ZIP archives. Examples, which were developed in classes, were also added.

B. Video materials preparation

Video materials for the course consist of short screen recordings with narration. We used CamStudio [7] and headphones with a microphone to record our interaction with Visual C# Express. In order to make screen text readable on YouTube, we shrunk the VCSE main window to approximately 800 pixels wide.

Recorded videos were edited and processed in Windows Live Movie Maker [8]. Unnecessary parts were cut, text captions and lesson reviews were added (Fig. 1).

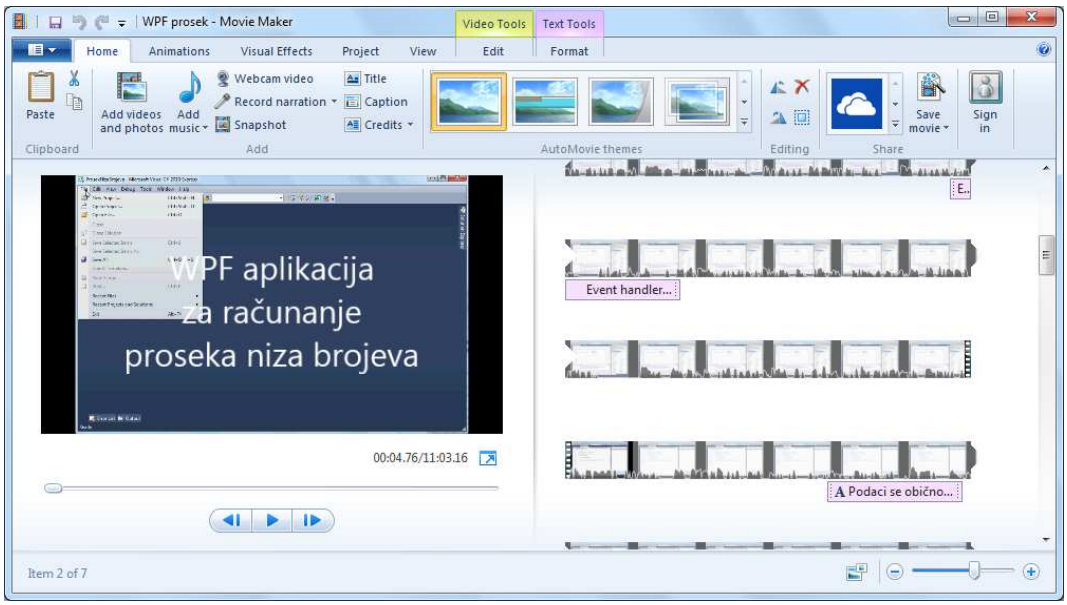

Figure 1. Video clip editing in the Windows Live Movie Maker

Finally, processed videos were saved in 720p resolution and uploaded to YouTube (Fig. 2).

We adhered to these guidelines while preparing videos:

- Video must not exceed 10 minutes;
- Focus on one topic;
- Explain the used classes, methods and techniques just as much as necessary;
- Gradually introduce complex problems;
- Use captions to emphasize important points;
- Provide review at the end of the video

The main idea is that compex problems are better explained through a series many short examples, instead of a single long one.

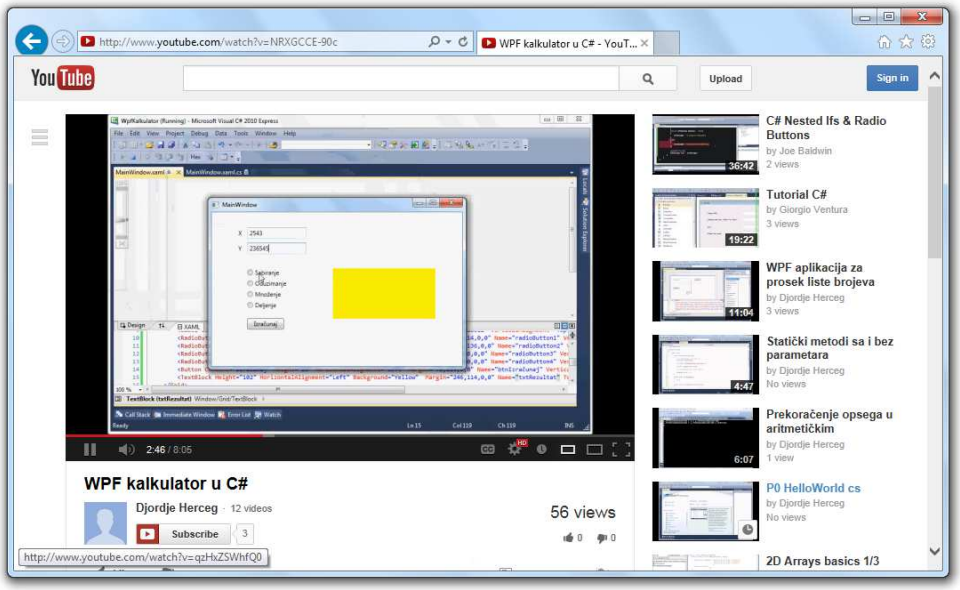

Figure 2. Our C# channel on YouTube

C. *Materials sharing*

Completed materials were published on SkyDrive [9] and YouTube. We used the SkyDrive Windows application, which greatly simplifies uploading. The teacher only needs to copy the desired files into a specific folder on her/his computer, and the SkyDrive application then silently synchronizes that folder with the cloud storage.

The students can freely download the materials by using a web browser (Fig. 3). Links to the materials on SkyDrive, as well as to the YouTube videos were published on the course web page. The students used this web page as the starting point for accessing the published teaching materials.

IV. TAKING THE COURSE ONLINE

A poll was conducted at the beginning of the course, order to explore how the students' general attitude towards learning and self-study affects the learning outcomes. The poll is a part of a larger research study, which is in still progress. We offered the students a chance to study from home, using Moodle [10], but were surprised to find that only 19 of about 70 students have chosen this option.

One of the poll questions was "I chose to attend the course in person instead of on Moodle because...", and we received the following answers (multiple choices were allowed):

- I don’t have a computer or Internet access – 10.42%;
- I don’t want to spend to much time at the computer – 16.67%;
- I think I will learn better if I attend the classes – 79.17%;
- I never took an online course and I don’t know what it's like – 91.67%;
- I would have to put in additional effort – 2.08%;
- I am afraid that I won't be able to keep up with the course on Moodle – 47.92%;
- My parents won’t let me skip classes – 2.08%;
- It is easier to learn after taking classes – 58.33%;
- It will take more time to follow the course on Moodle – 22.92%;
- It does not fit my schedule – 6.25%;
- I think personal contact with teaching staff is better – 60.42%;
- I am not sure if it is easier to pass the exam with Moodle – 41.67%;
- I use the Internet only for fun, not for learning – 2.08%;
- Other reasons – 2.08%;

Obviously, the students prefer attending classes from taking an online course. Many students have heard about Moodle, but they were afraid to take an online course. Some students (8.33%) have tried other online courses before but they were not satisfied with their quality. The most common remark was that they missed the personal contact with the teaching staff. Besides, they mentioned that self-study is boring and not as interesting as being in class. A more significant remark was that the course materials were not well prepared. This remark prompted us to invest additional effort into improving our teaching materials.

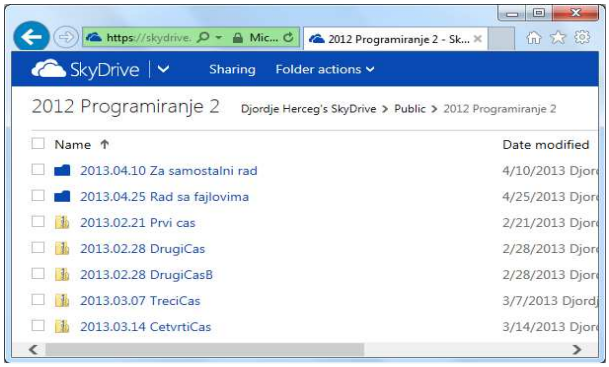

Figure 3. Course materials on SkyDrive

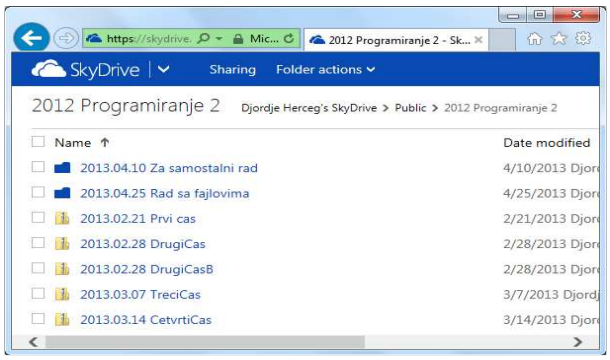

Figure 4. SkyDrive synchronization with the cloud

V. QUIZ RESULTS

In order to track the student's success, we decided to give quizzed after each lecture and three major quizes, in the 5th, 9th and 13th week of the course. Homework was also assigned after each class, with a deadline of 14 days.

After the first five weeks we observed a polarization in students' success, as some students' test scores clearly lagged behind the group. We then decided to award additional points to those students who did their homework correctly and on time. We also assigned homework in a more open-ended manner, where goals were not strictly stated, hoping to promote autonomy and sense of purpose in students. The students were also constantly reminded to use the online teaching materials.

The results of our approach were positive. A comparison of results from the first and the second quiz shows a shift up in the grade curve (Figure 5). We divided the scores into four groups: from 0 to 3 points – fail, from 4 to 7 points – pass, from 8 to 13 points – good, from 14 to 17 points – excellent. While there were 36% of excellent scores in the first quiz, in the second quiz this increased to 42%. However, the number of students who failed the quizzes remained the same. It should be noted here that the percentages in the second chart do not add up to 100%, as 10 students have not taken the second quiz.

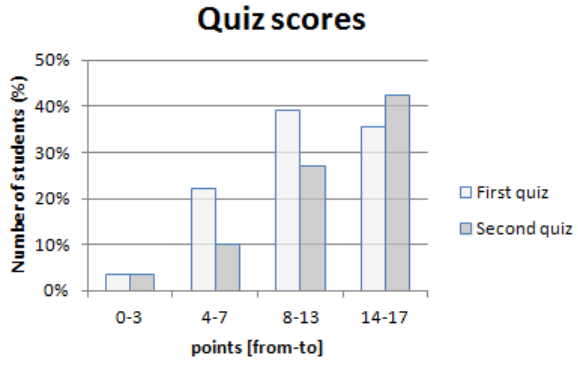

Figure 5. Comparison of quiz results

As the course is still in progress, we hope to have the complete data after the end of the summer semester in 2013.

VI. CONCLUSIONS

Preparing a good set of set of teaching materials is essential when teaching a course. Mastering object-oriented programming is a difficult task, especially for students who have not had much experience in programming. We approached this challenge by covering a wide range of topics, and relying on combined text, example C# projects and instructional videos which were published online. Due to a short timeframe alloted for this course, we encouraged the students for self-study and independent work. By awarding extra points for activity and homework during the course, we further motivated the students to learn. Preliminary quiz scores show that our approach gives results.

REFERENCES

[1] C.C.W. Hulls, A. J. Neale, B. N. Komalo, and V. Petrov, “Interactive online tutorial assistance for a first programming course”, Education, IEEE Transactions on, vol. 48, Issue: 4, pp. 719-728, 2005.

[2] J. Sharp, “Microsoft Visual C# 2012 Step by Step”, O’Reilly Media, Inc, 2012.

[3] Microsoft, “Mala škola programiranja u C#”, http://www.microsoftsrb.rs/download/obrazovanje/pil/Mala_skola_programiranja_Csharp.pdf (accessed May 2013)

[4] J Wells, R. M. Barry, A. Spence, “Using Video Tutorials as a Carrot-and-Stick Approach to Learning”, Education, IEEE Transactions on, vol. 55, Issue: 4, 2012

[5] YouTube, http://www.youtube.com/channel/UCh28UJxUjI9Dy_PP8xhKYng (accessed April 2013).

[6] PrimoPDF, http://www.primopdf.com/ (accessed February 2013).

[7] CamStudio, http://camstudio.org/ (accessed February 2013).

[8] Windows Live Movie Maker in the classroom, http://www.microsoft.com/education/en-us/teachers/guides/Pages/windows-live-movie-maker.aspx (accessed March 2013).

[9] SkyDrive, http://windows.microsoft.com/en-us/skydrive/download (accessed April 2013).

[10] D. Glušac, K. Vančo, S.Lukić, G. Terzin, and E. Eleven, “Moodle as Pedagogical Environment”, Proceedings of International Conference on Information Technology and Development of Education ITRO 2012, 2012, pp. 292 – 296

USING INTERACTIVE WHITEBOARDS IN EDUCATION

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Abstract - Paper discuses the advantages of using Interactive Whiteboards (IWBs) in education. Use of accomplishments of information technology becomes extremely important for development of modern pedagogical science creating educational politics and enhancing direct teaching practice. Change of pedagogical practice reflects increase of teachers' and students' interactivity toward subject position, respectively students' activities and IWB technology initiates just that. Positive influence of interactivity on successful learning and teaching using the IWB technology reflects in: the use of principles of the obvious because well conceived material and interaction of users with objects on the board using a pencil, a finger or some other device influence positively in understanding the content; game elements make the use of this board fun for students, and when something's fun it's easier to learn and remember; using colours, movements, emphasized things and other visual effects reflects positively on students' learning; creating multimedia material on the subject stimulates interaction between students through discussion and direct manipulation of the media. Success of using this teaching means mostly depends on teachers who should find the best ways of using great possibilities of IWB in their work so students would be more active, comprehension greater thus learning more successful.

I. INTRODUCTION

The documents of UNESCO that deal with issues of education, created during the last decade, states, inter alia, that the policies and strategies of education under the strong influence of scientific and technological revolution. Modern technical and technological developments important factor in the democratization of education and improving its internal and external efficiency. The application of modern information technology advances, it becomes extremely important for the development of modern pedagogical science and for immediate improvement of teaching practices. We are witnessing a time in which information technology is becoming a key factor in the overall human and social existence causing the readiness of the entire educational system for the rapid transformation and adjustment with new requirements and changes, so that the traditional role of education in the individual acquisition of knowledge and the development of his abilities getting new features. In these processes, the role of the teacher does not lose its importance, on the contrary, there is a need for the development and improvement of its competence to work in new conditions [1]. Using modern approaches to organizing teaching in which students are active are beyond the traditional forms of teaching. The use of modern teaching aids contributes to the adoption of permanent knowledge and developing skills of students for lifelong learning and professional development, developing the students' creativity and sense of success.

IWB technology initiates changing pedagogical practice to increase interactivity of teachers and students in the classroom. Since this technology is relatively new, there is little scientific research on its impact on teaching and learning. The researches carried out in the UK, Australia and New Zealand where the IWB technology significantly represented in teaching, unambiguously significant influence IWB technology in learning performance of students, but no recorded negative impact of these teaching tools. Most of the existing scientific researches states that the most important variable in improving the quality of learning in students lecturing. The technology itself is not a guarantee that we will achieve better results in their work and we will be more efficient. Although the IWB technology with great potential, it is still just a tool, a teaching tool, but a tool that will allow teachers who passionately committed to doing their job, to do it even better.

All the reviews and praise of this technology cannot be taken seriously without looking at the learning process and the way in which the teacher used the IWB. Efficiencies IWB technology varies from teacher to teacher. Thus, the only relevant way that the teachers will have a clear picture of this technology is to begin to use it and try to improve their practice and also increase the possibilities of using new technologies.

Most of the presentations that are used in teaching are linear, with lots of information and very little interaction with the student. Furthermore, the majority of teachers manage the process of presenting while sitting at the computer. Consequence of this kind of actions by teachers,

presenting lesson while sitting at the computer is such that students can be confused, which is not the case when the teacher presenting lesson by using IWB, students do not have the dilemma on of what they should paid attention, because they see where teacher's finger or stylus pointing.

From this point of view, we can say that IWB are developed from the need to directly manipulate with objects on computer while teacher is in front of the working surface of the IWB (interaction with projection surface), while preserving all the possibilities we were use before IWB (multimedia materials in combination with computer and projector).

Although the interactive whiteboard is just another teaching tool that is used in teaching, IWB technology has brought a lot of possibilities. If we consider only the possibility of manipulating the computer at projection surface, we have an advantage compared to pure presentation, because we can now use integrated software tools (as a ball pen or highlighter in a Power Point) directly on the projection surface.

If we leave aside the PowerPoint for a moment, we can see a number of software that we can use in the classroom (GoogleEarth, GeoGebra, 3DCabri, MS Mathematics, Sketchup etc), and we can see that the possibility of direct manipulation with objects in these software's really is a big advantage over the current use, projecting image without the possibility of interacting with the software on the projecting surface.

All interactive boards have a set of tools that provides interactivity and sensitivity of the projection surface on user command. IWB technology offering except cursor control and interactive tools that allow you to use the projection surface as we once used a plain whiteboard, such as writing notes or drawing over the content currently visible on the screen, using a "sponge" to delete the objects or lines. IWB technology offered much more than simulating ordinary whiteboard. It is also possible to record all or part of the lecture, the audio or video format, to make photographs of part / full-screen, to use handwriting recognition, shape recognition, the magnification of the screen, ... With each object (line, geometric body, complex illustrations, video and audio facilities) can be freely manipulated.

All of these tools open up a range of possible uses in the classroom, and most boards these tools integrated into the flipchart software that are essentially software very similar to Power Point, arising from the need to overcome the limitations of existing presentational software and work with interactive boards make it easier, more beautiful and elegant. Flipchart software applications are now serious great features that come with large libraries of ready-made teaching materials that are literally at your fingertips text, images, charts, diagrams, video, audio, interactive animation, ... required to work in class. Flipchart software also allows us to use the interactive whiteboard, organize material through the slides or pages that are not visible at the same time, but it is easy to show again, with or without notes created during the class, and with the capability of multimedia and interactive materials.

Using flipchart software with interactive whiteboard is not necessary. With interactivity that brings IWB technology during using existing presentations made in Power Point or with use software such as GeoGebra mentioned, can be achieved very much. However, to we waive the flipchart software completely, would mean not to use full potential of the IWB technology.

II. TEACHING WITH IWB

Teachers who just began to use IWB in their work, usually in the early stages of use the IWB as a tool to carry out the basic objectives and learning. In this context, teachers use the IWB as a replacement for the previously used teaching resources (using projector and ordinary projection screen), or carry on the current practice with using a new method of presentation. At first, teachers use the IWB software that provide various forms of writing and drawing and in that way extend their lecture. As confidence grows, teachers are exploring new possibilities of using the IWB with familiar software, such as Power Point. The teacher is then able to use generic software features, such as writing notes and comments to a slide presentation, usually using the tools built into PowerPoint. Of course this type of activity can be taken by students, and it supports interactive learning. As time progresses, teachers increases confidence in the use of IWB, and then they starts to research the possibilities offered by the IWB technology. Teachers' skills in the use of IWB technology can be described by the following steps:

- hand-written text on the board in the same way as the traditional board
- The use of pre-prepared text and graphics - making use of flipcharts
- Save a flipchart for future use
- Using Power Point with IWB included using directly from the desktop panel and use markers for notes on the slide

- Using drag and drop techniques with text and graphics on the desktop board
- Moving back and forth between pages to create an effective learning sequence
- Import digital photos and audio recordings
- The use of hyperlinks to switch between pages / use of resources on the Internet
- The use of hyperlinks to launch different software
- Preparation and effective use of galleries / library of ready-made resources
- Sharing galleries and resources with other teachers

As a teacher progresses in steps and these skills, linear passage through the lesson (presentation) changes to the "bouncy" where exactly IWB technology allows movement through the lesson in different directions. Teachers use hyperlinks to follow different ideas (but without moving away from the goal of the lesson), so learning materials can be modeled and prepared using the links to the programs, to documents, web sites and materials available over the Internet.

With the progress of students' understanding of the functioning of hyperlinks and IWB technology, the teacher encourages them to create their own versions of "work" that will be presented using the IWB and will be part of a lesson and/or activity in the classroom. These “works” are usually students answer the task set by the teacher on a specific topic in the form of Power Point presentation with hyperlinks to resources. Students present their work using the IWB, and then discuss the results that are stand. The teacher may at any time put a note with the essential parts of which are currently present to direct the attention and/or pointing to correction of errors in the students’ work (or can encourage students to take on this role).

Of course, the teacher can plan ahead and align with students the time of presentation of their work and even participate in students work and adjust it if it is necessary with curriculum before student present his work on IWB to the class. Students present their work and discuss the results with classmates; Teachers during these presentations can gain insight into the knowledge and understanding of individuals or groups of students. Presentations are themselves evidence of student work, and can also be printed out with the comments of teachers if necessary.

With the implementation of these activities, the potential of the IWB becomes obvious and teachers are beginning to slowly change their pedagogical practices towards better use of IWB technology features:

- The teacher introduces the class with the objectives of the lesson at beginning and and bring students attention to them at key moments of lesson
- The teacher uses the board to present information to students through various resources (audio, video, simulations, animations, images, ...) but mainly in manner that students manipulate with these resources
- The teacher encourages class discussion and follow them by making notes on the IWB
- Activities such as naming, drawing and graphic design teacher takes using IWB
- Arguments and explanations for certain aspects of the IWB are written by students on IWB
- The teacher and/or students write on the board the text, such as the conclusion of a discussion, and then analyze it and try to improve it

The speed and magnitude of changes in teachers' work depends on the teacher himself. Essentially, only adjusting the current way of teacher work using new teaching tool will not bring significant benefit to the teacher or the students, except for higher student motivation during the initial period of using IWB technology in which students are still fascinated by the new technology. With time, teachers will use their experience and knowledge with the introduction of new teaching resources to develop new strategies and to change their own pedagogical practices.

Changing pedagogical practice is a process in which teachers need to change their current way of working to increase interactivity, not only in terms of IWB technology, but also the mutual interactivity of teachers and students in the class. In that way use of IWB technology will be given its full meaning in the classroom. We can highlight key reasons for the positive impact that interactivity have on successful teaching and learning with the use of IWB technology:

- Obviousness. Well-designed materials and user interaction with the objects on the board using a pen, finger or other device positively influence understanding.
- The elements of the game. The elements of the game used with IWB technology are interesting and funny for the students, and when something is fun it’s easy to learn

and remember it. Integrating sound, animation, video, text, and other interesting resources for lesson has a positive effect on attention and learning. Elements of Game can appear in different forms when it comes to IWB, as computer games with the educational potential, as designed game knowledge competitions between students that are divided into groups ... In this case interaction exists between players and IWB, between students and the teacher as the leader of the game, between team members, i.e. students, ...

- Visualization. The use of color, movement, emphasis, and other visual effects has a positive effect on learning for all students. Student interaction with the visual world of the media is intuitive and effective.
- Students' work. A wide range of possible media that can be used and the ability to students can manipulate them is a big plus for IWB technology. Creating multimedia material on the topic by students stimulate interaction between students through discussion and through direct manipulation with media. The interaction between the students has positive effect on learning. The teacher in this case is the mentor for resource developing and mediator of discussion.
- Interactivity in teaching with the IWB is not a one-way process, but a process where teachers modify their approach to the needs of students. For a successful learning there must exist student interaction with the teacher, resources and other students. Under the interaction is considered not merely physical use IWB by the students, but also the interaction in terms of the exchange of views and ideas with other students and the teacher.

The use of IWB technology encourages more active participation of students in the teaching process. What is certainly important is that the teacher must carefully choose and create teaching resources and successfully manage teaching process in order to avoid the negative connotations of the active participation of students (for example, when a student is exposed to bad comments of his classmates while working drag and drop exercise on IWB). The teacher therefore has to create resources that can present a challenge for the students, but in that way that tasks set before the students are solvable.

The most important factors of effective use of the IWB in teaching are:

- Availability. Some kits interactive whiteboard are mobile and small, practically fit in a small purse. If a teacher wants to use IWB, and bag with the equipment is locked somewhere in school, same teacher will quickly lose interest in using IWB. Without access to the IWB, teacher can't have practice, and consequently the effective use of IWB
- Proper positioning of the IWB in the classroom. If any part of the table is not at hand and not properly positioned, the IWB will not be used efficiently
- Teachers training. Without timely and continuous training there is no effective use of IWB. Teachers who do not have enough self-confidence in using IWB rather will continue to operate as they did before the opportunity to use the IWB. For each IWB takes time to invest in the knowing equipment and practice. In order to use IWB routinely, it's needed at least 10 to 15 hours of using and experimenting, except the initial training. A good part of that training time waste in exploring opportunities of flipchart's software and its capabilities.
- Equal percentage utilization by students as from the teachers. If only teacher uses the IWB, students will quickly lose interest and teaching will be reduced to a situation as same as where we have a computer and a projector, with the difference that teacher stands at the board instead in front of the computer. Using IWB in this way is like driving a new Mercedes with 60 Km/h speed at highway. In this way we do not use half the possibilities of vehicle and path, and further we disrupt other users of highway by driving too slow. Students should be encouraged to use IWB. Students are more attentive in case that one of their friends use IWB, much more than in case that teacher using IWB, they are more willing to communicate, help, discuss.
- The exchange of materials and ideas among teachers. If this exchange does not exist, teachers must prepare learning materials for each topic properly which requires a lot of designing and time. Lately, IWB manufacturers have realized that their products sells better if they offers hardware with resources gallery. These galleries are resource collections of images, multimedia and articles are very similar to the ClipArt in MS Office applications. Each new

software version has bigger and richer resources galleries.

- Technical support. All IWB boards have their own problems. Hardware failures are possible, but in particular, software failures and moodiness are more often case. The first time when teachers encounter a problem and there is not available technical person to help them to solve the problem, self-confidence and the desire to uses IWB dramatically decrease. The existence of technical support is particularly important in the early stages of IWB use while teachers are still not familiar with the IWB technology.

III. BENEFITS AND PROBLEMS OF USE IWB TECHNOLOGY IN TEACHING

What IWB brings to students?

- Students are motivated to work thanks to new technology at the very beginning and later because of its advantages
- Easy understanding of complex concepts (with the IWB we have the ability to highlight and emphasize important parts and manipulate video from your desktop and engage students in the process. Animations are also important resources which often include the ability to change input parameters that cause change output parameters and the analysis of the differences in the results can be a lot to learn).
- Increased capacity to meet different learning styles
- Decreased need for taking notes, everything is on the board can be saved for later replay and analysis, and can be printed
- Teachers adequate use of IWB encourages students to discuss and exchange views
- The result of the previous two points has increased the cooperation between students and active participation of students in the teaching

What IWB brings teachers?

- Integration of ICT in teaching process
- The ability to draw and write at a very different resources (including video, animation, photography, picture, software windows ...)
- The ability to save and print whatever is currently on the board
- The ability to share and re use materials (once prepared materials can be reused and once they make available to their colleagues become widely usable)
- Savings in time because teaching is much more efficient with the pre-prepared lecture material (for example math teacher can use picture of previously prepared coordinate system instead of drawing it).
- Savings in time leads to change the approach and pedagogical practice, there is more time for discussion, verification, analysis, teamwork, ...

Possible problems that may occur when using the interactive whiteboard are:

- Failure to exploit the possibilities of interactive table due to insufficient or incomplete training of teachers
- Partially hiding table by the lecturer or lecturer real shadow that can cover a large part of the visible surface of the projection surface (This problem is solved by adequate UST projectors)
- Several hours standing in front of the projector can be hard for users eyes (This problem is also solved by adequate UST projectors)
- Both students and teachers must have adequate knowledge and skills to effectively use the IWB

IV. CONCLUSION

Using the interactive whiteboard in teaching can significantly affect the educational process and to contribute to a better quality of teaching. The efficiency of the teaching resources largely depends on teachers who should find the best ways for use the great features IWB in their work so that students can be more active and better understand topics and therefore we will have more successful teaching. However, practice shows that teachers are just one side of the coin. Where problems may arise in our schools? In the first place because the technology is often not available to teacher, and if it is available, it is often not properly positioned (set too high or too low, there are physical obstacles in the approach, inappropriately positioned the projector, a shadow on the projecting surface ...). At the other hand, for effective use of IWB technology it is necessary to spend some time for training and practice of teachers, approximately ten to fifteen hours of work, from the first meeting with the IWB technology. If teacher change IWB technology (school has purchased another model of IWB), he or she must spend up to five hours to master

differences in functionality of different models and software. Furthermore, the teachers are often deprived of technical support. After purchasing IWB technology by schools, distributors carry only rudimentary training and do not provide any kind of further technical support. The next problem is the insufficient use of opportunities IWB technology which contributes to the insufficient exchange of materials prepared for use with IWB among teachers. All the reviews of this technology cannot be taken seriously without looking at the context of the educational process and without analyzing the way in which the teachers use the IWB. Efficiencies IWB technology varies from teacher to teacher. Thus, the only relevant way that the teachers will have a clear picture of this technology is to begin to use it and try to improve their practice and also increase the possibilities of using new technologies. The modern approach to teaching, as a condition of quality assurance, implies training of teachers. A teachers which are actively involved in the development of their scientific discipline and continuously improve their pedagogical skills, develop their technical and scientific competence, thus contributing to the quality of teaching.

By using appropriate media and instructional materials designed with respecting standards, raises the motivational aspect of the learning process. Time and future research of IWB technology will show if we overestimated or underestimated the possibilities and importance of IWB, and whether we are up to the task to use this technology properly, or how much we are willing to change our current pedagogical practices in direction of better utilization of opportunities IWB technology.

REFERENCES

[1] Babic-Kekez, S: Popov, S. (2012), Managing Departments And Of Classes Through E-Learning In The State Of Emergency, TTEM, Sarajevo, Vol.7, No. 1, p. 354-361.

[2] Babic - Kekez, S. Tasic, I. (2012), Didactics, University of Novi Sad, Novi Sad.

[3] Beauchamp, G. (2004). Teacher use of the interactive whiteboard (IWB) in primary schools - towards an effective transition framework. Technology, Pedagogy and Education, 13 (3), 329-349.

[4] Harris, S. (2002) Innovative pedagogical practices using ICT in schools in England. Journal of Computer Assisted Learning, 18, 449-458.

[5] Herceg, Dj. (2007), The use of C # in the teaching computer science, Proceedings: Technology, Information Technology, Education., Institute for Educational Research, Belgrade, Center for Development and Application of Science, Technology and Information Novi Sad, Faculty of Sciences in Novi Sad, Page 9 - 15,

[6] Thompson, J. and Flecknoe, M. (2003) Raising attainment with an interactive whiteboard in key stage 2 Management in Education, 17 (3), 29-33.

[7] Woods, D., Bruner, J. S. and Ross, G. (1976) The role of tutoring in problem solving. Journal of Child Psychology and Psychiatry, 17, 89-100.

[8] http://www.smoothboard.net/ (25.2.2013.)

[9] http://www.ansn.edu.au/becta_research_on_iwbs (25.2.2013)

[10] http://www.cnti.info (26.2.2013)

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Abstract - With the purpose of upgrading and enhancing the cooperation, communication and the exchange of teaching material between the students and the professors of the Faculty of Education in Sombor, a model of Cloud Service has been developed based on ownCloud open source software. File exchange is possible through the usage of web clients, workstations or usage of mobile clients of different software platforms (Microsoft Windows, Linux or Mac OS X operating system). The mobile client is available on most Android and Mac OS X clients from cellular to tablet devices (iPhone, iPad).

I. INTRODUCTION

In a variety of publicly accessable services for sharing and exchanging data (chart number 1), a model of Cloud service based on ownCloud has been developed to meet the needs of the students and the professors of the Faculty of Education in Sombor. The service has a primary task of providing access to the teaching material and the data no matter where you go or where you are. Teaching material and data have to be accessable from all platforms and devices. The service was concieved and realised in a way that you can easily access, post, delete, download and sync your teaching materials by using your own computer (PC) through web interface or ownCloud application. Teaching material can consist of files, folders, photos, photo galleries, contacts, calendars, and audio or video recordings. Some of the advantages of this service are:

- The service is available through web interface of FILE EXPLORER.
- Adding new teaching material and foldres is possible by simply dragging (drag and drop) between the application and the ownCloud diretory.
- Organizing the files and folders is very simple, like any regular directory.
- Creating a separate directory for the needs of data sync on your PC and on ownCloud service is available.
- Sharing teaching materials and folders is possible between users of the service also outside the service.
- Deleted files can be restored.
- Search of the teaching material is simple.
- Within the service, browsing and reading without downloading are the options at the user's diposal as well as automatic recongition of the file extension and the launch of an appropriate reader.
- Application Store is also at the user's disposal, which, by simply truning it on, adds, installs and runs a new ownCloud application.
- A high lever of safety and security of the teaching material as well as sensitive files and documents can e achieved.
- Service administrators can now use groups and users through LDAP and active directory.

TABLE 1: SOME OF THE PUBLICLY ACCESSIBLE SERVICES

Web host	***Storage size***	***Maximum file size***	***Direct access***	***Bandwidth limit***	***File expiration***	***Remote uploading***
DropBox	2 GB (max 18) for free users, unlimited for subscribers	300 MB (Unlimited for app users)	-	20 GB for free users, 200 GB for subscribers	90 days for inactive free users	Yes
Amazon Cloud Drive	5 GB	2 GB	No	Amazon limit	None	No
Cloud Safe	2 Gb for free users, 150 GB for subscribers	2 GB	Yes	None	None	Yes
Google Drive	5 GB for free users, 16 TB for subscribers	10 GB	Yes	None	None	Yes
SkyDrive	5 GB (upgradeable up to 25 GB)	4 GB	Yes	None	None	Yes

II. SERVICE ARCHITECTURE

The heart of ownCloud service is the server (picture number 1). With a role defined in this way, the server has many important tasks. Some of the tasks:

- Managing the data and providing security and safety of the data within the system
- Integration of the server and the stored data in the existing infrastructure
- Proper and safe execution of all the initiated processes on the server side
- Administration and management of users and security sertificates

In the very centre of the ownCloud service there is a PHP web application which can be initiated on all popular web servers (Misrosoft IIS or Apache), which are run on different platforms (Windows or Linux).

PHP application is in charge of managing all the aspects of the service, from control to user management all the way to the very storage of the teaching material and files on the memory media. In order to speed up the data access within the service, the PHP application has a data base addition which stores all the user, contact and shared information data. The data base is realised through a wide range of base types: Oracle, MySQL, Postgres, Microsoft SQL server and SQLite. Implementation of the data base on the memory media and the memorised data can be kept in different storage protocols: NFS, GFS, XFS,... If you need to expand storage capacities of the ownCloud service, it is possible to optionally add external file systems such as: FTP, WebDAV, DropBox, Google drive..

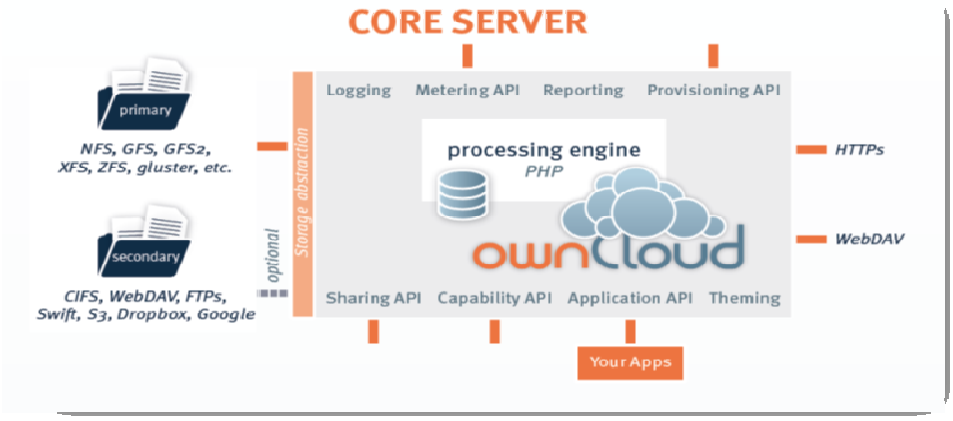

Figure 1. The architecture of ownCloud service

The functioning of the service is based on the execution of ownCloud application on the server side of the service while on the client's side the user can approach and post teaching material by using web browsers or specicfic client application for desktop computers and application for all the leading mobile platforms and devices. Service application for the execution on the server side is developed for the leading web softwares (MS IIS or Apache) with the acitve usage of PHP. Client application is available on all MS Windows (Windows XP, Windows 7, Windows 8, Windows Server 2008), Mac OS X or Linux (openSUSE, Red Hat, CentOS, Fedora, Debian or Ubuntu)operating systems.

In order to launch the server side of the service, the server must have a web server installed (Apache or MS IIS server) with a support for FastCGI and installed support for the following:

- PHP (5.3 or a bigger version)
- Data base (MySQL, Postgres or SQLite, while support for MS SQL server is not yet available)
- Configurate the maximum file size which can be uploaded to server (default size is set to maximum file size of 2 MB, which is not enough even for uploading MP3 files) and set the right directorium permissions needed for unobstructed functioning of the server.

OwnCloud service uses a desktop application for synchronization of the contents of local directories on the desktop computer with the server itself. Constant propagation of the files

guarantees constant syncronization between these two repositories. It means that if a file is uploaded on one side, the syncronization process is launched which syncs the new condition with the condition on the server. If one file deleted (or edited) in one repository the same one is also automatically deleted (edited) in the other repository. Basically, ownCloud application is not a standard client-server apllication where the server is always the master.

Student (client) accesses the content of the ownCloud server, through the system of the service log in. There is no independent client account creation on the server, for opening access accounts and passwords there is an ownCloud administrator responsible. After logging in on the server the student gets work surfaces from multiple units:

1. Navigation bar: provides navigation among different sections of ownCloud (sections for files, music, calendars, pictures...)
2. Application view: section where the content of the launched application is shown. For example, if you run a pdf file, it automatically launches pdf viewer which shows the content of the pdf file.
3. Upload/Create button: Posting new files.
4. Search/Logout: Searchin for specific files under a specific criteria and
5. Settings: Menu access key for adjusting server work setting. For example: setting language localization, selection of working threads, user and active application administration.

Access to the files and teaching materials is possible in various ways. Either by using the file manager, WebDav protocol or the client application. The application is also in charge of executing the process of file syncronization between the client (user of the server) and the ownCloud server. An application was developed for launching on PCs and mobile platforms (tablets or mobile clients/cellular phones). The application can also be installed on Android, iPhone and BlackBerry mobile platforms while on PCs it is intended for Windows, iOS and Linux operating systems.

III. CONCLUSION

The main task and objective of ownCloud service is to get the users accostumed to the usage of cloud technologies. By using ownCloud service we make it easier for our clients and students to access the teaching material, data and folders from various different platforms. Institutions which use this service are liberated of great costs of expensive server hardware, software and their maintenance. Even the end-user and the institution which uses this server eliminate the problem of data privacy and their security. Some of the advantages of the usage of this server are:

- File accessibility from all platforms: desktop computers, laptop computers, tablet computers, smart phones and other mobile devices.
- Guaranteed syncronization of files between different devices and locations.
- Controlled file sharing among service users as well as outside the service.
- Automatic data backup.
- Browsing or editing uploaded files, without using additonal applictaions other than the ones integrated within the service.
- It is possible to syncronize and access addresses, calendars, files, photos, albums, music files.

REFERENCES

[1] Voorsluys, William; Broberg, James; Buyya, Rajkumar (February 2011). "Introduction to Cloud Computing". In R. Buyya, J. Broberg, A.Goscinski. "*Cloud Computing: Principles and Paradigms*". New York, USA: Wiley Press. pp. 1–44. ISBN 978-0-470-88799-8.

[2] Amies, Alex; Sluiman, Harm; Tong, Qiang Guo; Liu, Guo Ning (July 2012). "*Infrastructure as a Service Cloud Concepts*". *Developing and Hosting Applications on the Cloud*. IBM Press. ISBN 978-0-13-306684-5.

[3] Cvetkovic D., Rastovac D., Mandic M. (2012). "*EyeOS – Cloud operativni system za obrayovanje"*, NIR, Internacionalni univerzitet u Brckom, Brcko, BiH (2012), ISSN: 2233-1603, pp. 83-87.

[4] B Rochwerger, J Caceres, RS Montero, D Breitgand, E Elmroth, A Galis, E Levy, IM Llorente, K Nagin, Y Wolfsthal, E Elmroth, J Caceres, M Ben-Yehuda, W Emmerich, F Galan. "The RESERVOIR Model and Architecture for Open Federated Cloud Computing", IBM Journal of Research and Development, Vol. 53, No. 4. (2009)

[5] Hsu, Wen-Hsi L., "Conceptual Framework of Cloud Computing Governance Model - An Education Perspective", IEEE Technology and Engineering Education (ITEE), Vol 7, No 2 (2012

SUBJECT „DISASTER RISK MANAGEMENT“ - SPATIAL CONTEXT

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Abstract - This paper describes possibilities of application of information technology during lectures of the subject "Disaster Risk Management". One of the main goals of the course is to raise an awareness among the students about the existence of the disaster risks and consequences they can cause. As the risks of catastrophic events require to be kept to a minimum it is necessary to implement disaster risk management activities before hazard realization.

The initial phase of the disaster risk management process is identification of potentially harmful events in Southeast Europe region. Data acquisition is performed by searching the available databases: EM-DAT, GLIDE, GDACS.

Students are introduced to the possibility of data acquisition by searching the database. The identification of historical events is performed by analysis of data about the geographic origin of the events. The vector layers associated with the atribute tables are obtained by using the geografic information systems. Created layer presents map of hazards in the area of interest and suitable database for the purpose of disaster risk assesment.

I. DISASTER RISKS

Effective disaster risk management is a requisite for sustainable development and it is paramount to include a wide range of stakeholders to manage risk in this context.

Students at the Department for Environmental Engineering and Safety at Work who chooses study program “Environmental Engineering” have possibility to attend course “Disaster Risk Management”. This course introduces students to the principles of managing disaster risks. Students acquire the knowledge they need to understand the complex processes of managing disaster risks (Disaster risk management cycle; Readiness and early warning systems; The answer to the disaster, rehabilitation and reconstruction; Monitoring, evaluation and improvement of accidental risks management; Disaster risks management and sustainable development).

A disaster is an unusually severe and/or extensive event that usually occurs unexpectedly and has such a severe impact on life and health of many people and/or causes considerable material damage and/or impairs or endangers the life of a large number of people for a long period of time to such an extent that resources and funding available at local or regional level cannot cope without outside help [1].

Defining risk is difficult because it vary from different viewpoints. The most widely accepted theory is that risk is probability of harmful consequences or losses resulting from a given hazard over a specified time period [2]. Perhaps more understanding definition is that disaster risk can be viewed as a function of several components: hazard, vulnerability, exposure, and resilience [3].

Hazard is a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation [4]. Usually, when it is referring to hazards, it deemed to the natural hazards (earthquake, tsunami, volcanic eruption, flood, drought, tornado and hurricane, tropical cyclone, etc.) Manmade hazards are chemical, industrial and nuclear accidents. Still, many of natural hazards can be described like human induced hazards, because their root causes are human activities that cause climatic hazards or amplify existing natural threatens (heat and cold waves, desertification, landslides, floods, drought, etc.).

Vulnerability of populations/areas can be seen as damage potential in terms of intensity of unwanted event on the population/area that is exposed to disaster risk, while exposure to the risk creates the final level (amount) of damage.

Understanding who is vulnerable, and why, can help us to prevent ourselves and our environment from disaster event. All of us are vulnerable to some risk, though to varying degrees.

Risk is the probability of an event multiplied by the consequences if the event occurs [5]. Probability of the event is crucial for decision making (damage-frequency, return period), while vulnerability informs about the consequences of possible adverse events and it is a forward looking variable. The probability of occurrence of adverse events is beyond human control, but on consequences it can be influenced.

Holistic management of disaster risk requires action to reduce impacts of extreme events before, during and after they occur, including technical preventive measures and aspects of socio-economic development designed to reduce human vulnerability to hazards [6].

Risk identification provides an essential baseline for any disaster risk reduction application, from response preparedness to measures for reducing existing risks.

Spatial and temporal indicators are essential for monitoring hazardous events, both preventively and correctively. This data are extremely important because they allow assessment of the nature and population vulnerability to the hazardous events. They also, indicate the possible outcomes of risk realization and raise global awareness about this issue.

Hazard mapping have purpose to integrate hazard exposure and vulnerability information in order to generate risk information, accessible to decision makers who manage risk.

II. DISASTER RISK MANAGEMENT

The risk of catastrofic event is not possible to completely eliminate, but it can be reduced to an acceptable level. Bringing the risk of a catastrophic event at an acceptable level is achieved through timely implementation of risk management activities.

Risk management is a process of analysis, selection, implementation, and evaluation activities to reduce risk. It takes place in five stages: problem identification, risk assessment, risk evaluation, risk control and risk monitoring [7].

Disaster management involves a cycle which should consist of an organized effort to mitigate against, prepare for, respond to, and recover from a disaster [8]. Therefore risk management activities can be carried out before, during and after the occurrence of a catastrophic event. In order to minimize the effects of the occurrence of a catastrophic event ,it is necessary to shift from hazard-related defense to disaster risk management, as well as from emergency management only, the disaster prevention, preparedness and mitigation activities [9]. Therefore, it is necessary to manage risk before it comes to fruition hazardous events in terms of taking proactive measures.

One of the proactive measures whose implementation significantly contributes to effective risk management is the transfer of risks prior to the occurrence of events, i.e. insurance. Smartly designed insurance instruments can provide powerful incentives for reducing risks [10]. The inclusion of insurance in risk management process creates the awareness of the population of the risk and opportunities of each individual's own behavior and actions contribute to the reduction of risk. As part of the study program Engineering and Management Insurance Faculty of Technical Sciences in Novi Sad, students gain practical knowledge on how to with help of insurance effectively manage risk.

The complete disaster management cycle includes the shaping of public policies and plans that either modify the causes of disasters or mitigate their effects on people, property, and infrastructure [11].

III. COLLECTION AND PROCESSING OF DATA NECESSARY FOR THE PROCESS OF DISASTER RISK MANAGEMENT

Despite the fact that effective disaster risk management is paramount in our effort to reduce disaster losses and it is not always easy to implement such processes [12].

The identification of the problem is an important step in creating risk management. If we want to identify, what was the problem, first of all, it is necessary to examine the state of the monitored area or community where problem was. Special attention should be paid to identifying potential adverse drug events in the area of interest. It is necessary to gather information about the events that took place on the area of interest in the past (historical events) in order to identify hazards that have been occurred. For an accurate assessment of probability of occurrence it is necessary to have the largest

possible number of measurements (historical registry) for every hazardous event. According to the law of large numbers, with the increase of the sample, the deviation will decrease, which results in more accurate frequency of an event [9].

Using the Web and the development of on-line database make it much easier, fast, and affordable data collection implemented of catastrophic events. EM-DAT (Emergency Events Database), GLIDE (Global Identifier Number) and GDACS (Global Disaster Alert and Coordination System) are available, organized and timely Web data sources on a variety of parameters generated hazard. The available data are data on the frequency of occurrence of catastrophic events, the number of vulnerable, injured, dead, homeless, material damage as well as area that was affected. Center for Research on the Epidemiology of Disasters and Emergency Relief Coordination Centre (United Nations) are just some of the institutions that manage the maintenance of the above Web sources. Therefore, based on the competence of these institutions, correspondent Web sources can be considered a highly reliable source of accurate information necessary for the process of disaster risk management.

After the acquisition of data on potential hazards it is necessary to collect information about the level of observed preparedness of community for eventual achievement of hazardous events. It is necessary to find out whether there are evacuation plans, whether the rescue teams equipped and trained for a given emergency situation, what the capacity of the community to take care of the affected population, the structure of the population (the percentage of the elderly, children, people with special needs) [13]. A variety of collected data need to be processed in accordance with the requirements of this process. Only after processing the data we obtain information that is still possible to create a risk management strategy that will be most effective for a given case study.

IV. INFORMATION TECHNOLOGIES AS A TOOL FOR DISASTER RISK MANAGEMENT IN EDUCATION

Innovative (information, communication and satellite) technologies are very useful and helpful in every segment of the disaster risk management cycle. One of the possibilities of information technology, which significantly facilitates the detection of problems and making decisions aimed at solving the problem is to bring the collected data in a spatial relationship.

However, practical knowledge of geospatial technologies does not necessarily enable us to effectively deal with uncertainty, such as a disaster, unless we also learn to think spatially [14]. In simpler terms, Bednarz and Bednarz defines spatial thinking as "the knowledge, skills, and habits of mind to use concepts of space (such as distance, direction, distribution, and association), tools of representation (such as maps, graphs and diagrams), and processes of reasoning (such as Cognitive Strategies to Facilitate problem-solving and decision-making) to structure problems, find answers, and express solutions to these problems. "

The entry point for enhancing spatial thinking in disaster risk management is in the diagnosis and analysis stage. Joining the spatial component with data available in the above stages facilitates determining the activities to be undertaken in order to efficiently manage the risks of catastrophic events.

During the teaching of the subject "Disaster Risk Management", students were trained to use the spatial data (spatial thinking) for the purpose of identifying problems and finding solution the practical part. Of the course students are given the task of joining the spatial component data events with catastrophic consequences in South-Eastern Europe, analyze the possibility of establishing cooperation between the Republic of Serbia and the countries of the region for the joint implementation of risk management activities.

For the performance of this case studies it is necessary to collect data about natural hazards that have occurred in the area of interest during the period from 2006 to 2012. year. Bringing data into a spatial relationship is done with the help of QGIS.

It is necessary to carry out the following steps to perform a set of case studies:

1. Identify and collect the data relevant to the case study that’s presented through publicly available databases;
2. Form a vector representation (layer) of Southeastern Europe for each parameter of each identified event using the geometry of polygons in QGIS;
3. Select one of the identified potentially harmful event in the Republic of Serbia;
4. 4. To query the database to QGIS (advanced search) identify states, comparing with Republic of Serbia, that have the same / or more/s

frequency and consequences (total affected, injured, deaths, homeless, property damage) the occurrence of selected events during the specific period;

5. Based on the search results make conclusion by which neighboring countries Republic of Serbia might propose cooperation, i.e. joint implementation of risk management activities to reduce the risk of observed event.

public available online databases. All students are already familiar with the following databases: EM-DAT (Emergency Events Database), GLIDE (Global Identifier Number) and GDACS (Global Disaster Alert and Coordination System). By reviewing the content of above bases, as the most comprehensive and the easiest for customer use was recognized the Emergency Events Database. The content of the analyzed databases is shown in Table I.

TABLE I. THE CONTENTS OF DATABASES

	Disaster Group		Manifestation of Disaster							
	Natural	*Technological*	*Location*	*Date*	*Occurrence*	*Affected*	*Injured*	*Homeless*	*Deaths*	*Property Damage*
EM-DAT	x	x	x	x	x	x	x	x	x	x
GLIDE	x	x	x	x	x	x	x	x	x	
GDACS	x		x	x	x	x		x	x	

A. Data acquisition using the Web

Gathering the necessary data, during the realization of case study, is done by searching

EM-DAT contains essential core data on the occurrence and effects of over 18,000 mass disasters in the world from 1900 to present [15]. The database is organized according to catastrophic events and it is classified into two main categories: natural and technological disasters. The natural disaster category has been divided into five sub-groups (geophysical, meteorological, hydrological, climatological, biological), which in turn cover 12 disaster types and more than 30 sub-types [15].

Except data that contains information about disasters impact on humans (such as the number of people killed, injured or threatened by disaster), EM-DAT also provides estimated economic damage data induced by particular disaster on a specific region. Therefore, it can be said that the EM-DAT provides objective data for assessing vulnerability and setting the priorities in creating disaster risk management strategies.

To all data from the database can be accessed through the open database web site. The website is "user friendly". The search tool is designed to offer the possibility of direct search of generated and verified information about the disaster. The search can be performed at the following levels: Country profiles, profiles Disasters, Disasters list, Advanced Search, Maps and Trends.

For the purpose of this paper, data search was conducted using the tool *Advanced Search.* The Advanced Search allows users to generate data sets based on the EM-DAT recordings. In order to obtain the desired set of data it is necessary to define:

- time period (from year – until year),
- location (continent, region, country) and
- disasters (disaster group, disaster sub-groups, disaster types, disaster sub-types).

In accordance with the set criteria, as a result of data search are obtained frequency of hazards occurrence and data about the consequences of realizing hazard.

Table II shows results of natural hazards data search that occur in the area of the Republic of Serbia in the time period from 2006. to 2012. year. In the same way are collected relevant data and for the other countries of Southeastern Europe (SEE). In order to conduct further analysis, spatial component joins the collected data using QGIS.

TABLE II. RESULTS OF ADVANCHED SEARCH [15]

Results

Download csv

Disaster type	Year	Occurrence	Deaths	Injured	Affected	Homeless	Total affected	Total damage('000 USD)
Earthquake (seismic activity)	2010	1	2	120	25440	1470	27030	132260
Extreme temperature	2007	1	0	0	0	0	0	0
Extreme temperature	2009	1	0	500	0	0	500	0
Extreme temperature	2010	2	5	0	0	0	0	0
Extreme temperature	2012	3	25	0	88234	0	88234	0
Flood	2007	1	0	0	12370	0	12370	0
Flood	2009	1	0	0	3210	0	3210	0
Flood	2010	3	2	0	4900	0	4900	0

B. Forming a vector layer in QGIS

For the purpose of the case study it was necessary to create a vector layer of SEE for each parameter (frequency, total endangered, injured, died, remained without homes, property damage) of each identified event (flood, earthquake, fire, storm). To create desired vector layer the following inputs are required:

- map of Southeastern Europe,
- SEE country coordinates and
- attribute data of the displayed area.

The first step of creating vector in QGIS is forming a shape file. At creating shape file it is necessary to define:

- a geometry that will be used to display spatial data,
- a spatial reference system that is in use and
- attributes that on best way describes presented spatial data.

In creation of shape files were used the geometry of the polygon, WGS84 spatial reference system and the following defined attributes: nation, country name, country abbreviation, event, parameter, year 2006 ... 2012, total. Created shape file in such a way joins the map of SEE by Open Layers plugin. The Open Layers plugin gives the possibility to use the Google Maps web service in QGIS (to use Google Maps as a basis for work in QGIS). Using available maps it has been created a spatial representation of SEE. Thereafter, to created spatial representation it is joined attribute values, for each spatial data. In that way, it has been created the desired vector. Figure 1 presents the attribute table with the assigned attribute values of the floods frequency vector in SEE over the period 2006-2012. To the collected natural hazard data occurred in SEE over the period 2006-2012., it is joined a spatial component by creating a vector.

Attribute table - JI_Evropa_poplava_frekvencija :: 0 / 9 feature(s) selected

	NATION	CNTRYNAME	CNTRYABBR	Disaster	Parameter	Yr_2006	Yr_2007	Yr_2008	Yr_2009	Yr_2010	Yr_2011	Yr_2012	Total
0	387	Bosnia and Hercegovina	BIH	Flood	Frequency	0	0	0	2	2	0	0	4
1	359	Bulgaria	BG	Flood	Frequency	2	3	0	0	1	0	1	7
2	385	Croatia	HR	Flood	Frequency	1	0	0	0	2	0	0	3
3	36	Hungary	H	Flood	Frequency	1	0	0	0	1	0	0	2
4	40	Romania	RO	Flood	Frequency	6	4	1	2	1	0	0	14
5	382	Montenegro	CG	Flood	Frequency	0	1	0	1	2	0	0	4
6	355	Albania	AL	Flood	Frequency	0	0	0	1	1	0	0	2
7	389	Macedonia	MK	Flood	Frequency	1	0	0	0	0	0	0	1
8	381	Serbia	RS	Flood	Frequency	0	1	0	1	3	0	0	5

Figure 1. Attribute table of vector layer in QGIS

C. Data search in QGIS using the Advanced Search tool

By bringing data in a spatial context through QGIS, it has been created a base over which it is possible to carry out inquiries with aim to select available data. Data search within the base associated with shape file is possible to perform using the Advanced Search tool.

Advanced Search provides the ability to search at the attribute level of created attribute table. To search attribute values, function “Fields and Values” needs to be selected. Fields and Values function is one of the functions available in the Advanced Search. To identify the desired dataset, after selecting the function Fields and Values, it is necessary to define the criteria by which the search will be carried out. For example, if we want to identify the countries with higher flood frequency compared to Serbia in the period between 2006. and 2012. year, the search will be conducted at the level of the attribute "Total". When defining the criteria as a reference value, we set the Total number of floods that occurred in the period specified above at the territory of Serbia. After reviewing the value of the attribute "Total", we come to the information that in the territory of Serbia flood occurred five times, during a specified period. Accordingly, it is defined following search criteria: "Total"> 5 (“Total” is greater than five). Setting the criteria and the results of the search are shown in Figure 2.

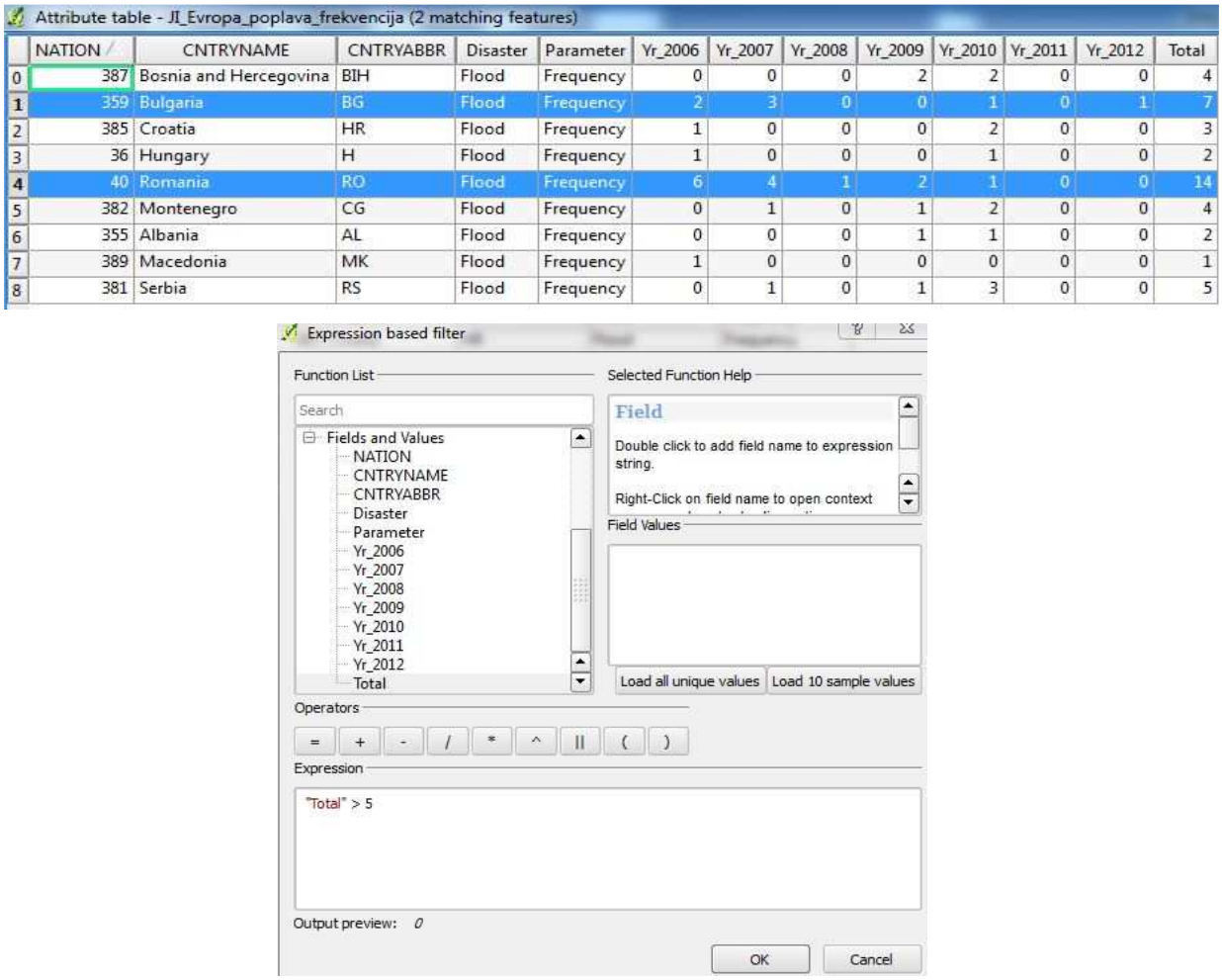

Figure 2. Criteria and the results of the search

D. Results of the case study

One of the results of this case studies is presented in Figure 3. and gives a visual overview vector frequency of potentially harmful events in Southeastern Europe. In the same way it is possible to show all the other parameters of the identified hazards.

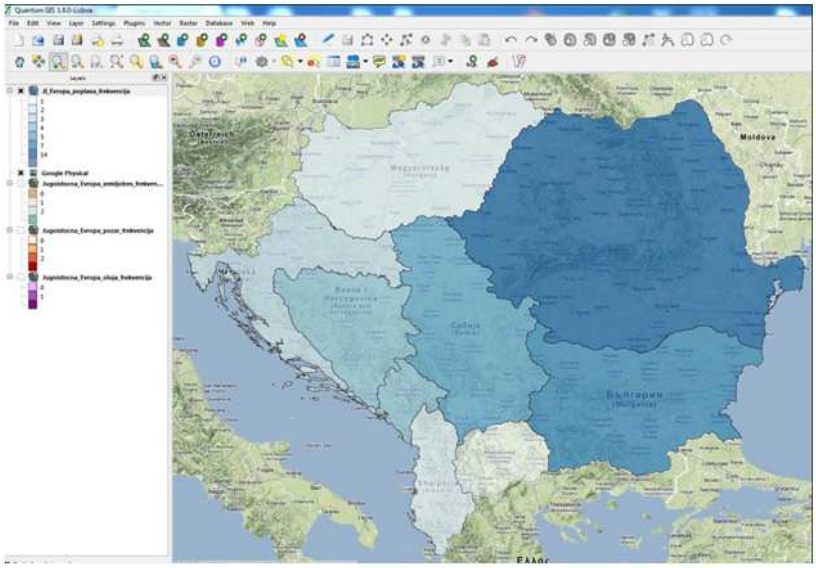

Figure 3. Vector layer in QGIS

Created vectors represent a model of the real system whose analysis it is possible to make decisions during risk management process. By analyzing real team environment in QGIS, we can identify a set of attribute values that satisfy defined criterion.For example.if we want to identify the state of Southeastern Europe compared to the Republic of Serbia that have greater or equal of the frequency of flooding, the analysis of a given visual display shows that there are only two countries that meet the set criteria - Romania and Bulgaria. Also, in this way we recognize data that are not relevant to solving the problem and therefore will not be subject to further analysis. Only files that have been identified as appropriate will be considered when making the final decision. The desired data set we can come and search data within the established base by putting questions to the QGIS. Search results provide insight into the information we need to determine the vulnerability and exposure to areas of interest on which is still possible to carry out a risk assessment of a catastrophic event.

V. FUTURE RESEARCH

During data acquisition about natural hazards in SEE, we faced the problem of the inability to identify the exact location of the natural hazard's occurrence in the period up to 2006th year. In the publicly available databases, data about the catastrophic events in the area of the former republics of Yugoslavia (The Kingdom of Yugoslavia, SFR Yugoslavia, Federal Republic of Yugoslavia, Serbia and Montenegro) are not divided by the member states and have been shown cumulatively. In order to obtain the relevant results of the risk analysis, further research will be focused to solve this recognized problem.

In addition, during analyzed case study it is noticed the need and importance of creating new vector layer. For creating an appropriate risk management strategy, for the observed catastrophic events, it has been identified the following vector layer as significant: settlements, populations, main roads, health centers, fire services, Seveso facilities, flood zones, flood defense line... as areas of interest. Consequently, further research will be focused to collect data necessary for creating listed vectors.

VI. CONCLUSION

By using of GIS as a supplementary tool in the process of risk management, geospatial data and information can be visualized and shared among stakeholders in ways that they can relate to and understand its context and implications.

Bringing data into spatial relations, concept maps, diagrams, graphs and other forms of visualization would be very effective in communicating disaster risks to policymakers an d the general populace.

Spatial thinking is a skill that we have developed and used in everyday life to solve problems using concepts of space, visualization and reasoning. The importance of bringing the data to the spatial relations in teaching of the subject "Disaster Risk Management" is reflected in

to create a generation of students who learn to think spatially in an informed way. Introduction, application and demonstration of appropriate geospatial technologies in the process of teaching can reinforce learning and facilitate absorption of new cognitive skills. Training student to use geoinformation technologies in the field of risk management is encouraged engineering mindset aimed at identifying and solving problems.

ACKNOWLEDGEMENT

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REFERENCES

[1] DKKV (German Committee for Disaster Reduction) (2002): Journalist's Manual on Disaster Management 2002. 7th revised and supplemented edition, DKKV, pp. 216.

[2] S. Schneiderbauer, and D. Ehrlich, „Risk, Hazard and People's Vulnerability to Natural Hazards. A Review of Definitions, Concepts and Data.", European Commission Joint Research Centre (Ed), 2004.

[3] K. Thywissen, "Components of risk, A comparative glossary", United Nations University, Institute for Environment and Human Security, Bon, Germany, 2006.

[4] United Nations, International Strategy for Disaster Reduction (UN/ISDR), "Living with Risk, A global review of disaster reduction initiatives", United Nations, New York and Geneva, 2004

[5] H.H. Einstein, "Landslide Risk Assessment Procedure", Proceedings of Fifth International Symposium On Landslides, Lausanne, pp. 1075-1090, 1988.

[6] R. Few, et al., Linking climate change adaptation and disaster management for sustainable poverty reduction (Synthesis Report for Vulnerability and Adaptation Resource Group, 2006).

[7] D. Sakulski et al., "Disaster risk management", Faculty of technical sciences, Novi Sad, 2012.

[8] L. Montoya, "Geo-data acquisition through mobile GIS and digital video: an urban disaster management perspective", Elsevier, Environmental Modeling & Softvare, vol. 18, pp. 869-876, 2003.

[9] Đ. Ćosic, S. Popov, D. Sakulski and A. Pavlovic, „Geo-Information technology for Disaster Risk Assessment", ACTA GEOTECHNICA SLOVENICA, 2011/1

[10] Lj. Kikinđanin, Đ. Ćosić, D. Sakulski, A. Polovina, „International insurance model for mitigation of climate-related disasters", Proceedings of XV International Scientific Conference on Industrial Systems (IS'11), Novi Sad, Serbia, September 14 – 16, 2011.

[11] C. Warfield, "The Disaster Management Cycle", 2008. Available at: http://www.gdrc.org/uem/disasters/1-dm_cycle.html

[12] P. Becker, H. Tehler, „Constructing a common holistic description of what is valuable and important to protect: Apossible requisite for disaster risk management", International Journal of Disaster Risk Reduction, 2013, Avaliable at: http://dx.doi.org/10.1016/j.ijdrr.2013.03.005i

[13] J.Simic et al., „Disaster risk management Web enabled information technology", Proceedings of International Conference on Applied Internet and Information Technologies 2012: AIIT 2012, Zrenjanin, Serbia, October 22, 2012, pp. 219-223.

[14] R.S. Bednarz, S.W. Bednarz, „The importance of Spatial Thinking in an Uncertain World", In: Sui D, Cutter SL, editors. Geospatial Technologies and Homeland Security: Research Frontiers and Challenges, New York: Springer, 2008, pp. 315-30.

[15] Centre for Research on the Epidemiology of Disasters, The International Disaster Database, avaliable at: http://www.emdat.be

EVALUATION OF WEB BASED INTELLIGENT E-LEARNING REPORT SYSTEM

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Abstract - The paper presents an aspect of the evaluation of an intelligent, web-based reporting system that has been created in order to obtain a report on patterns of behavior of future users of learning management system. A "subjective" aspect of the evaluation conducted by surveying teachers who use existing reporting system is presented in this paper. Suggestions for improvement have been determined and will be implemented in future work.

I. INTRODUCTION

E-learning, in the broadest sense, entails the use of information and communications technologies (ICT) as an aid in the process of education. The notion of E-learning nowadays implies the use of wireless and mobile technologies, as well as virtual worlds [1].

The expansion of E-learning has led to an increased use of Learning Management Systems (LMS).

The use of these systems has resulted in a need for monitoring the patterns of behavior of LMS users, with the aim of continuous improvement of the educational process.

Virtual learning environments such as Learning Management Systems are becoming more and more prevalent at universities. In addition to providing a wide range of possibilities in the process of blended learning, they also enable the planning of the whole teaching process by electronic means and facilitate the process of lifelong learning [2]. These systems are a good pedagogical basis for most of the activities that a student is expected to perform, since they require less effort, time and money and they are not limited in terms of the access point [3, 4].

Each learning management system contains a database with a record of the activities of each participant. This feature is of paramount importance because it allows a large amount of data to be retrieved in a fairly short period of time. However, many of these records require specialized tools for the extraction and processing of useful information. These tools have limited possibilities and their use is mostly reliant on the choice of administrator, depending on the type of information that needs to be extracted.

Data mining techniques provide a universal solution to this problem, with the possibility of enhancing the E-learning system [5, 6]. Data mining (also referred to as knowledge discovery in databases (KDD)) provides automatic extraction of implicit and interesting patterns out of very large databases [7]. The application of data mining techniques with the aim of discovering patterns from the Web is called Web mining.

In addition to the problem of analyzing the record of participants' activities, there is a need for improving the part of the learning management system which relates to reporting. This entails the use of intelligent possibilities in the analysis of user behavior patterns.

The current reporting system is improved by the addition of intelligent reporting capabilities in real-time. Teacher and creator of the courses are allowed to enter the input data (eg, course, activity, year, day, hour, minute). After analyzes the teacher receives a recommendation which module to use in the future.

Since the intelligent system for predicting future behavior patterns has already been created [8], this paper presents only an aspect of the evaluation of the created system.

II. RESEARCH METHODOLOGY

Created system integrates the results obtained with OLAP analysis and data mining techniques. OLAP is used in order to obtain precise information about the activities of the users that are not currently available within the system for reporting.

Data mining techniques are used to predict future patterns of user behavior within the Moodle learning management system. After entering the input data and analysis teacher receives recommendations on the selection of modules for a

given input. These results make it possible to organize classes in a different user friendly way.

Arhitecture of the created system is shown on the figure 1.

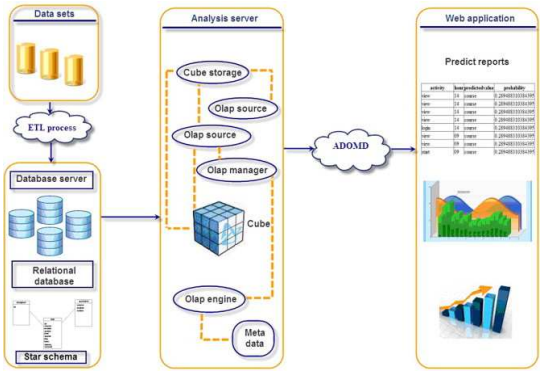

Figure 1. Arhitecture of the created system [8]

Evaluation of the created system was done in two ways. First one is selected use case over which it evaluated whether the designed system meets the set requirements.

Figure 2 shows the part where the user enters data and the obtained result. In Figure 2 is presented a part of the analysis relating to data mining techniques, and Figure 3 part of the OLAP analysis.

Id Kursa	Aktivnost	Godina	Mesec	Dan ime	Sat	Broj Studenata	Modul
120	view	2014	01	sreda	10	23	assignment

Figure 2. Part of data mining results

As can be seen in Figure 2, the input data are: id of course, activity, year, month, day, hour, and number of students. For those inputs proposed module is assignment.

Modul	Aktivnost	četvrtak	nedelja	petak
⊞ assignment	Total	9	52	37
⊞ blog	Total	4	1	15
⊞ chat	Total			3

Figure 3. Part of OLAP results

Figure 3 shows a portion of the results obtained with OLAP analysis. Here is given the number of access individual modules such as assignment, blog and chat for a selected period. The results can be further processed or visualized, according to user needs.

This paper describes a part of the evaluation that was conducted subjective method, questioning users via surveys.

A subjective evaluation was obtained by means of a survey conducted among the teaching staff of the Faculty of Technical Sciences in Čačak who use the Moodle system. The teaching staff use the system by designing one or more courses, depending on the number of courses they are teaching. They use electronic courses as a complement to the traditional teaching method. It remains upon the teachers to determine the measure in which the students will use the courses and the way they should be used, in terms of time, type and scope of the activities, as well as students' obligations with respect to this method of teaching.

The survey included 30 teachers who use the Moodle Learning Management System.

Table I presents the basic characteristics of the respondents.

TABLE I. INFORMATION ABOUT RESPONDENTS

Gender	Frequency	Percentage	Valid percentage
Male	16	53.3	53.3
Female	14	46.7	46.7
Total	30	100.0	100.0

III. RESULTS AND DISCUSSION

The results of the conducted survey are presented in this section in the form of questions and answers.

Question 1

Have you ever used/Are you using the current report system within the Moddle learning management system?

a) Yes b) No c) I don't know

The purpose of the first question is to determine the proportion of use of the existing report system.

The analysis of the results has shown that the majority of respondents (76.7%) use the report system, as shown in Table II. The analysis has been conducted using SPSS 17 program [9].

TABLE II. INFORMATION ABOUT RESPONDENTS REGARDING THE USE OF THE REPORT SYSTEM

Use of current system	Frequency	Percentage	Valid percentage
Yes	23	76.7	76.7
No	7	23.3	23.3
Total	30	100.0	100.0

Question 2

To what extent are you satisfied with the current report system?

1. Completely satisfied
2. Mostly satisfied
3. Cannot tell
4. Not thoroughly satisfied
5. Mostly dissatisfied

The second question refers to satisfaction with the current report system and its aim is to ascertain whether there is a need for enhancing the said system. Since 23.3% of teachers do not even use the current report system, only the answers of those who use it have been subjected to analysis.

The results are presented in Figure 4.

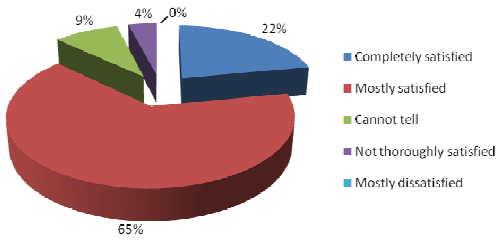

Figure 4. A graphic representation of respondents' satisfaction with the current system

As shown in Figure 4, the greatest percentage of teachers who use the report system is either completely or mostly satisfied with it, which leaves room for improvement. Improvement is done by creating a Moodle plugin that approach to intelligent reporting of course, without entering the system for reporting.

Question 3

Would it be useful for the teaching process if you could predict future behavior patterns of your students?

a) Yes b) No c) I don't know

In order to adequately analyze this question, the teachers were divided in two groups - those who use the report system and those who don't.

A statistical method of bivariate correlation has been applied in order to determine the correlation between the two variables. The Pearson's coefficient of linear correlation has been calculated [10].

The results are presented in Table III.

TABLE III. CORRELATION AND PEARSON'S COEFFICIENT FOR QUESTION 3

		Usefulness of prediction	Use of current system
Usefulness of prediction	**Pearson** **Sig.** **N**	1 30	0.559 0.000 30
Use of current system	**Pearson** **Sig.** **N**	0.559 0.000 30	1 30

As shown in Table III, N refers to the number of respondents. Pearson's coefficient is 0.559, but there is a positive correlation between the use of the current report system and the usefulness of the system for predicting behavior patterns.

The value of Pearson's coefficient of correlation can range from -1 to 1.

According to Cohen [11], if the value of this coefficient exceeds 0.5, as it does in this case, the correlation is strong. This means that there is a strong relationship between the previous use of the report system and the need for introducing prediction of user behavior patterns.

The coefficient of determination in this case is 31.2% which shows the common variance of the two variables.

Since the Sig. value is 0.000, it is possible to say that the results are reliable, but as the sample was drawn from 30 respondents, the obtained correlation is moderate.

Question 4

4.1 To what extent is the newly-created program useful in predicting activities within different modules?

1. Entirely satisfies the needs
2. Mostly satisfies the needs
3. Cannot tell
4. Mostly fails to satisfy the needs
5. Totally fails to satisfy the needs

The correlation has also been determined for question 4.1. It is the correlation between the need for predicting behavior patterns and the level of satisfaction with the newly-created system.

A statistical overview of answers to this question has previously been provided (see Figure 5).

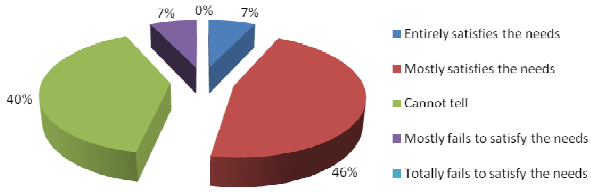

Figure 5. A graphic representation of respondents' satisfaction with the current system

As shown in Figure 5, the greatest percentage of users is mostly satisfied with the created system, but a significant percentage of users (40%) cannot decide whether or not they are satisfied.

In order to determine the correlation between the users who cannot decide whether they are satisfied with the report system and the need for predicting user behavior patterns, Pearson's coefficient has been calculated for both correlations (see Tables IV and V). 7% of the total

number of respondents is completely satisfied with the newly-created system, but the same percentage claims that the use of the current system would fail to satisfy their needs. These users have also suggested ways of improving the system and their suggestions will be considered separately in the "Improvements" stage.

TABLE IV. CORRELATION AND PEARSON'S COEFFICIENT FOR QUESTION 4.1

		Satisfaction with newly-created system	Use of current system
Satisfaction with newly-created system	**Pearson**	1	0.190
	Sig.		0.314
	N	30	30
Use of current system	**Pearson**	0.190	1
	Sig.	0.314	
	N	30	30

According to the results given in Table IV., Pearson's coefficient of correlation is 0.190, which implies a positive correlation between the use of the existing system and satisfaction with the newly-created system.

According to Cohen [11], if the value of this coefficient ranges from 0.10 to 0.29, the correlation is small, which implies a weak relationship between the use of the existing system and the results referring to satisfaction with the new system.

Since the Sig. value is 0.314, the obtained results should be viewed with caution.

TABLE V. CORRELATION AND PEARSON'S COEFFICIENT FOR QUESTION 4.2

		Satisfaction with new system	Need for prediction
Satisfaction with new system	**Pearson**	1	0.390
	Sig.		0.033
	N	30	30
Need for prediction	**Pearson**	0.390	1
	Sig.	0.033	
	N	30	30

Pearson's coefficient in Table V is 0.390, which means that there is a positive correlation between the need for predicting user behavior patterns and satisfaction with the new system.

According to Cohen [11], if the value of this coefficient ranges from 0.30 to 0.49, as in this case, the correlation is moderate, which means that the relationship between the need for prediction and satisfaction with the newly-created system is moderate.

Since the Sig. value is 0.033, the obtained results should be viewed with caution.

4.2 To what extent is the newly-created system user-friendly?

1. Completely user-friendly
2. Partly user-friendly
3. Not at all user-friendly

In order to determine whether there is a need for providing training in the use of the created system, the users have been surveyed in the section which refers to user-friendliness. The obtained results are shown in Figure 6.

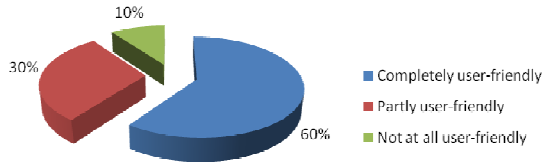

Figure 6. Users' opinions about user-friendliness of the created system

Figure 6 shows that 60% of respondents find the system completely user-friendly. However, the remaining 40% of respondents find the system partly user-friendly or not at all user-friendly. Due to the specified percentage of teachers who believe that the system is not user friendly, made the creation of video tutorials that teachers gradually explains capabilities of the system.

IV. CONCLUSION

The paper presents an aspect of the evaluation of the created intelligent system for predicting user bahavior patterns. The results indicate a need for the improvement of the existing system and a wholehearted acceptance of the new system. Since the newly-created system provides access probabilities, the teacher is in a position to organize the teaching process according to these results. With subjective evaluation of the system were obtained significant results that can be used in improving the system. In addition, the results indicate the need for further clarification of the way of functioning of the system, which is done by creating video tutorials for users. Future work relates to the authorization of the system and the addition of other modules.

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REFERENCES

[1] Julie Willems, Using learning styles data to inform e-learning design: A study comparing undergraduates, postgraduates and e-edu Retrieved from: http://www.ascilite.org.au/ajet/ajet27/willems.pdf

[2] Zorilla, M., Garcia, D., Alvarez, E.A Decision Support System to improve e-Learning Environments, Retrieved from: http://www.edbt.org/Proceedings/2010-Lausanne/workshops/beweb/papers/edbt_2010_submission_558.pdf

[3] S. Prakasam, R.M. Suresh, An Agent-based Intelligent System to Enhance E-Learning through Mining Techniques**,** Int. J. Comput. Sci. Eng. 2, 2010, pp. 759–763.

[4] Y. Lee, J. Choi, A Review of Online Course Dropout Research: Implications for Practice and Future Research, Edu. Tech. Res. Dev. 59, 2011, pp. 593–618.

[5] O. Zaïane, J. Luo, Web Usage Mining for a Better Web-based Learning Environment, in: Proceedings of Conference on Advanced Technology for Education, Banff, Alberta, 2001, pp. 60–64.

[6] C. Romero, S. Ventura, Data Mining in e-learning, Wit Press, Southampton, UK, 2006.

[7] W. Klosgen, J. Zitkow, Handbook of Data Mining and Knowledge Discovery, Oxford University Press, New York, 2002.

[8] Blagojevic M, Micic Z . A web-based intelligent report e-learning system using data mining techniques. Computers and Electrical Engineering, Volume 39, Issue 2, (2013) pp. 465-474. ISSN 0045-7906

[9] SPSS 17 softver, http://www-01.ibm.com/software/analytics/spss/

[10] http://www.une.edu.au/WebStat/unit_materials/c4_descriptive_statistics/pearsons_coeff.html

[11] Cohen, J.W. Statistical power analysis for the behavioural sciences, Hillsdale, NJ: Lawrence Erlbaum Associates

REQUIREMENTS QUALITY ONLINE COURSES

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Abstract - Every day on the Internet appear online courses (good, bad, free, expensive, legal, illegal, ...). They can be of great benefit, especially to people who, because of a lack of free time can not attend face-to-face teaching, and have a duty of continuous professional development. In this great offer is really difficult to choose the right one that will fully meet the strict criteria. In this paper we point to the conditions and requirements that may significantly facilitate students making their final decision regarding the selection of different forms of online training.

I. INTRODUCTION

Suffice it to connect to the internet and in the short time I have lavished on advertising on various online courses. From foreign to domestic. Whenever I see them I think that you can just fill out a registration form, enter your information and sign up for some of them in a matter of days the certificate is. Certificate of having passed the course, which will of course recognize all. Therefore, I decided to go a little further analyze this topic. First, I found that a large number of platforms that allow authors courses quickly and easily (sometimes free, sometimes not) create and deploy courses. As with everything in this area is dominated by a few companies that original solutions are no longer on the market, with most of its clients, which collaborate with the most eminent universities around the world, and that her career prescribed rules and establish standards to be met by online courses, because this issue very seriously. The hypothesis of this paper will set so that it can all future users and online courses help students to choose the best possible quality of course, that is to recognize those who truly meet the necessary standards. Hypothesis: standard courses are an important factor in raising the quality of online courses, without respect there is no quality standards and a recognized course. That means that anyone who wants to attend the course should keep in mind that they will not succeed if you expand your knowledge of the chosen course does not meet basic standards that will be discussed in this paper.

II. COURSE DESIGN

Course Design addresses elements of instructional design. For the purpose of this program, course design includes such elements as structure of the course, learning objectives, organization of content, and instructional strategies.

A. Goals and Objectives

Exemplary: Goals and objectives are easily located within the course; Goals and objectives are clearly written at the appropriate level and reflect desired outcomes; Goals and objectives are written in measureable outcomes (students know what they are expected to be able to do); Goals and objectives are made available in a variety of areas in the course (within the syllabus and each individual learning unit).

Accomplished: Goals and objectives are located within the course syllabus or the individual learning units; Objectives are written to reflect desired learning outcomes, although not all are written as measureable outcomes; Students have some understanding of what is expected of them.

Promising: Goals and objectives are not easily located within the course; Goals and objective are not clearly written in measurable learning outcomes Students may be unsure of what they are expected to be able to do; The level does not match the desired outcomes.

Incomplete: Goals and objectives are not easily located within the course; Some are missing and others poorly written; The level does not match the desired learning outcomes.

B. Content Presentation:

Exemplary: Content is made available or “chunked” in manageable segments (i.e., presented in distinct learning units or modules); Navigation is intuitive; Content flows in a logical progression; Content is presented using a variety of appropriate mechanisms (content modules, single pages, links to external resources,); Content is enhanced with

visual and auditory elements; supplementary resources are made available and are well-integrated with other course materials (integrated publisher resources, e-textbooks, course manuals, etc.).

Accomplished: Content is made available or "chunked" in manageable segments (i.e., presented in distinct learning units or modules); Navigation is somewhat intuitive, but some "exploring" is required to determine the flow of content; Content is presented using a variety of mechanisms (content modules, single pages, links to external resources, RSS Feeds, print material); Visual and/or auditory elements occasionally enhance the content; supplementary resources are made available (course CDs, textbooks, course manuals, etc.).

Promising: Some content segments are overly large (or possibly too small) for the specified objectives Navigation is only occasionally intuitive, thus the flow of content is sometimes not easily determined; The design does not avail of the content presentation tools (content modules, single pages, links); Few or no visual and/ or auditory elements are used to enhance the content; Supplementary resources may be made available (course CDs, textbooks, course manuals, etc.).

Incomplete: Content is not "chunked" into manageable segments; Navigation is not intuitive and the flow of content is unclear; The design does not avail of the content presentation tools (content modules, single pages, links); No visual or auditory elements are used to enhance the content; Supplementary resources are not made available (course CDs, textbooks, course manuals, etc.).

C. Learner Engagement

Exemplary: It is clear how the instructional strategies will enable students to reach course goals and objectives; Course design includes guidance for learners to work with content in meaningful ways; Higher order thinking (e.g., analysis, problem solving, or critical reflection) is expected of learners and explained with examples or models Individualized instruction, remedial activities, or resources for advanced learning activities, such as integrated publisher resources, are provided.

Accomplished: Instructional strategies are designed to help students to reach course goals and objectives, although this relationship may not be obvious to learners; Guidance is provided, but could be improved with greater detail or depth Higher order thinking is required for some activities but is not well-explained or supported (e.g., by providing examples of "good answers") Differentiated instruction (such as remediation) may be available on a limited basis

Promising: It is not clear how the instructional strategies will help learners achieve course goals and objectives Guidance in using content materials may only be provided on a limited basis Higher order thinking is not required or encouraged Differentiated instructional opportunities are not provided, although there may be supplementary content resources available

Incomplete: Instructional strategies do not provide students with skills needed to achieve course goals and objectives Content is provided but it is not clear what students are expected to do with it Higher order thinking is not expected from students No supplementary resources or activities are provided for remediation or advanced study

D. Technology Use

Exemplary: Tools available within the LMS are used to facilitate learning by engaging students with course content LMS tools are used to reduce the labor-intensity of learning (e.g., providing links to needed resources where they will be used in the course, integrating publisher resources that are tailored to the course materials, and providing streamlined access to supplementary materials) Technologies are used creatively in ways that transcend traditional, teacher-centered instruction A wide variety of delivery media are incorporated into the course

Accomplished: Tools available within the LMS could be utilized more (or more creatively) to engage learners with course content LMS tools are made available to assist students, but could be organized or arranged for even greater usefulness Technologies within the course are used in many cases merely to replicate traditional face-to-face instruction There is some variety in the tools used to deliver instruction

Promising: Tools available within the LMS are not used to their full extent or not used when it would be appropriate to do so Only a few tools (of those available within the LMS) are used in a way that streamlines access to materials and activities for students Technologies within the LMS are used primarily by instructors and not students ("students as recipients of content" model); There is little variety in use of technologies within the LMS.

Incomplete: Technologies used within the LMS do not engage students with learning; Tools that could reduce the laborintensity of online instruction are not utilized; Students are not expected to use technologies available within the LMS; Only a few technologies available within the LMS are used.

III. INTERACTION AND COLLABORATION

Interaction and Collaboration can take many forms. The ECP criteria place emphasis on the type and amount of interaction and collaboration within an online environment. Interaction denotes communication between and among learners and instructors, synchronously or asynchronously. Collaboration is a subset of interaction and refers specifically to those activities in which groups are working interdependently toward a shared result. This differs from group activities that can be completed by students working independently of one another and then combining the results, much as one would when assembling a jigsaw puzzle with parts of the puzzle worked out separately then assembled together. A learning community is defined here as the sense of belonging to a group, rather than each student perceiving himself/herself studying independently [1].

A. Communication Strategies

Exemplary: There are plentiful opportunities for synchronous and/or asynchronous interaction, as appropriate; Asynchronous communication strategies promote critical reflection or other higher order thinking aligned with learning objectives; Synchronous communication activities benefit from real-time interactions and facilitate "rapid response" communication (i.e., students gain practice discussing course content extemporaneously without looking up basic, declarative information).

Accomplished: Several communication activities are included to reinforce the desired learning outcomes; Asynchronous communications sometimes require reflection or other higher order thinking; Synchronous interactions are meaningful but may not take full advantage of the realtime presence of instructor and/or peers.

Promising: Communication strategies are included, however, they may not consistently reinforce desired learning outcomes; Asynchronous communications are focused primarily on lower levels of thinking (e.g., summarizing, describing, interpreting, etc.); Synchronous interactions are used mostly for instructor explanation or clarification of content, or other instructor-focused activities.

Incomplete: Little to no attention has been devoted to communication strategies; Interaction activities that are included do not invoke critical thinking, reinforce learning, or take advantage of the specific strengths of the communication tools used.

B. Development of Learning Community

Exemplary: Communication activities are designed to help build a sense of community among learners Student-to-student interactions are required as part of the course; Students are encouraged to initiate communication with the instructor; Collaboration activities (if included) reinforce course content and learning outcomes, while building workplace-useful skills such as teamwork, cooperation, negotiation, and consensus-building.

Accomplished: Communication activities may help learners build a sense of community, but do not appear to be designed with this in mind; Some student-to-student interaction is built into the course Students interact with the instructor, although primarily as a result of instructorinitiated contact; Collaboration activities (if included) support some team-building skills, but may not purposefully integrate these elements.

Promising: Effort has been devoted to fostering a sense of community in the course, but only minimally; More focus is needed on designing activities and a course climate that foster student-to-student interactions as well as student-to-instructor interactions.

Incomplete: Little to no attention has been devoted to building a sense of community in this course.

C. Interaction Logistics

Exemplary: Guidelines explaining required levels of participation (i.e., quantity of interactions) are provided; Expectations regarding the quality of communications (e.g., what constitutes a "good" answer) are clearly defined; A rubric or equivalent grading document is included to explain how participation will be evaluated; The instructor actively participates in communication activities, including providing feedback to students; The instructor uses communication tools to provide course updates, reminders, special announcements, etc.

Accomplished: Expectations of student participation in communication activities are given, but would benefit from more detail; Expectations regarding the quality of communications are included, but may be sketchy and lack detail or illustrative examples; Minimal information may be provided regarding grading criteria for communications activities; The instructor is occasionally involved in communication activities; The instructor sometimes takes advantage of LMS tools to post announcements, reminders, etc.

Promising: Instructor expectations of student interactions are not made clear; Little information is provided regarding what constitutes a "good" response or posting; Students are not given a clear set of criteria for how communications activities will be graded; The instructor appears to be largely absent from communication activities.

Incomplete: Few announcements, reminders, or other updates are provided; Few or no guidelines are provided to students regarding the desired quantity or quality of communications/ interactions within the course; The instructor does not participate in communications activities with students.

IV. ASSESSMENT

Assessment focuses on instructional activities designed to measure progress towards learning outcomes, provide feedback to students and instructor, and/or enable grade assignment. This section addresses the quality and type of student assessments within the course [2].

A. Expectations

Exemplary: Assessments match the goals & objectives; Learners are directed to the appropriate objective(s) for each assessment; Rubrics or descriptive criteria for desired outcomes are provided (models of "good work" may be shown, for example); Instructions are written clearly and with sufficient detail to ensure understanding.

Accomplished: Assessments match the goals & objectives; Rubrics or descriptive criteria for desired outcomes are included for some assessment activities Instructions are written clearly, with some detail included.

Promising: Students are assessed on the topics described in the course goals and objectives; There may be some explanation of how assessments will be scored/ graded; Instructions lack detail that would help students understand how to complete the activities.

Incomplete: Assessments bear little resemblance to goals & objectives; Expectations or grading criteria are not provided; Instructions are limited or absent.

B. Assessment Design

Exemplary: Assessments appear to measure the performance they claim to measure (e.g., activities are explained using appropriate reading level and vocabulary); Higher order thinking is required (e.g., analysis, problem-solving, etc.); Assessments are designed to mimic authentic environments to facilitate transfer; Assessment activities occur frequently throughout the duration of the course; Multiple types of assessments are used (research project, objective test, discussions, etc.).

Accomplished: Assessment activities have "face validity" (i.e., they appear to match the curriculum); Some activities involve higher order thinking; Assessment activities may focus on tasks similar to real-world application of skills; Multiple assessments are included; at least three different types of assessments are used.

Promising: It is not clear whether the assessment activities actually measure the desired skill; The vast majority ofassessments require only low-level thinking (memorization, for example); Assessment activities typically do not include tasks that are relevant beyond the scope of this course; multiple assessments are included; Two types of assessments are included, at a minimum.

Incomplete: Assessment activities appear to lack validity due to bias, lack of clarity in questions or tasks, or because students are evaluated on performance unrelated to the stated objectives; No higher-order thinking skills are required to complete assessment activities; There is little or no evidence of authenticity built into assessments; Assessments are too few and far apart for the course content.

C. Selfassessment

Exemplary: Many opportunities for self-assessment are provided; Self-assessments provide constructive, meaningful feedback.

Accomplished: Some self-assessment activities are included; Self-assessments provide feedback to learners.

Promising: There may be selfassessment activities, but they are limited in scope and do not offer useful feedback.

Incomplete: A few self-assessments may be included, but they offer little more feedback than flash cards.

V. LEARNER SUPPORT

Learner Support addresses the support resources made available to students taking the course. Such resources may be accessible within or external to the course environment. Specifically, learner support resources address a variety of student services [3].

A. Orientation to Course and LMS

Exemplary: Clearly labeled tutorial materials that explain how to navigate the LMS and the specific course are included; Tutorials are found easily (few clicks) whether internal or external to the course, with easy return to other areas of the course; Tutorial materials support multiple learning modalities: audio, visual, and text based.

Accomplished: Clearly labeled tutorial materials that explain how to navigate the LMS and the specific course are included; Tutorials may not be easily accessed, or require the learner to leave course site without an easy return; Tutorial materials support multiple learning modalities: audio, visual, and text based.

Promising: Tutorial materials that explain how to navigate the LMS and/or the specific course may be evident, but not easily found; Materials do not support multiple learning modalities and are textbased only.

Incomplete: Tutorial materials explaining how to navigate the LMS or the specific course may be included but are difficult to find, lack detail, are not well organized, or are incomplete; Tutorial materials that are included do not support learning modalities

B. Supportive Software (Plug-ins)

Exemplary: Clear explanations of optional and/or required software including any additional costs are provided within the course; Software required to use course materials is listed with links to where it can be captured and installed; Links are located within the course where learners will use the software (i.e., near the materials requiring its use).

Accomplished: Clear explanations of optional and/or required software (in addition to the LMS) are provided within the course; Software required to use course materials is listed but links to where it can be captured and installed are not found near where it will be used.

Promising: Software (in addition to the LMS) required to use course materials is mentioned, but not explained; Links to where it can be captured and installed are provided, although they may not be conveniently located.

Incomplete: The need for additional software required to use course materials may be mentioned; Links to software may be missing or incomplete.

C. Instructor Role and Information

Exemplary: Contact information for the instructor is easy to find and includes multiple forms of communication (for example, e-mail, phone, chat, etc.); Expected response time for e-mail replies is included; The instructor's role within the course is explained (for example, whether he/she will respond to "tech support" type questions); The instructor's methods of collecting and returning work are clearly explained.

Accomplished: Contact information for the instructor is included but may not be easy to find; contact information includes more than one type of communication tool; Expected response time for e-mail replies may be included; Instructor's role within the course is not clearly spelled out to students; The instructor's methods of collecting and returning work are clearly explained.

Promising: Contact information for the instructor is provided but not easy to find; Contact information includes only one way to reach the instructor; Information concerning response time for e-mail replies is not included; Little or no information is given regarding the instructor's role in the course; The instructor's methods of collecting and returning work are evident but not clearly explained.

Incomplete: Contact information for the instructor is sketchy, at best; Lacks information concerning response time for e-mail replies is included; Information regarding the instructor's role in the course is not included; Instructor's methods of collecting and returning work are confusing or non-existent.

D. Course/Institutional Policies & Support

Exemplary: Links to institutional policies, materials, and forms relevant for learner success (for example, plagiarism policies) are clearly

labeled and easy to find; Links allow easy navigation from the course to the information and back; course/instructor policies regarding decorum, behavior, and netiquette are easy to find and written clearly to avoid confusion; Links to institutional services such as the library, or writing center, are clearly labeled and easy to find.

Accomplished: Links to institutional policies, materials, and forms relevant for learner success (for example, plagiarism policies) are included but may require searching to find; Links allow easy navigation from the course to the information and back; Course/instructor policies regarding decorum, behavior, and netiquette are included and are written clearly to avoid confusion; Links to institutional services such as the library, writing center, or financial aid office may be included but require searching to find.

Promising: Links to some institutional policies, materials, and forms relevant for learner success (for example, plagiarism policies) are included but are difficult to find; Course/instructor policies regarding decorum, behavior, and netiquette are included but are not clearly written or would benefit from more detail; A few links to institutional services such as the library, writing center, or financial aid office may be included but require searching to find.

Incomplete: Links to some institutional policies, materials, and forms relevant for learner success (for example, plagiarism policies) are not included; Some course/instructor policies regarding decorum, behavior, and netiquette may be included but are not clearly written or would benefit from more detail; Links to institutional services such as the library, writing center, or financial aid office are not included.

E. Technical Accessibility Issues

Exemplary: Course materials use standard formats to ensure accessibility; If specific software is required to which some learners may not have access, alternative file types are provided; Large files are identified to help learners consider download times; Alternative (smaller) files are provided where appropriate; Videos are streamed whenever possible; graphics are optimized for web delivery and display without needing extensive scrolling.

Accomplished: Course materials use standard formats to ensure accessibility; If specific software is required to which some learners may not have access, alternative file types are sometimes provided; Large files are not identified as such; alternative (smaller) files are not provided; Video files are streamed in some cases; Graphics are not be optimized for web delivery but display without extensive scrolling.

Promising: Course materials use standard formats to ensure accessibility; If specific software is required to which some learners may not have access, alternative file types are not provided; Large files are not identified as such and alternative (smaller) files are not provided Video files are not streamed; Graphics are not optimized for web delivery and may require extensive scrolling.

Incomplete: Course materials sometimes use standard formats to ensure accessibility; If specific software is required to access course materials, no mention of this is included and alternative file types are not provided; Large files are not identified as such and alternative (smaller) files are not provided; Video files are not streamed; Graphic files are not optimized for web delivery and require extensive scrolling.

F. Accommodations for Disabilities

Exemplary: Supportive mechanisms allow learners with disabilities to participate fully in the online community; The design and delivery of content integrate alternative resources (transcripts, for example) or enable assistive processes (voice recognition, for example) for those needing accommodation; Links to institutional policies, contacts, and procedures for supporting learners with disabilities are included and easy to find; Design factors such as color, text size manipulations, audio and video controls, and alt tags reflect universal accessibility considerations.

Accomplished: Supportive mechanisms allow learners with disabilities to participate in the online community for most activities; The design and delivery of content integrate some alternative resources or enable assistive processes for those needing accommodation; Links to institutional policies, contacts, and procedures to support learners with disabilities are included but may not be easy to find; Design factors such as color, text size manipulation, audio and video controls, and alt tags have been considered in some cases.

Promising: Supportive mechanisms allow some learners with disabilities to participate fully in the online community; The design and delivery of content do not include alternative resources nor enable assistive processes for those needing

accommodation; Links to institutional policies, contacts, and procedures to support learners with disabilities are not evident; Design factors such as color, text size manipulation, audio and video controls, and alt tags have not been considered.

Incomplete: Supportive mechanisms allow some learners with disabilities to participate in the online community for some activities; The design and delivery of content do not apply alternative resources nor enable assistive processes for those needing accommodations; Links to institutional policies, contacts, and procedures to support learners with disabilities are not evident; Design factors such as color, text size manipulation, audio and video controls, and alt tags have not been considered.

G. Feedback

Exemplary: Learners have the opportunity to give feedback to the instructor regarding course design and course content both during course delivery and after course completion; Feedback mechanisms allow students to participate anonymously in course evaluation.

Accomplished: Learners have the opportunity to give feedback to the instructor regarding course design and/or course content, but only after course completion; Feedback mechanisms allow students to participate anonymously in course evaluation.

Promising: Learners have the opportunity to give feedback to the instructor regarding course design or course content, but only after course completion; Feedback mechanisms do not guarantee privacy to the student.

Incomplete: Learners do not have the opportunity to give feedback to the instructor regarding course design or course content; Feedback mechanisms do not guarantee privacy to the student.

VI. CONCLUSION

All this leads to the conclusion that it is not easy to choose a course. It is certain that the work hypothesis was confirmed, and a conclusion on this issue is: no respect these standards there is no quality onlaj course. This would be especially be of great value to teachers, professors, educators , with a duty of continuous professional development, because the changes in the field of their work commitments often occur, and they need to be in constant touch with the latest developments. Hence, the development of even more necessary. However, this does not mean that it should be abuse, so these courses and seminars charging schools and educators at enormously high prices (most would even supposed to be free). Because the platform used for creating online courses and seminars are free of charge can be found on the internet. This, however, could be the subject of a new study.

REFERENCES

[1] Cavanaugh, C. *Virtual Schooling Standards and Best Practices for Teacher Education,* Jl. of Technology and Teacher Education, 2009.

[2] Patrick, S. and Powell, A. *A Summary of Research on the Effectiveness of K-12 Online Learning,* International association for K-12 online learning , 2009.

[3] *Instructions for the preparation of documents for the accreditation of degree programs at a distance,* The National Council for Higher Education, 2009.

TEACHING COMPUTER SCIENCE WITH THE APPLICATION OF PEX4FUN IN A WEB-BASED ENVIRONMENT

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Abstract - Programming is a major subject in Computer Science (CS) departments. However, students often face difficulties on the basic programming courses due to several factors that cause these difficulties. Maybe the most important reason is the lack of problem solving abilities that many students show.

This paper describes a web-based environment Pex4Fun from Microsoft Research for teaching computer science. Pex4Fun can be used to teach and learn computer programming at many levels, from high school all the way through graduate courses. It provides three very useful capabilities to support testing. First, it can explore code and suggest which tests should be done. Second, if there are parameterized tests, Pex can figure out which combination of parameters needs to be tested in order to give full coverage of possible scenarios. And finally, in Code Contracts, it is possible to fine-tune the unit tests it suggests or generates for user. Pex4Fun finds interesting and unexpected input values that help students understand what their code is actually doing. Pex For Fun (PEX4FUN) can be used to build interesting, engaging, demanding classes and homework on mathematics, algorithms, programming languages or problem solving in general.

I. INTRODUCTION

Programming is a complex mental activity that is defined as an abstract process. Understanding and visualizing abstract processes poses a considerable problem for students when learning programming, as well as other fields with similar characteristics.

Linn and Dalbey [1] define an ideal chain of the learning process of learning programming and suggest it as a standard for comparing programming teaching methods. The three links of the chain are:

- characteristics of the programming language – in order to log the programming solution of the problem with the given language, the student needs to understand the syntax, semantics, and expressive possibilities of the language.
- the skill of forming the program is the knowledge to use a bundle of techniques which, applied and combined, are used to solve the given problem. The skill is based on the knowledge of stereotypical code samples which combine different characteristics of the language. The models implement complex functions, such as sorting, finding the lowest common denominator of two numbers, counting words in a given text, etc. Programmers design the language and model characteristics to be combined, problems to be decomposed into parts, solving every part independently, then linking the partial solutions into a unique unit – the program. At the end of the program writing process its correctness is checked by testing.
- the general problem solving skills come to light during learning new formal systems and this is set as the goal to be achieved by studying programming. The same models and procedural skills are common to many, or even all formal systems. Therefore, this approach is used to learn models of logging with one formal system and the rules of transfer to the new one, the subject of the learning process, so it results in mental learning and activation of pre-existing knowledge.

Lemut et al. [2] explain the difficulty of learning programming by the need for implementing complex activities that have to be mastered even by beginners simultaneously. For example, the program is tested by executing it, using carefully selected input marginal values that will result in checking all program paths. The choice of the marginal values requires the knowledge of semantic program instructions. Opposed to this, the beginner programmer learns instructions, so they find it very difficult to choose

such inputs on their own. Du Boulay [3] finds that the sources of difficulties are the following:

1) Orientation – the general idea of students about programming and the program.
2) Abstract engine – understanding the computing model that defines the program language.
3) Notation - syntax and semantics of the language.
4) Structures – knowledge of programming constructions as a composition of instructions with which certain program requirement are met.
5) Pragmatics – skills implemented in creating the correct program (planning, decomposition, coding, testing, detecting and fixing errors).

II. PEX: UNIT TESTING TOOL FOR .NET

Pex [4] is an automatic white-box test generation tool for .NET, based on dynamic symbolic execution. This tool is integrated into Microsoft Visual Studio in the form of an add-in. It can generate test inputs which are combined with different unit testing frameworks [5]. They have implemented Pex in classroom teaching at various universities (for example North Carolina State University, University of Illinois at Urbana-Champaign, and University of Texas at Arlington), and also in a variety of tutorials both within Microsoft (such as internal training of Microsoft developers) and outside Microsoft (such as invited tutorials at .NET user groups). Further, they have created numerous open source research extensions upon Pex [6].

One of the most important methodologies that Pex supports is called parameterized unit testing, which broadens the scope of today's industry practice which prefers closed, traditional unit tests (i.e., unit test methods without input parameters) [5].

```
// which values will trigger collisions in MyHashSet?
[PexMethod]
public void TestAddContains(int x, int y) {
  var s = new MyHashSet();
  s.Add(x);
  s.Add(y);
  PexAssert.IsTrue(s.Contains(x));
  PexAssert.IsTrue(s.Contains(y));
}
```

Figure 1. A parameterized unit test for testing the Add method of a MyHashSet class

There are useful characteristics that Pex offers to support for testing. Primarily, there is the option of exploring code and suggesting the tests that should be done. Secondly, assuming that it is a parameterized test, Pex can determine the combination of parameters that has to be tested so as to provide all feasible versions. Lastly, once Code Contracts is being used, Pex uses that information to fine-tune the unit tests that are offered or generated for the user [7].

III. PEX4FUN

Pex for fun on the web is a fundamentally simplified form of the fully featured Pex Power Tool for Visual Studio. There is no need for any installation; since it is handled in the cloud (www.pexforfun.com). Code can either be written in C#, Visual Basic, or F#. Figure 2 shows the user interface of the Pex4Fun web.

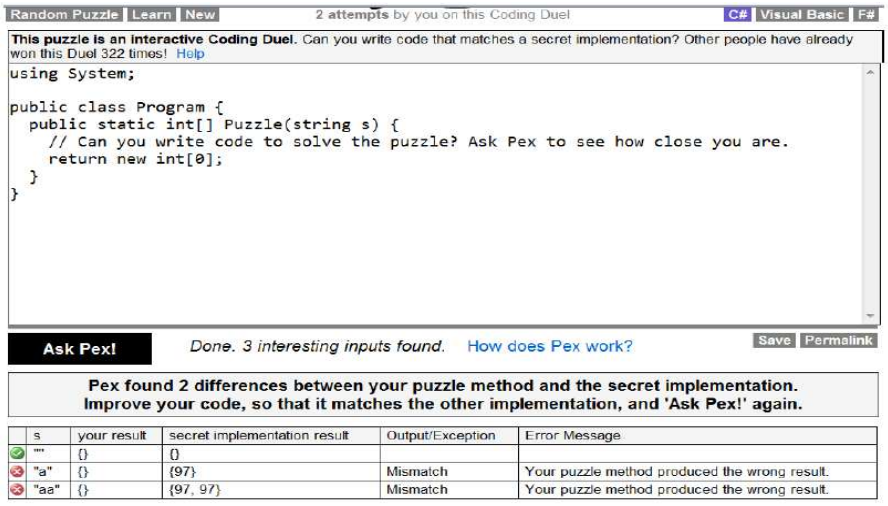

Figure 2. The user interface of the Pex4Fun web [12]

A. *Solve Puzzles*

Pex4Fun has a given set of particular code examples, which are called puzzles; these are displayed in the working area for the players. Every puzzle is focused on a major method named Puzzle. When a puzzle is loaded in the working area, the user will click the "Ask Pex!" button so as to compile and run it. The compilation and execution takes place on the Pex4Fun server; only the testing results are displayed. The main Puzzle method can take parameters and return values. If one wants to run one of these Puzzle methods, argument values have to be provided. Pex automatically detects interesting argument values as it analyzes the code. A table of input and output values then shows the generated input argument values and produced return values under the working area. The player can click every row of the table for further details, e.g. console output or stack traces [5].

B. *Solve coding duels*

A coding duel is an interactive puzzle. In a coding duel, the idea is to apply the Puzzle method to recreate the same behavior as another secret Puzzle method (e.g., the teacher's specification). In order to set out with a straight-forward coding duel, click an example coding duel from the web site. There is a dummy implementation which does not do much. If you click "Ask Pex!" it will show you how it is different from the secret implementation. Then you run a comparison between your result and the secret implementation result. You make an analysis of the differences and alter the code so as to match the secret implementation result for all input values. Again, "Ask Pex!" is clicked and the whole process is repeated until you win the coding duel. After winning the duel, try another one! The tool "Pex for fun" will track how you progress, but you have to be signed in for that.

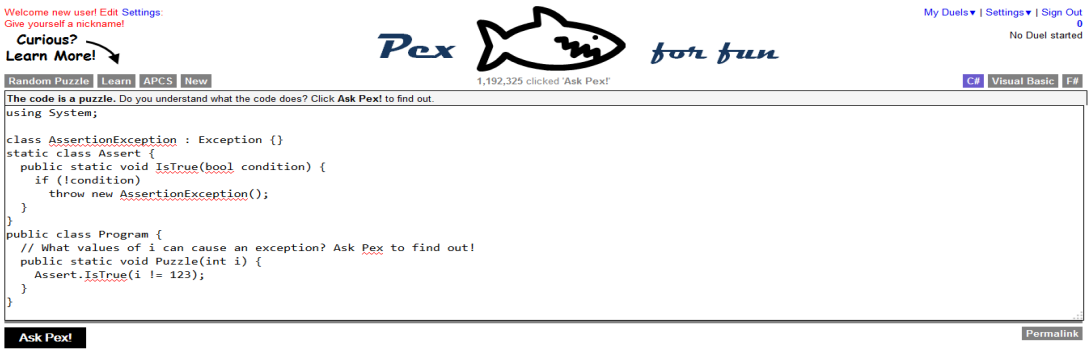

Figure 3. A coding duel

As far as learning and teaching are concerned, such coding duels serve the purpose of helping them to train different skill sets of players. These include the following, among others [5]:

- Abstraction skills. The shown list of generated input argument values is there to exhibit various behaviors and identical behaviors, respectively, though these are just exemplary argument values, which means that these are not a complete set of argument values for exhibiting different or same behaviors. Before realizing how to alter the player's implementation to move closer to the secret implementation, the player is forced to generalize from the seen exemplary values and the same or different.
- Problem solving or debugging skills. In order to solve a coding duel the player needs to run iterations of trials and errors. The player has to decompose the problem on the basis of the observed exemplary argument values and behaviors: grouping exemplary arguments that may show the same category of different behaviors, e.g., because of lacking a branch with the conditional of if (i>0). As a following step the player has to think of a hypothesized missing or corrected piece of code to cause failing tests (different-behavior-exposing tests) to pass as well as passing tests (same-behavior-exposing tests) to still pass. Following this, the player has to do a test to validate the hypothesis by clicking "Ask Pex!". Thus, solving a non-trivial coding duel may require exercising different problem solving skills.
- Program comprehension and programming skills. Assuming that the dummy implementation at the beginning is not that "simplistic", including non-trivial code, the player has to first comprehend what actions the dummy implementation is performing. This makes it clear that the players must have solid programming skills in order to do well on a non-trivial coding duel.

C. Create and teach a course

The purposes of Pex4Fun are manifold: it can be used to make classes on mathematics, algorithms, programming languages, or problem solving in general seem more captivating. Teachers have at their disposal an embedded wiki to create class materials based on puzzles and coding duels. More specifically, this enables the teacher to integrate existing pages into the course. The author of these pages could either be the given teacher or anyone else. The participation process is the following: students are invited by way of the teacher sending them a registration link. It is even possible to have more than one teacher. A registration for the course through the registration link will make it possible for anyone to become a student. Then the student will go through the pages that are part of the course. In order to pass the course, the requirement is that the student executes the tasks as coding duels. Any time the student wants to leave the course, they simply unregister.

D. Creating and publishing coding duels

There are five steps necessary to create and publish coding duels. The first step is to sign in, so as for Pex4Fun to maintain coding duels for you. The second step is to write a specification setting out from a puzzle template where the specification is written as a Puzzle method which transforms inputs into output. The third step is creating the coding duel by clicking the button “Turn This Puzzle Into a Coding Duel” (which appears after clicking “Ask Pex!”). The fourth step is editing the visible program text by clicking the coding duel Permalink URL, which leads to the coding duel. You fill in a somewhat more useful outline of the implementation (as well as adding optional comments) which somebody else will at some point complete.

The fifth step is to publish once you have finished the editing process of the visible Puzzle method text, then you click “Publish”.

E. Learning advanced topics behind Pex4Fun

The origin of Pex4Fun is the Research in Software Engineering (RiSE) group at Microsoft Research. It is a testing technique showing great potential, using advances in software verification and automated theorem proving, using dynamic symbolic execution [8, 9]. The user runs the program multiple times using different concrete inputs, and the chosen execution paths are checked at the instruction level, with a symbolic representation created for the conditions controlled by the branching statements. A constraint solver [10] computes new specific test inputs that choose other execution paths. This is an efficient technique if the goal is finding software defects, whose diverting execution paths are triggered by either implicit runtime checks or explicit sanity checks in the code.

Each time a new program is submitted by the student, a new test suite is generated by Pex4Fun, revealing any behavior mismatches to the secret program, conversely, no mismatches are found, this indicates that the student has won the coding duel.

IV. EXPERIMENT ON USING PEX4FUN

A survey was carried out among the undergraduate students during the Visual Programming course in the 2012/13 academic year. The total of 83 students were included in the survey, out of which 79.52% were male and 20.48% were female students. The course lasts for 15 weeks. The students attended two different groups based on the language of instruction, which was Hungarian or Serbian. The experimental group consisted of 30 students and the control group of 53.The aim of this survey was to establish to what degree Pex4Fun makes studying of Visual Basic easier for students.

Traditional lectures were held for both groups, and all students had the lab practices in the PC laboratory. The students of both groups used Microsoft Visual Studio for coding and solving practical problems, however, the students of the experimental group also used Pex4Fun during the lab exercises.

Coding duels from Pex4Fun were used for mastering and developing the students’s problem-solving and program-understanding skills. In a coding duel, students are required to write a missing code in the Puzzle method so as to obtain the exact same behavior as another secret Puzzle method, which is not revealed to the player [5, 6, 14]. Finding the solution for a coding duel needs the student to decompose the problem, to put hypothesis (to correct some part of code or to write down missing part of code), and finally, to run an experiment by pressing “Ask Pex!”. The student is given feedback from Pex4Fun in the form of a table, marked by red and green circles which serves as indication as to whether the student had or had not passed the test for corresponding input value [14].

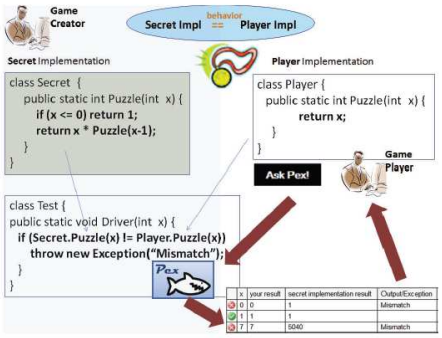

Figure 4. Creating and playing a coding duel [9]

For the purpose of examining the advantages and disadvantages of learning with Pex4Fun the five exercises were designed. The students' task was to figure out what the program does and to create appropriate sample values. The MCQ test was given to the students of the both groups. The total number of students that participated in the test was 67 out of 83 (16 students did not take the test). The results of the test are presented in Table I.

TABLE I. TEST PASS

Group	Number of students	Pass	Failed	Passing rate [%]
control	42	18	24	42.85
experimental	25	12	13	48

As seen from the table, the passing rate of the test for the control group is 42.85% and for the experimental group it is 48%.

Questionnaires are common research practice and measure the opinion and attitude about the subject of the research. The questionnaire consisted of 5 statements about Pex4Fun. The Likert scale was used, with the answers ranging from 1 meaning "I totally disagree with the statement", to 5 meaning "I totally agree with the statement". Table II shows the students' opinion from the experimental group about Pex4Fun. Mean values, standard deviation and variance values are shown.

TABLE II. OPINION AND ATTITUDE ON PEX4FUN

statement	mean	stdev	var
Pex4Fun was easy to use.	3.44	0.82	0.67
Pex4Fun was interesting for usage.	3	0.99	0.92
Pex4Fun motivating me to work.	3.68	0.85	0.73
Pex4Fun was a positive experience for me.	3.88	0.78	0.61
Pex4Fun is suitable for learning programming.	3.24	1.052	1.11

As can be seen from the table, students have a positive attitude about the Pex4Fun tool. In total 4 values are above 3.5, only one value is 3 which represents the state "undecided", making us believe that in general opinion of and attitude to Pex4Fun is positive. It is interesting to see that the two highest grades were given to statements expressing motivation to work and the positive experience for students.

V. CONCLUSION

Microsoft Research produced Pex4Fun [13] as a web-based serious gaming environment for teaching computer science. Pex4Fun may be implemented as a tool for teaching and learning computer programming at multiple levels, starting from secondary school up to graduate courses. With Pex4Fun, a student can edit code in any browser – using Intellisense – and Pex4Fun runs and analyze it in the cloud. Pex4Fun is a means to link teachers, curriculum authors, and students in an exclusive social experience, with the ability to track and stream the progress updates in real time. Specifically, Pex4Fun detects captivating and unexpected input values that help students comprehend what their code is actually doing. The real enjoyment starts with coding duels where students write code to apply the teacher's specification. Pex4Fun discovers any discrepancies in behavior between the student's code and the specification.

Teacher participants are encouraged and supported to form their courses under the Pex4Fun web site. In particular, as the teacher customizes the teaching modules from the web site, they can form complete courses, as a combination of explanatory text, example code, and coding duels as exercises. Students can register for these courses, thus the teacher is informed about student progress, including through table that presents the exercises that the student has completed – which actually means that the course assignments are automatically graded.

REFERENCES

[1] M.C. Linn, J. Dalbey, "Cognitive Consequences of Programming Instruction, in Studying the Novice Programmer", Editors Soloway E, J. C. Spohrer, Lawrence Erlbaum Associates, Publishers; Hillsdale, New Jersey; 1989. p. 57-81.

[2] E. Lemut, G. Dettori, and B. Du Boulay, "Cognitive models and intelligent environments for learning programming", Springer-Verlag New York, Inc., 1993.

[3] B. Du Boulay, T. O'Shea, J. Monk, "The Black Box Inside the Glass Box. In Studying the Novice Programmer", Editors Soloway E, J. C. Spohrer, Lawrence Erlbaum Associates, Publishers; Hillsdale, New Jersey; 1989. p. 431.

[4] http://research.microsoft.com/projects/pex/

N. Tillmann, J. de Halleux, and T. Xie, “Pex for Fun: Engineering an Automated Testing Tool for Serious Games in Computer Science”, March 2011, TechReport, MSR-TR-2011-41.http://research.microsoft.com/pubs/147143/pexforfun-engineering.pdf

[5] http://pexase.codeplex.com/

[6] D. Esposito, “Pex: Microsoft Research's Unit Test Generator and Evaluator”, November 26, 2012.

http://www.drdobbs.com/testing/pex-microsoft-researchs-unit-test-genera/240009056

[7] N. Tillmann and J. de Halleux, “Pex – white box test generation for .NET”, 2008, In Proc. TAP, pp. 134–153.

[8] P. Godefroid, N. Klarlund, and K. Sen, “DART: directed automated random testing”, In Proc. PLDI, 2005, pp. 213–223.

[9] L. M. de Moura and N. Bjørner, “Z3: An efficient SMT solver”, In Proc. TACAS, 2008, pp. 337–340.

[10] K. Taneja and T. Xie, “DiffGen: Automated regression unit-test generation”, In Proc. ASE, pp 407–410, 2008.

[11] N. Tillmann, J. de Halleux, T. Xie, “Pex4Fun: Teaching and Learning Computer Science via Social Gaming”, 24th IEEE-CS Conference on Software Engineering Education and Training (CSEE&T), 2011,

doi: 10.1109/CSEET.2011.5876146, pp. 546 – 548

[12] http://www.pexforfun.com

[13] N. Tillmann, J.De Halleux, T.Xie, S.Gulwani, J. Bishop, “Teaching and learning programming and software engineering via interactive gaming”. In Proceedings of the 2013 International Conference on Software Engineering, IEEE Press, pp. 1117-1126.

http://research.microsoft.com/pubs/189240/icse13see-pex4fun.pdf

MATERIAL AND TECHNICAL RESOURCES AS A CASE OF EVALUATION

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Abstract - The introduction of school evaluation as a continuous and systematic process that is consistent with the educational standards would contribute to ensuring the quality of teaching, achievement of educational outcomes and improvement of the conditions in which it takes the educational process. The obtained data would provide to all stakeholders in the education system and stakeholders promptly valid and relevant information on the effectiveness and impact of education. One of the areas of evaluation and analysis are material and technical resources in schools.

I. INTRODUCTION

In this paper, the focus will be directed to the area of resources. When evaluating the quality of resources, it is determined by whether:

- Human resources are in a function of the quality of the school.
- If there exist material-technical resources (facilities, equipment and materials)?
- If the material - technical resources used functionally? [1]

By testing material and technical resources, it is determined whether the school meets those criteria:

- The school is physically safe place. School premises meet health and hygienic conditions.
- The school has space to work in accordance with the regulations.
- The schoolroom is equipped in accordance with the regulations.
- School is equipped with necessary teaching resources for implementing quality teaching.

II. QUALITY STANDARDS OF EDUCATIONAL INSTITUTIONS

Standards of quality performance are:

- part of the quality assurance system of education,
- a mechanism to better agreements in key target groups in education, adopted by consensus
- instrument for evaluating the quality of institutions,
- clear, detailed and comprehensive picture of school quality or the conditions in which such quality can be achieved.

Development of quality standards of institutions:

- the obligation arising from the Law on Primary Education (2009).
- the competencies to prepare - Institute for Quality Education
- result-year project IEQE, Ministry of Education and the Inspectorate of Education of the Netherlands, with the support of experts from the Inspectorate of Education of England, Scotland and Germany
- pilot-testing in real school setting
- harmonization and improvement of the public debate
- National Council of Education adopted the standards of quality performance.

The characteristics of quality performance standards:

- areas include all the key aspects of the school standards are presented in the complex evidence of quality practices and conditions in which it can be achieved
- indicators include some New aspects of the quality of schools (eg, educational standards, vulnerable groups, safety, inclusion, IOP, exam results and tests, etc.).
- indicators to identify requirements that are in the "zone of proximal development" school (leadership role Directors, the use of research results in the development of

schools, using databases for development, developed procedures, etc.)[3].

Key areas of quality performance are: school program and the annual work plan

- teaching and learning
- educational achievements of pupils
- support
- ethos
- resources
- the organization of the school and management [1].

III. EVALUATION OF QUALITY OF SCHOOLS

The main task of the educational systems in the world is to determine, establish and ensure the quality of educational institutions.

This includes:

- the responsibility of all stakeholders in the education system
- generally accepted and agreed standards of quality of schools
- Standard implementation
- Mutual trust
- school autonomy [1].

At the level of the education system and the schools there are four basic domains of evaluation:

- self-evaluation
- supervision service
- external exams;
- evaluation research [2].

A. Self – evaluation

One of the most effective mechanisms to ensure the quality is the self-evaluation which is implemented by professional bodies, parent council, student parliaments, director and governing body of the institution. Self-evaluation organizes and coordinates the team for self-evaluation, whose members are appointed by the director of the facility for a period of one year. The self-evaluation team has at least five members, namely: representatives of professional bodies, parent councils, student councils and governing bodies of the institution. Members of the team elect team Leader from their ranks. Director participates in the team for self-evaluation.

Self-evaluation is based on analysis of:

- records and documentation of pedagogical institutions, programs of education, annual work plan and the development plan of the institution;
- databases within a single information system of education and other sources
- monitoring of activities;
- data collected from research conducted at the institution;
- the impact of the project activities;
- interviews, expert discussions, meetings, poll results and other ways data collection [3].

Team for self-evaluation collects and process information related to the subject of self-evaluation and analyzes the quality of cases of self-evaluation based on the processed data.

School self-evaluation, as well as any system for monitoring and evaluating the quality of education should be based on the following principles:

- Relevance - the subject evaluation should be the most important areas and aspects of the school;
- Transparency - the educational standards and criteria for monitoring and evaluation, assessment and evaluation of the consequences should be known and clear to the evaluator, and evaluant as well and all other stakeholders in the educational process;
- Professionalism - organizational, methodological and technical aspects of the evaluation must be at the level of contemporary professional standards
- Participation - when the evaluator and the person who is being evaluated are not the same person, it is necessary that both parties participate in decisions about evaluation;
- Ethics - respect for the personal integrity of each actor whose work is subject to evaluation, correct relationships between the participants in the evaluation, confidentiality, protection of human rights and children's rights;
- Autonomy - teachers / e, students / e, directors / professional / staff e / ei all

other actors evaluation should without external pressure, make decisions relevant to the planning, implementation process and the use of evaluation results [3].

B. External evaluation

External evaluation of is done by ministry, through educational advisors and the Office via employees who have completed the training program for external evaluation. External evaluation is done as a team. Ministry appoints a team of external evaluation and determines a team leader. Annual Plan provides a number of facilities that are used for external evaluation at the level of the school administration, the duration of the external evaluation of the number of team members for external evaluation. External evaluation is primarily aimed at improving the quality of schools and at collecting comparative data that can help schools to review their functioning compared with others. It provides feedback to schools on their strengths, weaknesses and opportunities, directing them to the necessary actions, offering support and additional resources that lead to desirable goals [4].

External evaluation of schools is based on:

- analysis of records and educational records of the school, the school's self-evaluation report, the curriculum, the annual work plan, the development plan of the school and educational consultant reports;
- direct monitoring of teaching and other forms of educational and pedagogical work;
- interview with the director, associate, teachers, educators, students, parents, and others significant to the life and work of the school or otherwise;
- Other actions who are deemed to be necessary [3].

Based on the report of the external evaluation, the institution prepares plan to improve the quality of the institution in the areas defined by standards of quality of institutions on the basis of which they can change development objectives defined by development plan facilities, and by school administration [1].

IV. TECHNICAL RESOURCES AS AREA OF EVALUATION

The school can independently make different instruments and complement the existing ones. School judges the quality of their work according to the given framework of evaluation (key areas, areas of evaluation, indicators and descriptions of achievement levels 4 and 2). School determines the level of achievement of specific indicators within specific areas of evaluation by identifying strengths and weaknesses. To the assessment of the level of achievement of indicators leads to the analysis of the data collected. The assessment must be based on valid and reliable evidence. Within 6.area of evaluation, following resources are evaluated: human, material, technical, and financial resources of the local community.

In the area of financial and technical resources, we are looking at the following indicators:

1. School space and equipment - a necessary condition for achieving the goals, objectives and content of education, is directly connected with the provision of the necessary resources, contemporary designed furniture and school space. Work efficiency and favorable working environment contributes to functional furniture in specialized classrooms: for students, by age and position of the subject, for the needs of teachers and teaching materials for housing.

2. Teaching resources - teaching resources are diverse technical and other resources that are tailored to the needs of teaching. They serve to provide, transmit and receive information, and this is also called teaching techniques. Teaching resources are a source of knowledge and understanding, and contribute to a proper representation of objects and phenomena of the real world around us. It should be noted that some of the tools we use is used exclusively teaching (texts, film), and many are used for other purposes (battery, projection apparatus, electrical measuring instruments). Appropriate use of teaching aids increases the concentration of students to the essential elements of learning material. Activating all the senses in the learning process, the student creates a clear picture of the objects and phenomena. This increases the durability of knowledge and greatly reduces forgetting. Learning tools that we call "learning resources" must meet a number of specific requirements. When deciding about teaching tool, we should take into account these requirements in order to achieve maximum pedagogical usefulness of

applying. Teaching aids should be placed so as to be within arms reach of students and teachers and no special difficulties facilitate communicative working environment for frontal, group and individual work - the modern mobile classroom furniture [5].

3. Use of available technical resources - depending on the organization of the school, teaching aids may be appropriate cabinets or cabinet specially designed for didactic instructional resources. Regardless of which system is the organization of the school, teachers and students have a role in the preparation and maintenance of teaching aids. The value of the implementation of teaching materials is enormous. To ensure the implementation of didactic value of teaching materials, it is essential that they are used: measured, timely, complete, cost-effective, and skillfully combined.

It is determined whether the spatial conditions (classrooms, offices, library, utility rooms, yard, gym), equipment and furniture are to the standard, and if they are adequately maintained. You can determine whether a school has room for the use of modern information technology.

By evaluating whether the buildings and equipment contribute to creating a safe, pleasant and stimulating environment within the field of evaluation of teaching, it is checked weather the school has the necessary and modern teaching aids (books, working papers, audio-visual materials, computers, photocopier machines ...), which are preserved in the function of a variety of methods and forms of work with. Many teaching materials are made by teachers and students.

Assessment of the available material and technical resources arises the question of whether they are available to teachers and students and if are in a function of educational and extracurricular activities. It is determined whether they are effectively used by students and teachers, and there should be a record. Here are just some of the issues raised during the evaluation process in the field of technical resources:

- Does the school environment provide adequate opportunities for the implementation of educational and extracurricular activities?
- Are all the rooms in the school adequately maintained?
- Are all the rooms in the school well lit?
- Do teachers have been involved in editing the school premises?
- Are students involved in editing the school premises?
- Is there the functional furniture in school?
- Are the teaching resources in place?
- Are there classrooms equipped with appropriate teaching aids?
- Are the classes implemented in classrooms?
- Do teachers have and use the facilities for the preparation of teaching?
- Are there rooms for gathering and socializing students?
- Are there rooms for the parents?
- Does the school library has literature and sufficient fund books for students and teachers?
- Does the school library regularly update and modernize the new releases?
- Does the school have a well-equipped media center?
- Do teachers have the ability to use school mediate?
- Do the teachers access to the Internet?
- Is the material for teaching purposes provided sufficiently?
- Does the school have a gym?
- Does the gym fit norms?
- Have good sports facilities regulated?
- Have students and teachers the opportunity to use the sports facilities and after school? [3]

Well-designed criteria and indicators enable you to control various stages in the process of self-evaluation, providing quality information and make it possible to obtain reliable, relevant and clear information that can be used for the improvement of school practice. Successfully implemented self-evaluation process and quality data are obtained for improvement work in one area and can help us, using the knowledge and experience gained in the process, devise and implement a self-evaluation in other areas of the school. In this way, we can obtain a wealth of data with which we will be able to more comprehensive

approach to change and improvement of the school [1].

V. CONCLUSION

The basic questions for whose answers teachers and methodologists of different subjects are looking for, is how to enable students to achieve the learning objectives related to the specific content in the shortest possible time and to allow continuous acquisition of knowledge, applicable in different situations. The goals can be achieved by different methods of teaching and learning, but it is very important to choose the most efficient method with appropriate teaching aids.

In order to affect the students, the basic conditions in school cannot be worse than those students have at home (especially when it comes to basic infrastructure), and the equipment would have to be such that the school can monitor newspapers and innovations used in working with children. Still, especially in rural areas, there are some improper working conditions.

The quality of primary education affects working conditions in schools, the physical (buildings, facilities, infrastructure) and equipment (office equipment, library, teaching aids, instructional materials). Periodic evaluation should be conducted for obtaining review of the current status in all key areas of the life and work of the school. This overview provides immediate feedback on the particular strengths as well as areas that need improvement.

REFERENCES

[1] Ministry of Education and Sports "Self-evaluation and evaluation of the school", Belgrade, 2005.

[2] G. Manojlović, Systems for monitoring and evaluating the quality of primary education, 2011 (available at: http://www.cqm.rs/2011/FQ2011/pdf/38/10.pdf)

[3] Guide for improving the work of teachers and schools, Belgrade: Educational reform circles, 2005

[4] R.Vulović, G.Milosavljević, Self-evaluation as a function of education, 2007 (available at: http://www.cqm.rs/2007/pdf/34/45.pdf)

[5] www.podaci.net/_zakon/propis/pravilnik_o.../p-bupspo03v0902.html

KEY ISSUES IN COOPERATION BETWEEN PARENTS AND SCHOOL MANAGEMENT

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Abstract - Starting school is an important moment in the life of a child and its family. When a child enrolls in school, all parents have the same expectations - quality education. Most of them then completely transfer this responsibility on professors, teachers, and assistants. To some extent, they are right, as their children will spend, in an average, 6 hours in school and their compulsory education lasts 8 years. The rest of the time, children spend with their family that like schools, provide child-specific forms of upbringing and education. Thus, the role of schools and families are turning to a common goal - the creation of high-quality, educated individuals of the society, and the responsibility for education is divided between family and school. The effectiveness of education certainly depends on the quality of cooperation between the family and the school. Nevertheless, many teachers believe that some parents are not interested in following and participating in the educational process of their children. It is necessary for parents to realize that only by successful communication with school and taking part in school life, they can increase the chances of their children to be successful not only in school but also in later life. Therefore, it is important to find the most appropriate ways and means of communication and cooperation between home and school.

I. FAMILY

The family is the basic unit of any society and is the first environment for every child. Therefore, it is a major factor in shaping the personality and upbringing. . "Family and school as fundamental and indispensable factors of education are interrelated and neither would be able to achieve the desired results in solving behavior problems without a common and unified action. [1]" According to The Vocabulary of Education, "in the family, the child becomes progressively conscious of himself and his surroundings, socializes, acquires basic forms of behavior and adopts the meanings attributed to phenomena, as well as the views of their immediate environment for them. [2] "It should be noted that the formation of attitudes and meanings of children are to be heavily influenced by moral and social norms and values of the family in which they grow up.

Types and characteristics of the family have been changing through the ages. Today's family is open to the society and its members are active in public life and seek to align their own interests with the common ones. The family is based on the base of shared love, desire for procreation, upbringing of children and achieving personal happiness. In terms of raising children, modern family tends to form a broadly educated and free individual, to develop positive character traits in children, their creativity, independence, self-confidence and to ensure the harmonization of domestic and social interests. According to M. Kuki, the modern family is nuclear – it is composed of two generations: a husband, wife, and children, and it is financially independent of the parental family. Women have equal rights in terms of ownership. The main responsibility of children is to complete their education. A reduction of parental authority is noted as well as the liberalization of sexual freedom. [3]

Families have multiple roles in order to meet both, their own, and social needs. Grandić lists the following family features:

1. emotional,
2. reproductive,
3. economic,
4. functions of providing protection,
5. educational and educational functions,
6. functions for fun and entertainment [4].

In the family, three developmental processes occur spontaneously: culturalisation, socialization, and individualization. Regarding cooperation between home and school, it is a particularly important educational function of the family.

II. SCHOOL

School is an institution whose roots go far back to time in ancient civilizations. Since then it has gone through various changes and reforms with the aim of adapting new demands of the society and its individuals. After family, school is the second most important factor in the development of psychosocial personality. Historically, the institution of school is under the family.

"School is an institution whose main task is to achieve the objectives and tasks of education". [5] According to the Dictionary of Psychology School, school is "a specialized educational institution in which teachers, based on identified program, plan and systematically transfer their knowledge, attitudes and skills to students "[6].

The structure of the Serbian educational system consists of:

- Pre-school education - the first part of the compulsory education is implemented in kindergarten while attending the kids of age: 5 - 6 years in preparation for primary school
- General Education - compulsory education that is provided in elementary schools and lasts for 8 years. The children are enrolled in primary school with 6 - 7 years, and teaching takes place in two rounds: the first to 4th grade and 5th to 8 grade;
- Secondary Education – it is the first part of non-compulsory education. There may be secondary, and vocational schools;
- Higher education - students are enrolled and ranked based on their success in high school and entrance exam results.

Like family, school has a number of important goals and objectives related to the development of all aspects of the child's personality, knowledge and skills, fostering creativity, independence, forming attitudes, beliefs and values, communication skills, preparation for assuming the role of responsible citizen. The school is the process of secondary socialization as an extension of primary socialization within the family. It is essential that these two institutions work closely together in order to avoid a conflict between the school and the family that could lead to negative consequences in the overall development of the child.

III. PARENTS AND SCHOOL

Communication between school and family is one of the prerequisites of a quality school. In terms of the quality of schools, the most common are the four factors that are of particular importance: the general conditions of education, which are achieved by means of increasing the quality of the goals of education, quality of teachers and the cooperation with parents and the local community. Parents should actively cooperate with the school since they are the protagonists of education and not just passive observers. In order to do this the school management is faced with several tasks such as increasing the number of parents who will cooperate with school law actively and systematically, improving the quality of relationships between parents and the school principal, parents and pedagogical and psychological services. The cooperation extended to a large number of issues and questions of life and work of the school and students.

Family expects that schools assist in overcoming the problems encountered in the course of growing up a child who does not know or is not able to solve independently. In response to the needs of the family, their school curriculum offers various forms of assistance and training to parents: the organization of lectures, workshops and meetings.

On the other hand, school expects help from the family. This support is reflected primarily in the alignment requirements set for students - in terms of upbringing, education, problem solving. In the literature, five basic types of parents depending on their attitude towards cooperation with the school can be found. Professor Eva Gajdosova from the Department of Psychology at the University of Bratislava, lists the following types of parents:

1. type: a parent who avoids any form of cooperation with the school;
2. type: a parent who does not accept calls for cooperation and which is indifferent to cooperation;
3. type: a parent who needs encouragement and support for cooperation with the school;
4. type: a parent who is willing to work with the school and comes with its own ideas and suggestions to improve the quality of cooperation with the school;

5. type: pretty active, authoritarian parent who would like to dominate the independent school and takes complete collaboration [7]."

The importance of cooperation between parents and school tells us the fact that it is defined by the Law on the Foundations of education, the structure and operation of the school board and parents' school.

According to the basics of the education system, it is essential that each school has established Parents' Council. The Council members consist of one representative - a parent from each department of the school. Article 58 of This Act defines the responsibility of the Parents' Council:

1. proposes representatives of children's parents and students in the management body;
2. proposes their representatives in expert working for development planning teams and other institutions;
3. proposes measures for quality assurance and improvement of educational work;
4. participates in the nomination of elective courses and the selection of textbooks;
5. considers the proposed program of education, the development plan, annual work plan, reports on their implementation, evaluation and self-evaluation;
6. considers the intended use of funds from donations and from the extended operation of the institution
7. proposes to the governing body intended use of funds generated by the work of students association and collected by parents;
8. reviews and monitors the conditions of the institution, the conditions for growth and learning, safety and protection of children and students;
9. participates in the process of prescribing measures under Article 42 this Act;
10. approves the program and organizing excursions and teaching programs in nature and considers the report on their implementation;
11. addresses other matters specified in the statute. [8] "

The Parents' Council cooperates closely with school management and forwards their views, opinions and suggestions to it. With the membership in these bodies, parents represent the interests of students and teaching, and have the opportunity to participate in other aspects of school work.

IV. DUTIES AND FAMILY PLANNING OF COOPERATION AND SCHOOLS

Main tasks of cooperation between family and school are:

1. "By joint efforts and coordinated actions work resolves any problems that arise in relation to the education of students;
2. propagation of pedagogical knowledge (to detect parents pedagogical necessity of mastering skills and help them to raise their pedagogical culture) "[1]

In order to have successful cooperation and achieve these goals at the beginning of each school year, professional teams in the annual school plan, develop plans and programs of work: cooperation of school with parents, the PTA, the teachers and librarians regard to cooperation with parents, class teacher's cooperation with the parents. These plans define the forms of co-operation, the subject, the time frame and the implementing agencies. Attached to this paper are the plans and programs that include cooperation with parents who are part of the Annual Plan of the elementary school "Ljudovit Stuhr" in Kisač for the school year 2012 / 2013th year.

Individual contacts with parents are the primary and irreplaceable form of cooperation between parents and school. In this way the student's family is directly acquainted, which provide additional information about the student: the conditions of his life and work, family atmosphere, parent-student relation. Such cooperation may be achieved by home visits by school stuff or parents visiting the school and departmental officer. Cooperation with groups of parents takes place in situations where it is necessary to interconnect the parents of children (of course, with the participation of elders in a class), which in Educational achieving educational goals and objectives have similar outcomes.

Parent meetings are kind of cooperation that is regulated by law. It envisages the realization of at least four parent meetings throughout the school year. These meetings are commonly used for global notification and exchange of information in

terms of the entire class and less for individual students. At parent-teacher conferences, in addition to discussions on current topics in the classroom, homeroom teacher should be able to handle parents and subject specific policies adopted by the Plan in a class of officers. Counseling for parents are organized within the school with the aim to help in solving problems by professionals - educators, psychologists, physiotherapists, speech therapists or pediatric physician. According to some research, this counseling is one of the rarest of applied forms of cooperation between parents and school.

Correspondence and text messages to parents are a form of cooperation that is most common in the first cycle of basic education. Generates by a text message to parents and prospective parents 'responses that can circulate through the notebooks, notepads or students' booklet. Most often, they are used to inform parents about a problem, calling on parents' meetings and individual contacts, information on the work and success of students. Besides these forms of cooperation, school management may depending on the needs or based on research conducted in schools, organize some other forms of cooperation with parents.

If you analyze the plans and programs of cooperation with parents, it can be noted that these plans cover most of the issues of interest to both parents and the school. Elementary school age child is special about the psychology, and adaptive changes. This period of life is very important for the overall development and it does the most critical period. During this period, an intensive development of intellectual abilities, there are new interests and needs of students. Some news are also introduced in school work - go to subject teaching, more cases that need to be overcome. All of these are potential problems for whose solution parents expect help from the school management. Most common questions parents ask are related to the child's academic achievement, achievement in school, improve teaching, student behavior and their intended safety at school.

V. Problems in Parents and School Cooperation

Based on the above, so far, it seems that the cooperation between families and school management works without a problem as it has been is planned previously, and applied in different forms of cooperation that covers all current issues. The successful cooperation of parents and schools, however, is affected by different factors. According to some surveys on school principals, communication barriers are parents themselves - their lack of interest in cooperation (lack of time, we are so busy) and the lack of communication skills. As a second factor mentioned, it is the lack of school resources to organizing and implementing better collaboration. The third factor is the teachers - their indifference (overload) and insufficient training and expertise to establish and maintain the quality of cooperation. "It is not common that parents do not come regularly, or very rarely to meetings. They do not consider the work with school as their continuous commitment to their children's education. They do not pay enough attention to their pedagogical and general elevation. They take care of the living and working conditions of school children badly. For the failure of the child unilaterally accuse the environment in which they live, their peers and the school and unfairly criticize teachers (usually when the child is getting poor grades, fines and when have to repeat the grade), and do not attempt to align their educational outreach to the educational measures taken by schools ". It is noticeable phenomenon that today's parents do not consider school as a key factor that contributes to the efficient implementation of student life and taking over their role in social environment. There are many other available sources of knowledge and information that provide interesting and engaging content. On the other hand, parents are very interested in their children's success in school, regardless of their real capabilities. The school is placed in an untenable position – not.

VI. Conclusion

Family and school life can be seen as a partnership. In order for a partnership to be successful, all stakeholders must develop their skills in communication, collaboration. Quality of mutual cooperation between home and school, provides children a sense of security and protection. Both, parents and school management can prevent misunderstandings, conflicts, problems, quality, and successfully solve problems and contribute to the success and quality of both the students and the educational process of the school.

REFERENCES

[1] Orlović-Potkonjak M., Potkonjak N., Pedagogy Part II, Institute for Textbooks and Teaching Aids, Belgrade, 1976.

[2] Institute for Educational Research, Belgrade, Teacher's Dictionary 2, Institute for Textbooks SRS, Belgrade, 1967.

[3] Kuka M., Family pedagogy, available at: www.kukagrosmeister.com/pdf/Porodicna%20pedagogija2.pdf

[4] Grandić, R., Contributions family pedagogy, Novi Sad, 2006

[5] Potkonjak, N., Šimleša, P., Educational Encyclopedia 2, Institute for Textbooks, Novi Sad, 1989

[6] Trebješanin, T. Dictionary of Psychology, Beograd, Pillars of culture, 2000

[7] Gajdošova, E., Cooperation between schools and families, University of Bratislava, Department of Psychology

THE EFFECTS OF COMPUTER-ASSISTED INSTRUCTION ON STUDENTS' ACHIEVEMENT IN BIOLOGY

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Abstract - The paper analyzed comparative effectiveness of Computer-Assisted Instruction (CAI) and traditional teaching method in biology on grammar school students. This experimental study was conducted in a grammar school in Zrenjanin, Serbia. A stratified random sample consisted of 100 students 4th grade of grammar school, wich were randomly distributed into control and experimental groups. The students in the experimental group learned a biology content (Genetics) by CAI, whereas the students in the control group learned the same content by the traditional teaching. The research design was the pretest-posttest equivalent groups design. All students received one pre-test in order to estimate their prior knowledge, posttests in order to assess knowledge and comprehension immediately after learning and retest again after 60 days. Using the software package SPSS 19.0, arithmetic mean, standard deviation were analyzed and t-test was used in order to establish the difference among the same statistical indicators. Analysis of the results of the posttest and the retest showed that students from the CAI group achieved significantly higher quantity and quality of knowledge than students from the control group.

I. INTRODUCTION

The more and more increasing role and significance of information and communication technologies (ICT) in human society is one of the most important characteristics of today's world. These new technologies are an integral part of many human activities and have implications both in pedagogy and education from pre-school to institutions of higher education. We can assume that ICT increases student motivation, what is seen in many arguments for why ICT should be used in schools. There are a lot of assumptions that students are interested in using ICT; they found it more pleasant, more appealing, and more motivating to study with computers than with traditional means. Teaching and learning of biology could be made more interesting if the lesson presentation using Power Point or multimedia education software to motivate students to learning and to make more interesting, to attract more students. Software can be provided to the students to allow them to engross the biology as subject, thus making learning more meaningful. The use of educational computer software will bring new, exciting, actual and rewarding educational experiences for both students and teachers [7].

In the field of education, computer has been used in a variety of ways instructional process which consist of computer assisted instruction (CAI) and computer management instruction (CMI), and in administration. In the instructional process, Computer Assisted Instruction (CAI), is used to instruct students in various subjects. Information and messages are presented to the learner using the computer, through interactive process involving drill, practice, tutorial and dialogue. The CAI ensures that students are presented materials or problems situations, guiding students' thinking, responding to students' questions, assessing students' performances and managing students' path through a course [3].

Computer-assisted instruction is the process by which written and visual information is presented in a logical sequence to a learner through a computer. CAI can be characterized as interactive and individualized learning. The students learns by using software with the text material, graphic information displayed, audio-visual presentation or simulation. CAI allows learners to be able to take increasingly more responsibility to choose, control, and evaluate their own learning activities which can be pursued at any time, in any place, through any means, at any age. Simply put, learners can decide what they want to learn and in what order [11]. CAL also eliminates the misconceptions by providing immediate feedback, since the immediate feedback prevents incorrect learning concepts. In the Computer-Assisted Learning rote learning is minimized and meaningful learning can occur [1]. Computer

Assisted Instruction (CAI) is a program of instructional material presented by means of a computer or computer systems in which teacher use computers at different times and spaces according to the characteristics of the subject matter. CAI can be used for tutorials (drill and practice), problem solving, simulation exercises, enrichment programs, remedial learning, applications (of problems or concepts) and testing [13] (Andrews,1992) A computer enables repeated trials of experiments with considerable ease in a limited time, provides immediate feedback, allow stimulus, observation of graphical representation and offers a flexible environment that enable students to proceed with their own plans [4], [13], [17].

The content of Biology lectures is practically predisposed for CAI. The largest part of theme units and lesson items from Biology curriculum at all levels of education can be presented with pictures, texts, adequate video sequences and simulation applications. For certain fields this is the way to achieve maximum effects. However, little is known about the use of computer assisted instructional package in the Serbia education system particularly in grammar schools. Thus, much remain to be empirically studied on the effect of CAI in biology education, in Serbia.

Many science teachers, educators, and researchers have proposed to employ CAL in biology teaching.

Chapman and Ferguson (1993) [10] investigated the performance of students using skills using Computer assisted genetics instructor which was evaluated in an introductory genetics course. Students utilizing CAGI scored an average of between 6 and 10 points higher on hour exams than students in the same class who did not use CAGI. Authors found that CAGI helps students focus on the key aspects of biological processes, diagnose misconceptions, and provides drillaccompanied by immediate feedback.

Yildirim, Özden and Aksu (2001) [18] compared the traditional and hypermedia learning environments on the chosen subjects in a control-treatment group and pre- and posttest design in their study on acquiring and retaining knowledge. Nine grade biology students were distributed into subject (hypermedia learning environment) and control (traditional) groups. Pre-tests, post-tests and retention tests were administered to both groups. The results of the post-test did not display a significant difference between the control and experimental groups about acquiring knowledge. However, the retention tests showed that the experimental group retained knowledge better than the control group.

Cepni, Tas and Kose (2006) [15] investigated the effects of a Computer-assisted Instruction Material (CAIM) related to ‘‘Photosynthesis’’ topic on student cognitive development, misconceptions and attitudes. An experimental research design including the photosynthesis achievement test (PAT), the photosynthesis concept test (PCT) and science attitude scale (SAS) was applied at the beginning and at the end of the research as pre-test and post-test. After the treatment, general achievement in PAT increased by 10% in favour of experiment group (EG) at ($p < 0.05$) significant level. Although the increase in cognitive development at knowledge level was 14.8% in the EG and 18.2% in the control group (CG), the development at comprehension and application levels were 19.8–18.5 in the EG and 1.75–0.86 in the CG, respectively. This result showed that using CAIM in teaching photosynthesis topic was very effective for students to reach comprehension and application levels of cognitive domain. However, CAIM did not change major misconceptions related to photosynthesis topic in EG as expected.

The effects of tutorial and edutainment software programs related to genetics concept on student achievements, misconception and attitudes investigated Kara and Yesilyurt (2007) [17]. The results showed that only tutorial desing software program had the positive effect to the awareness of student’s understandings to the genetics concepts.

Yusuf and Afolabi (2010) [9] investigated the effects of computer assisted instruction (CAI) on secondary school students’ performance in biology. Also, the influence of gender on the performance of students exposed to CAI in individualised or cooperative learning settings package was examined. The findings of the study showed that the performance of students exposed to CAI either individually or cooperatively were better than their counterparts exposed to the conventional classroom instruction.

Mahmood and Mirza (2012) [6] investigated effectiveness of the computer assisted instruction (CAI) on students’ achievement in general science as compared with the traditional method of instruction (TMI). The experimental group performed better on all the three components of the achievement test as compared to the control

group. The CAI group also scored higher than the TMI group in various content areas of general science.

II. PURPOSE OF THE STUDY

The aim of this paper was to investigate the effect of computer-assisted instruction on the performance of secondary school students in Genetic (Biology). Specifically, the study examined the effectiveness of the CAI on student's learning Molecular genetic as compare to traditional method of instructions.

III. RESEARCH HYPOTHESES

The following research hypotheses were tested in the research:

H1: Students in experimental group will achieve better results on the posttest than students in control group.

H2: Students in experimental group will achieve better results on the retest than students in control group.

IV. METHOD

A. Research design

The research was true-experimental in nature because the equivalence of the control group and the experimental group was provided by random assignment of pupils either to the experimental or the control group. Both groups of pupils had the same characteristics: GPA at the end of the second semester of the third grade – very good, GPA in biology at the end of the second semester of the third grade – very good, and the average score achieved in the pretest – 80 points. This demonstrated the equivalence of the control group and the experimental group. The research design followed by researcher was the Pretest-Posttest Equivalent groups Design.

B. Sample

A stratified random sample consisted of 100 students from grammar school in Zrenjanin, Serbia. In total, 50 students of the fourth grade were in the experimental group, and 50 students were in the control group. Stratification of the sample was carried out according to the students' GPA at the end of the second semester of the third grade, the students' GPA in biology at the end of the second semester of the third grade, and the pretest. Both groups of students who did not belong to any stratum, were equally involved in all school activities during educational research, but their test results were not considered in the statistical data analysis.

C. Research Instruments

The main measuring instruments which were designed and applied in the research were the pretest, the posttest and the retest. Each test had 20 questions. The maximall scores on any test were 100. The time allowed for test completion was the duration of one lesson (45 minutes). Each test was comprised of questions that included six levels of knowledge: the level of knowledge, the level of understanding, the level of application, the level of analysis, the level of synthesis and the level of evaluation (cognitive levels identified by Bloom). In the analysis of the knowledge level the following tasks were use: defining terms and marking the corect answer. For the analysis of the level of understanding tasks of making order and filling in the blank were used. The level of analysis was examined by means of the following types of tasks: finding similarities and differences, the classification and expression of attitudes. At the levels of analysis and synthesis tasks such as: recognition and making conclusions were applied. For the level of evaluation the main type of tasks used was the interpretation of drawings. During the evaluations of tests, the main rule was that tasks that require higher levels of knowledge were granted a higher number of points.

The values of Cronbach's Alpha for the pretest (α=0.802) and the posttest (α=0.913) have indicated a high internal consistency of tests.

D. Research Procedure

The experiment was carried out in the school year 2012/2013, during regular biology classes, on the contents of the lesson topic Genetics in the first semester of the fourth grade of grammar school. Duration of the experiment was 5 weeks in total for both groups, simultaneously.

In the experimental model, teaching of the topic Genetics took place in the computer classroom by using educational software. The software "Genetics" is made in Adobe Captivate 5.5 programme. Teaching software "Genetics" is compiled for 4th grade students of grammar schools as a substitution for the book during the elaboration of Biology materials. The software contains 15 tutorials about DNA structure, DNA replication, transcription, translation and Mendelian genetics, exercises, animations as well as the final test from Genetics. After each lecturing unit (tutorial) the test follows. The test contains various types of questions and problem tasks:

multiple choices questions, fill in the blanks, matching. The classroom had the same number of workplaces and computers, enabling pupils to work individually on the computer. The general scenario for the implementation of the CAI was the following: introductory activities (teacher gives verbal instructions pupils to open the software), central activities (learning individual by using the computer sofware), and the final activities (independent testing of knowledge of the entire unit by solving the Final test).

In the control model implementation of the complete educational topic took place in the biology cabinet. Both teaching and reinforcing the lesson were implemented in the traditional instruction, including three instructional strategies: frontal lectures, discussion and intermittent asking questions by the teacher, and responding by pupils. Teaching aids and devices used in the research were textbook, a blackboard and chalk.

Upon completion of the experimental research (after the implementation of the topic Genetics in different ways in Group E and Group C), there were analyzed differences in the pupils' achievement in Group E and Group C by analyzing their achievements on the posttest. 60 days later the retest was applied (the same posttest) which aim was to identify durability and quality of knowledge in both groups of pupils.

E. Data analysis

In order to compare the differences between control and experiment groups on the pre-test, post-test and retest results the independent t-test was applied. Statistical processing of data obtained from the tests was done by using SPSS 19.0 software package.

V. RESULTS AND DISCUSSION

Upon analyzing the results of the pretest, the posttest, and the retest, there were analyzed changes in the pupils' achievements in two groups, and given explanations of the obtained differences.

Both experimental and control student groups were balanced at the beginning of research according to the results of the pre-test. As seen in Table 1, at the beginning the pre-test means of experimental group (EG) and control group (CG) was 79.840 and 80.780, respectively. These results showed that the sample's present knowledge levels were very close to each other and a significant difference does not exist between the pre-test scores of the computer assisted and traditional educational groups. ($t = 0.625$, $p > 0.05$). For this reason, it can be stated that students do not differ in knowledge levels), in other words, the groups are equal.

TABLE 1. THE SIGNIFICANCE OF DIFFERENCES IN EXPERIMENTAL AND CONTROL GROUP FROM THE PRETEST OF KNOWLEDGE (T-TEST)

Group	N	Number of achived points	Mean	Std. Deviation	t test	Sig.
EG	50	3.992	79.840	7.402	0.625	0.534
CG	50	4.039	80.780	7.643		

The final verification of knowledge was aimed at by using a variety of tasks (the objective type that determine the level of the recently adopted knowledge) immediately after the completion of the experiment. The results of the post testing of students in the experimental and control groups (Table 2) show that 4.348 points out of the possible total of 5.000 points were obtained by the experimental group, while 3.718 points out of possible 5.000 points were achieved by the control group. The difference in the total number of achieved points was 630 in favour of the experimental group, indicating more effective knowledge acquisition when computer assisted instruction was used in the implementation of the contents of Genetics. The posttest scores for E group and C group were 86.960 and 74.360, respectively. (Table 2). These results showed that the sample's posttest knowledge levels were different, E group had significantly higher than the mean score for C group . A statistical significant difference was found beetwen the groups ($t = 10.191$, $p < 0.05$). This means that CAI was more effective at Genetics teaching in E than tradicional method in C group. Based on the results of the t - test for E and C groups presented in Table 2, there are statistically significant differences in favor of the experimental group on the posttest ($p<.05$), thus confirming the hypothesis H1: Students from Group E will achieve better results on the posttest in comparison to the students in Group C, as a result of greater effectiveness of the individual CAI in biology teaching in comparison to traditional teaching.

TABLE 2. THE SIGNIFICANCE OF DIFFERENCES IN EXPERIMENTAL AND CONTROL GROUP FROM THE POSTTEST OF KNOWLEDGE (T-TEST)

Group	N	Number of achived points	Mean	Std. Deviat.	t test	Sig.
EG	50	4.287	85.740	5.306	11.766	0.000
CG	50	3.595	71.900	6.405		

Retesting of pupils was conducted 60 days after the posttest in order to verify durability of the acquired knowledge of pupils from E and C groups concerning the topic Genetics. The results of the experimental and control groups (Table 3) showed that 4.287 points were obtained by the experimental group, while the total of 3.595 points out of the possible 5.000 points was achieved by the control group of pupils. The difference in the total number of obtained points was 692 points in favour of the experimental group, indicating a greater durability of students' knowledge in the experimental group. The average score in the students' retention test, who received computer assisted instruction was 85.740 and the average retention test score of the students who received traditional education is 71.900. The difference of 13.84 between the scores in the retention test is found was significant. A statistical significant difference was found beetwen the groups ($t = 11.766$, $p < 0.05$) thus confirming the hypothesis H2: Students from E group will achieve better results on the retest in comparison to the students from C group, as a result of higher quality and durability of their knowledge, gained in the individual CAI compared to the traditional teaching of biology.

According this result, it can be stated that students receiving computer assisted instruction in teaching Genetics shows differences in terms of remembering what they have learnt and enables retention in learning when compared to traditional education, in other words it can be stated that CAI is more effective than traditional education.

TABLE 3. THE SIGNIFICANCE OF DIFFERENCES IN EXPERIMENTAL AND CONTROL GROUP FROM THE RETEST OF KNOWLEDGE (T-TEST)

Group	N	Number of achived points	Mean	Std. Deviat.	t test	Sig.
EG	50	4.348	86.960	4.562	10.191	0.000
CG	50	3.718	74.360	7.458		

To support education activities with visual and audio equipment provides enrichment based on the technological developments or availability of technology. As seen on Figure 1. computer assisted instruction is a better method of instruction for secondary level Genetics science as compared to the traditional method of instruction.

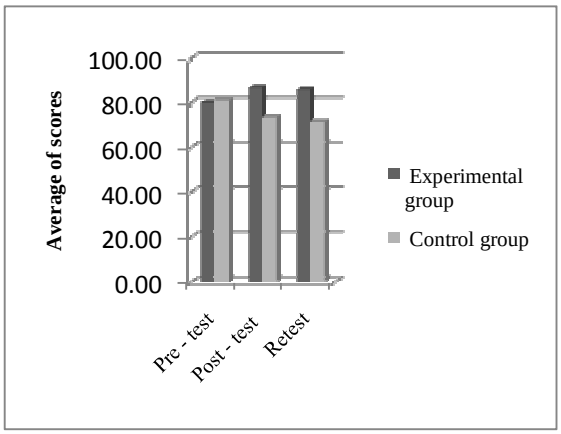

Figure 1. The average score of experimental and control group on the pre-test, post test and retest

The efficiency of these kinds of lectures and enhanced motivation of students is especially emphasized. The effectiveness of computer assisted instruction for improved student learning as demonstrated by the present study may be attributed to the software used in the experiment and the way it was used. Educational software can be used to explain the concepts and processes in such a manner that is not possible through traditional practices. Achieved results show students' interest for these types of lectures and learning, and output results show that the students' average grades are higher in comparison to traditional approach of learning with lecturing topic Genetics.

Results of the study demonstrated that computer assisted instruction was an effective mode for learning in Genetic lectures. The results of the present study are in consonance with the results of many of the experimental studies demonstrating effectiveness of CAI for better student achievement in biology [2], [6]; [9]; [10]; [15]; [18]. All listed authors emphasize the advantage of the use of computers in relation to application of other forms and methods of work in Biology lectures.

VI. CONCLUSION

This experimental study examined effectiveness of the use of computer assisted instruction on students' achievement in biology science compared with the traditional method of

instruction. The pedagogical research was conducted with parallel groups (an experimental one and a control one) during which the efficiency of applying computer assisted instruction (CAI) in biology classes was analysed in relation to the traditional classes. The experiment was realised on the sample of 100 students (of which 50 were in the experimental group and 50 in the control group). With the students from the experimental group, lessons of Genetics teaching unit, was done by using CAI, while the students form the control group covered the same content in a traditional way. The difference in results from the pre-test for the two groups is not statistically significant. After realisation of the Genetics teaching unit, by applying different teaching methods in experimental and control groups, the students from both groups were tested in the post test. After 60 days, the students of both groups were tested with the same test (retest). The analysis of the results from the post-test and retest has shown that the students from the experimental group achieved higher quality and quantity of knowledge in relation to the students from the control group. The differences in achievement of the students from experimental and control groups on post-test and retest are statistically significant in favour of the experimental group. The results of this research indicated that CAI had contributed significantly to the better quality of the pupils' knowledge than had the traditional way of learning. The main hypothesis of the research was thus confirmed. A general conclusion of this empirical research is that the individually applied CAI of biology has enabled learning of the topic Genetics with different approach, bringing pupils into the position to acquire biological principles through their independent work.

This study has some limitation. Samples were selected by stratified sampling procedure. The subject of the research was limited only to the biology teaching for the fourth grade of grammar school, the teaching topic Genetics. Accordingly, the results could be generalized neither to other biological topics, nor to the contents of other subjects. More extensive data collection is needed for greater generalization.

REFERENCES

[1] C. E. Renshaw, & H. A. Taylor, The educational effectiveness of computer-based instruction. Computers and Geosciences, 2000, Vol. 26(6), 677 – 682. DOI: 10.1016/S0098-3004(99)00103-X

[2] D. Morrell, "The effects of computer-assisted instruction on student achievement in high school biology" SchoolScience and Mathematics, 1992, pp 177–181.

[3] J. A. Milner, and S. A. Anderson, "The Microelectronic Education Programme Dissemination and Diffusion of Microelectronic Technology in Education." *Programme Learning and Technology*, 1984, 21(2), pp 82-87.

[4] M. A Ahmed, "Lecturers' assessment of difficulty levels of genetics concepts in Nigeria colleges of education," *Journal curriculum and instruction*, 2009, 7(1).

[5] M. J. Costa, E. Galembeck, G. A. Marson, B. B. Torres, "A Quick Guide for Computer-Assisted Instruction in Computational Biology and Bioinformatics. PLoS Comput Biol, 2008, 4(4): e1000035. doi:10.1371/journal.pcbi.1000035

[6] M. K. Mahmood, and M. S. Mirza, "Effectiveness of Computer-Assisted Instruction in Urdu Language for Secondary School Students'" Strength for Today and Bright Hope for Tomorrow Volume 12 : 2 February 2012, ISSN 1930-2940.

[7] M. Kubiatko, Z. Halakova, Slovak high school students' attitudes to ICT using in biology lesson. Computers in Human Behaviour, 2009, 25(3), pp. 743-748.

[8] M. McLean, "Introducing computer-aided instruction into a traditional histology course: student evaluation of the educational value," Journal of Audiovisual Media in Medicine, 2000, 23(4), pp. 153-160.

[9] M. O. Yusuf, A.O. Afolabi, "Effects of Computer Assisted Instruction (CAI) on Secondary Schools Students' Performance in Biology," TOJET: The Turkish Online Journal of educational Technology, 2010, Vol 9(1), 62-69.

[10] N. H. Ferguson, & S. R. Chapmen, "Computer-assisted instruction for introductory genetics," Journal of Natural Resources and Life Sciences Education, 1993, 22, 145–152.

[11] O. Pilli, (2008). "The Effects of Computer-Assisted Instruction on the Achievement, Attitudes and Retention of Fourth Grade Mathematics Course", Unpublished PhD thesis, Department of Educational Sciences, Middle East Technical University, 2008.

[12] R. E. Mayer, "Multimedia Learning," Cambridge University Press, New York, 2001.

[13] S. E. Andrews, and M. A. J. Collins, "Computer enhanced learning in biology," Tested studies for laboratory teaching, Proceedings of the 14th Workshop/Conference of the Association for Biology Laboratory Education (ABLE), 1993, Volume 14, pp 169-190.

[14] S. Franklin, M. Peat, "Strategies to support learning and student progression: the first year biology way," School of Biological Sciences, The University of Sydney, Australia, 1998b.

[15] S. Çepni, E. Taş and S. Köse, "The effects of computer-assisted material on students cognitive levels, misconceptions and attitudes towards science," Computers & Education 2006,Vol 46, pp 192–205.

[16] V. Odadžić., B. Odadžić, "Educational computer software "Inheritance mechanisms" in biology lectures," TEM Journal, Volume1, Number 2, 2012, pp 90-97.

[17] Y. Kara, and S. Yesilyurt, "Assessing the effects of Students' achievements, misconceptions and attitudes towards Biology," Asia-Pacific Forum on Science learning and teaching, 2007, 8(2), 1-22.

[18] Z. Yildirim, M. Y. Ozden, and M. Aksu, "Comparison of hypermedia learning and traditional instruction on knowledge acquisition and retention," Journal of Educational Research, 2001, 94, 207214.

DEVELOPMENT OF SYSTEM FOR AUTOMATED RANKING

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Abstract - A solution of an automated system for ranking is presented in this paper. When candidates are registering to study at Subotica Tech, a ranking problem occurs in certain study programs. To solve this, a new web service was developed. The main part of the service is an algorithm that decides and controls the entire logic of the service. During the decision-making process, the algorithm takes into account a number of parameters. The paper describes in detail the implementation of the algorithm and created web service.

I. INTRODUCTION

When candidates are registering to study at Subotica Tech, a ranking problem occurs in certain study programs. When applying, the candidates can choose a study program and for each of them the program assigns a priority. In order to speed up and automate the whole process automate web-based information service was implemented. This service is a part of a complex system of E-administration Office (Elektronska referada). The service is implemented using several internet techniques and methods. The main part of the service is an algorithm that decides and controls the entire logic of the service. During the decision-making process, the algorithm takes into account a number of parameters (priority date, wish list, type of funding, the number of vacancies, the number of (seats) places filled).

II. USED TECHNIQUES

This web service is developed with the use of several web techniques: PHP as server side programming language, MySQL as relational database management system, Javascript with Query library as client side programming language, XHTML for designing the layout of the pages, CSS for styling pages, and Ajax to get more user oriented functions. The Service uses Zend Framework. Passing through the stages of development and testing, the team worked also on the optimization of the code. Useful information are obtained from the users of this service. Based on those, further optimization was done on critical parts.

III. FRAMEWORK

Using frameworks in the world of software development has long been known. However, in the world of web development it is new. A software framework is a set of libraries, and an execution environment that allows programmers to develop web applications faster and more organized. The main idea of the framework is observed after the use of frequently used functions and basic structures upon which programmers can develop their applications. The greatest advantage of using frameworks is that all developers in a team working on a project should follow the same rules and conventions when developing web applications [1]. This current system uses Zend Framework.

A. Zend Framework

Zend Framework is an open source framework for the development of web applications and it is based on the PHP programming language. It contains a group of tools for design and implementation. Zend Framework also provides a complete implementation of the Model-View-Controller (MVC) pattern. Using modules with MVC is referred as HMVC (Hierarchical Model View Controller) pattern. MVC is a widely recognized design pattern that separates our database and business logic from the presentation layer [1].

IV. DESCRIPTION OF SYSTEM

A. History

The first version of the E-administration Office which is in use at Subotica Tech was developed in 2000. The Service was developed with ASP programming language, VBScript and MS SQL server. This version allowed students to apply for exams, review and evaluation of students' marks and other liabilities. The system was experimentally used only by the students of the Informatics study programs. The Web service was in offline synchronization with the desktop version

of E-Administration. The use of this version has contributed to the development team so that the design of the new version became much easier and was carried out without initial problems.

B. Existing solution

The existing solution, which is now in use, contains an overall solution for E-administration Office. It controls all data about students, teachers, stuff, curriculums, exams, etc. The solution contains all necessary data to be able to serve each party from the moment when a potential student registers to study at Subotica Tech, to the moment when a diploma and a diploma supplement is generated for the student who finished their studies.

Additionally, the communication between students and teachers, teachers and staff is also incorporated into the system.

V. RANKING PROCEDURE AND ALGORITHM

At Subotica Tech, students can apply for 5 different study programs (Mechanical Engineering, Electrical Engineering, Information Technologies, Mechatronics, and Technical Management), and within these programs for eight different modules (Product Development, Thermotechnics, Electronics, Automation, Technical Informatics, Internet and E-business, Mechatronics, and Technical Management). When applying, students can select up to three different modules, sorted into three levels of priority (1st, 2nd, and 3rd).

The main rule that is taken into consideration while performing the ranking of the students is defined by the following sub-rules:

- If the student is ranked within budget for the 1st priority module, they are removed from the rankings for 2nd and 3rd priority modules regardless of their rankings;
- If the student is not ranked within budget for the 1st priority module, but is ranked within budget for 2nd priority module, they are removed from ranking for 3rd priority module regardless of their ranking;
- If the student is not ranked within budget for the 1st and 2nd priority modules, they are not removed from any ranking.

To be able to perform the ranking, the following input data is needed:

- Available study programs – modules;
- Application term;
- Study year;
- Capacity for study programs –modules (Budget and self-financing);
- Required points (Budget and self-financing);
- Student's name;
- 1st priority study program – module for each student;
- 2nd priority study program – module for each student;
- 3rd priority study program – module for each student;
- Points for each student;
- Status for each student.

The ranking procedure is initiated manually to obtain the current rankings (Fig. 1). When initiated, ranking is performed for each study program – module, according to the points of the students who applied for it and whose status is unregistered, taking into consideration the remaining available capacities. After this ranking, a sub-procedure is initiated. For each study program – module, all students who applied for it with the 1st priority and are ranked within budget are one by one removed from all study programs – modules where they priority is higher than the checked priority. After that, the sub-procedure is repeated for the 2nd priority. The developed procedure takes into consideration whether at least one removal from any study program - module occurred during the sub-procedure. If at least one removal occurred, the sub-procedure is initiated over again. The ranking procedure ends if the sub-procedure is ended without any removal from the study programs – modules. At the end, the ranked students for all study programs – modules within budget, self-financing and outside available capacities are presented.

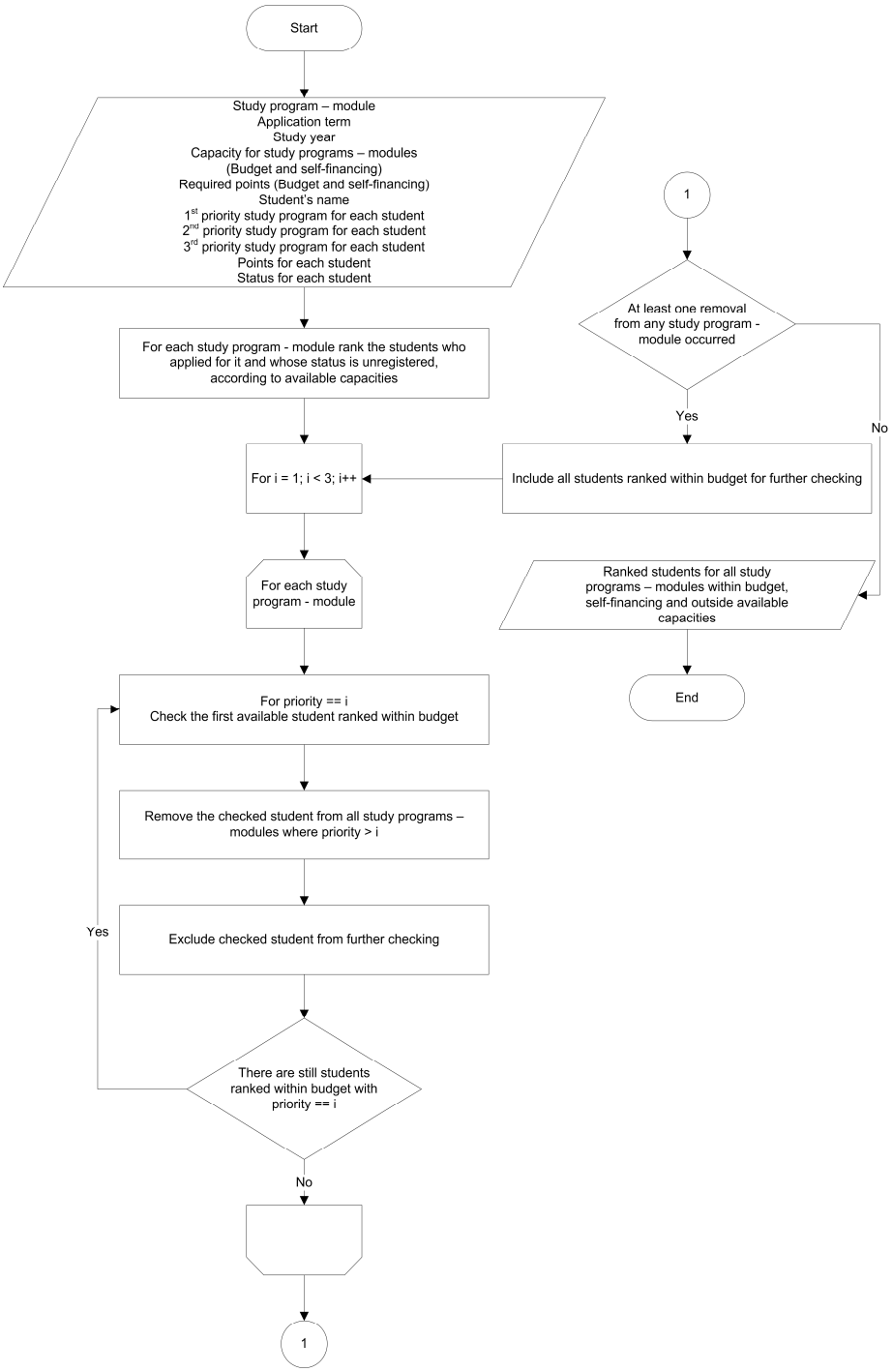

Figure 1. Ranking procedure

VI. IMPLEMENTATION

This section shows some screenshots of the implementation. First the students have to be added. In order to speed up the process, only the most basic information about them are asked. That is shown on the image below (Image 1).

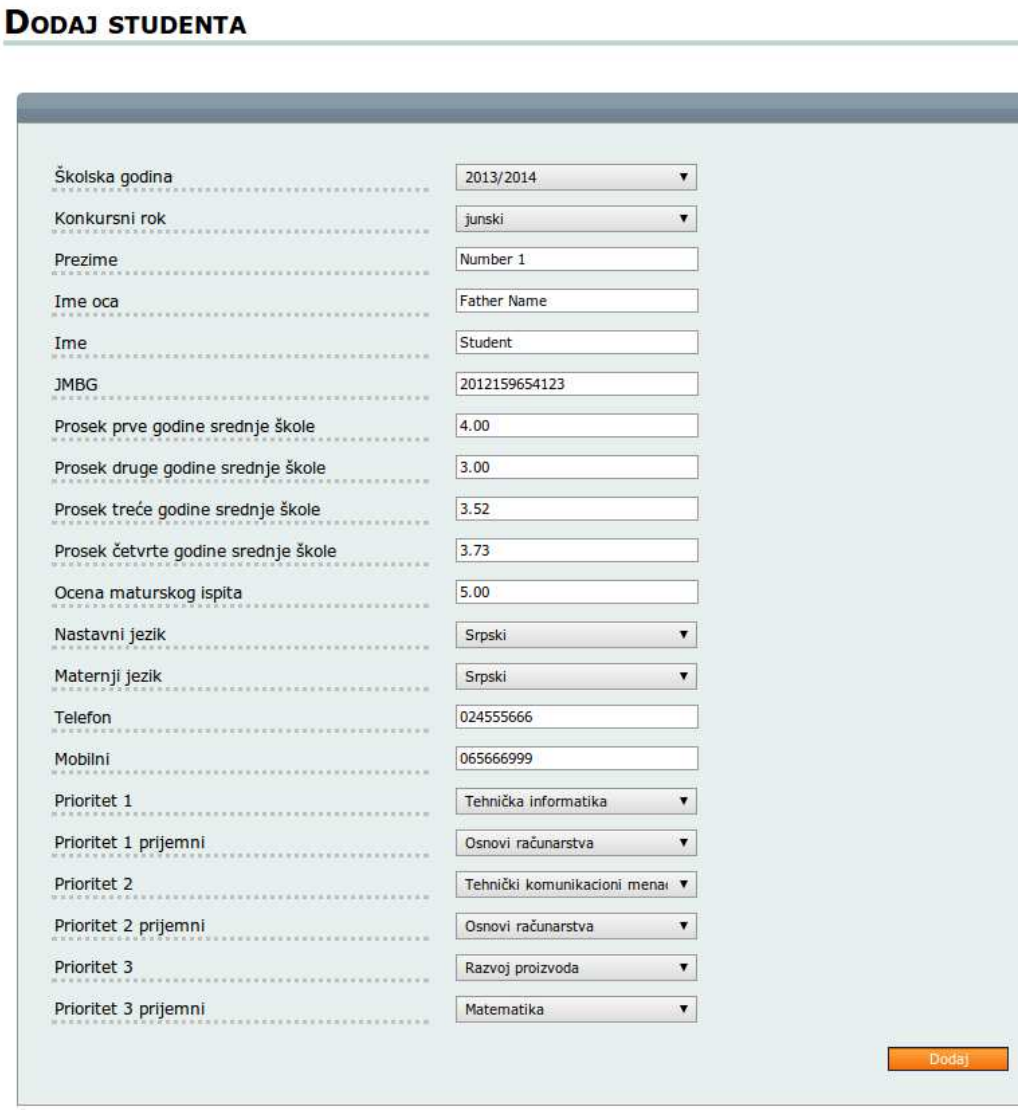

Figure 2. Basic information about the student

In the current case study 5 fictional students are added. When the students are in this database, the lecturer needs to insert the points that they achieved on the exam. The student list is shown below (Image 2), and the interface for exam points inserting in Image 3.

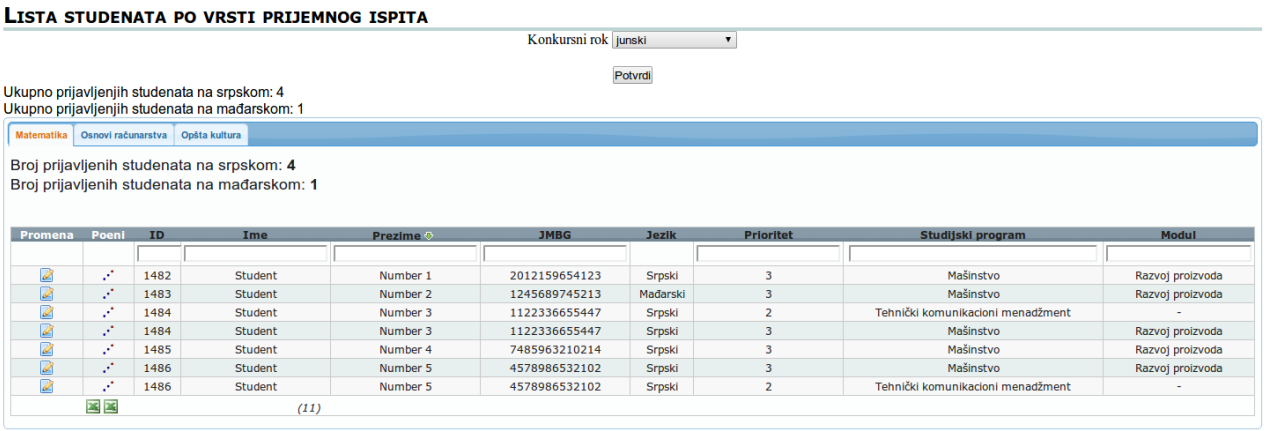

Figure 3. List of new students

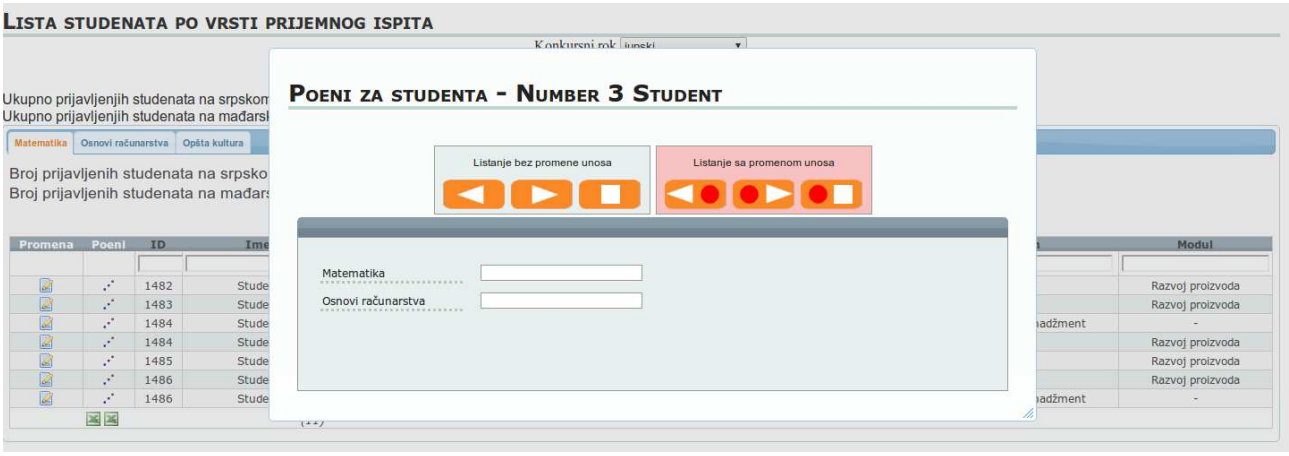

Figure 4. Inserting student exam points

When the points are inserted one can check out the ranking of students listed according to study programs (Image 4, 5 and 6).

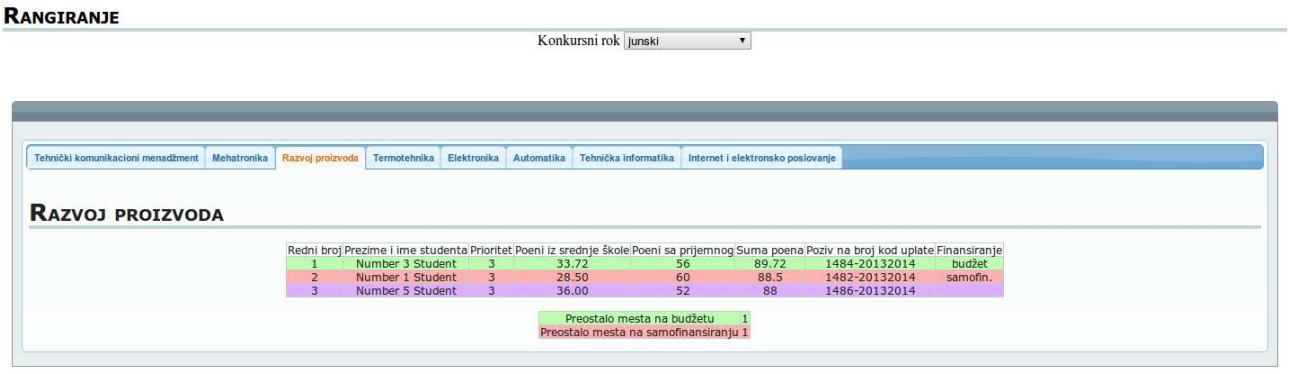

Figure 5. Students ranking by study program

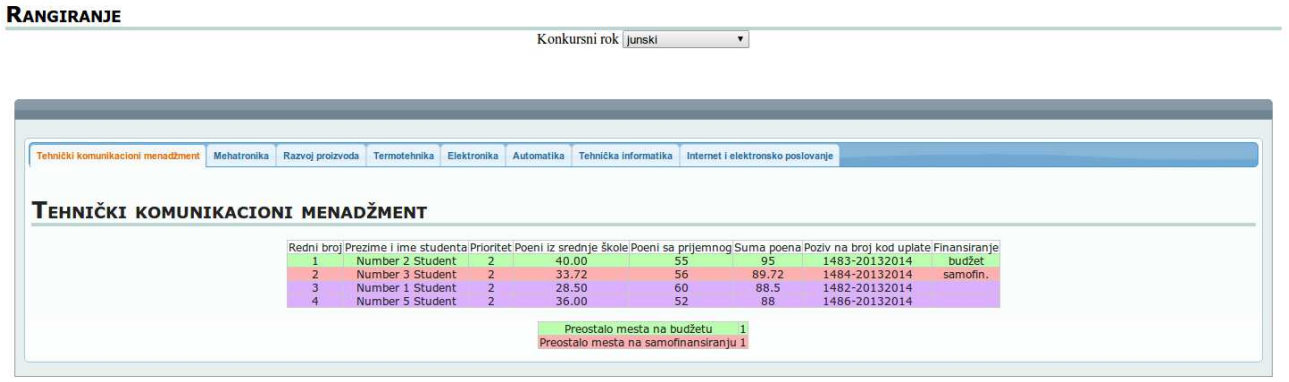

Figure 6. Students ranking by study program

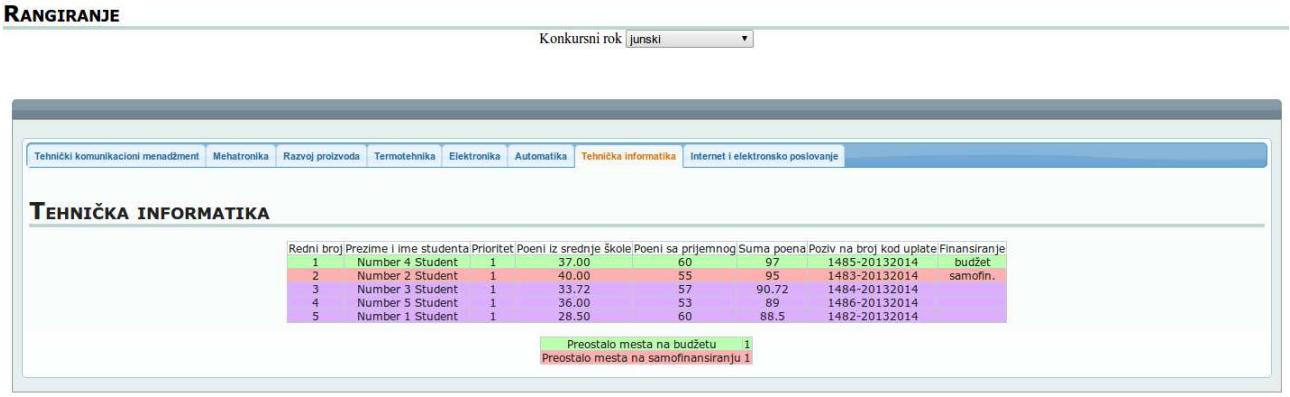

Figure 7. Students ranking by study program

From the images 4, 5 and 6 one can notice that Student number 4 got ranked on his first priority (Image 6). If one tries to find him on the other study program, we will notice that he does not appear there. That is because he achieved his first priority on a budget financed place.

With Student number 2 the situation is slightly different; he appears on 2 places, first in Image 6 where he is ranked to a self-financed place. Because that is not good enough, he is ranked again in Image 5, his second priority on budget financed place, because this happened he is not ranked anymore.

VII. CONCLUSION

This paper presents the ranking procedure algorithm which is developed for the use in the complex web based information system E-administration. The System is implemented at Subotica Tech – College of Applied Sciences. Some of the parts of this system are also described.

REFERENCES

[1] S. Vuković, M. Löberbauer, Z. Čović, M. Ivković „Development of Multiplatform CMS System with Zend Framework“, E-society Journal – Research and Applications, volume3, number 2, December 2012, ISSN 2217-3269, COBISS.SR-ID 255833863, Zrenjanin 2012, pp. 61-68

[2] An empirical study on SAJQ (Sorting Algorithm for Join Queries) Original Research Article Egyptian Informatics Journal, Volume 11, Issue 1, June 2010, Pages 19-26 Hassan I. Mathkour

[3] Teacher sorting, teacher quality, and student composition Original Research Article European Economic Review, Volume 49, Issue 2, February 2005, Pages 457-483 Hans Bonesrønning, Torberg Falch, Bjarne Strøm

[4] Mixing versus sorting: Entering top universities Economics Letters, Volume 100, Issue 1, July 2008, Pages 43-46 Sunku Hahn, Taeyoon Sung, Jisun Baek

[5] Which school systems sort weaker students into smaller classes? International evidence Original Research Article European Journal of Political Economy, Volume 22, Issue 4, December 2006, Pages 944-968 Martin R. West, Ludger Wößmann

[6] Sorting and inequality in Canadian schools Original Research Article Journal of Public Economics, Volume 91, Issues 11–12, December 2007, Pages 2185-2212 Jane Friesen, Brian Krauth

RULES FOR DETERMINING THE ASSESSMENT QUALITY IN DSI 2.0A

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Abstract – The topic of this paper is a specific approach to assessment in e-learning systems. The idea of Web 2.0 is per se compatible with constructivistic learning, where the learning process is done through students' building of their own knowledge. In this scenario, the student is the central agent of learning. This paper discusses one possible way of application of this strategy in assessment: instead of solving multiple choice or other types of predefined tests, student can be put in position to freely (within certain constraints) construct the knowledge in required domain. The quantity and quality of constructed knowledge can then display level of student's knowledge in the domain. Proposed system offers one way of formalization and automation of such approach, as well as the application of pedagogical rules through the system design.

I. INTRODUCTION

Any learning scenario, be it computer-aided or traditional, consists of two fundamental activities: the transfer of knowledge to the learner and the opposite path - assessment of learner's achievements. In traditional learning, both of these components are teacher-centered and though various types of objective assessment methods are used, they still serve as partial input to the teacher, who performs the core assessment process. Moreover, based on the Bloom's taxonomy, [1] higher levels of students' abilities cannot be assessed through objective methods, but rather in an open conversation or, in case of written tests, through freeform answers to questions.

Evaluation of natural language answers requires the use of Natural Language Processing tools for the extraction of meaning. However, once the semantics have been extracted and formalized in a chosen way, mechanisms for assessment (i.e. comparing the level of mapping of processed student's answer to the pre-formatted expected knowledge) requires both highly expressive formal representation methods and inference rules. The technologies of Semantic Web (namely ontologies and rules) are the most promising solution in this aspect, since they can both express semantics (machine-processed students' answers and the expected knowledge, predefined by course designers) and rules for mapping.

One of the most common definitions of ontology, in the context of Semantic Web, is a *formalization of a conceptualization*.[1] As such, it fits the visualisation of knowledge as a web (or a graph) of entities (or concepts), interconnected by relations. This approach isn't new. Before the growth of Semantic Web, research has been done on possible visual organisation of knowledge (both in teaching and assessment) through concept maps, [2] or cognitive maps. [3] With Semantic Web, these representations have been replaced with ontologies - data structures with inherent means to express meaning.

II. E-ASSESSMENT

There are various approaches to knowledge representation and assessment with Semantic Web technologies. Some researchers [4] attempt to represent the entire assessment domain in the form of ontology network. SWRL[2] language has been used to represent rules of assessment, and a network of educational domain specification, educational resource specification, assessment, assessment instrument and LOnto (LOM-based) ontologies are used to form the ontology network, and the general structure has been instantiated to cover different university courses. This approach is aimed primarily at automated generation of assessment modules. One other approach [5] is aimed at processing student answers to open questions, since these questions allow assessment of higher levels of student's knowledge. Natural language processing is used to extract meaning and semantically annotate student's answers, and then compare them to predefined expected results, also expressed as ontologies. A simple, but none the less useful approach is offered in [6]. The described system generates multiple choice

[1] http://www-ksl.stanford.edu/kst/what-is-an-ontology.html
[2] http://www.w3.org/Submission/SWRL/

questions on the basis of knowledge ontology, providing the student with a set of questions and offering different difficulty levels, knowledge competition between learners, user statistics etc. The system is implemented as a Protégé[3] plugin. [7] All these approaches face different challenges. Objective testing is in general easier to implement, while the open question assessment, though technically more difficult, offers more in-depth knowledge measuring. The approach presented in this paper aims at a "middle" solution: semi-automated assessment oriented towards Web 2.0 or peer assessment.

III. WEB 2.0 E-ASSESSMENT - DSI 2.0A

In order to tackle the problem of e-assessment in a constructive and peer-oriented fashion, The DSi 2.0 e-learning framework [8] has been developed. This framework is able to parse html documents and enable drag-and-drop functionality upon every word in text (using the JQuery[4] JavaScript framework). A text-case is shown in Fig. 1 and Fig. 2 - an excerpt from a Wikipedia article ("Automobile") before and after parsing by the DSi 2.0. On Fig. 2 drag-and-drop operation of a random word is presented.

Figure 1. An excerpt from a Wikipedia article before parsing.

The DSi 2.0 has two modes of operation: read mode and edit mode. In edit mode, each word can be dragged onto another or dropped onto, as shown in Fig. 2. This is achieved by recursively traversing the DOM tree up to every single word from the text nodes and wrapping it into a span tag of certain class. The source of the text shown in Fig. 2 (after being parsed by DSi 2.0) is as shown in Fig. 3.

Figure 2. Drag-and-drop operation over the parsed text.

DSi 2.0 framework operates with two documents: the learning material (in plain text or HTML) and an accompanying semantic document, expressed in RDF/XML. Each loaded document, even parsed for drag-and-drop ability, may or may not have the semantic counterpart. If the semantic document is not present, upon the first drop action, the user is prompted to enter the relation between dragged and dropped onto word. This triple (word, relation, word) will form the first RDF triple and will be written to a newly created semantic document. Each new drag-and-drop action, if any relation is entered by the user, forms a single RDF triple. This way, each user (learner) is able to enter any number of relations in the document.

However, if there are relations present (the semantic document does exist), upon the drag-and-drop action the user is presented with all existing relations, with the option to mark them with one to five stars. This way, each relation passes a peer review and are sorted in the descending order - the relations that peers are most satisfied with surface to the top. This is shown in Fig. 4.

[3] http://protege.stanford.edu/
[4] http://jquery.com/

```
<p><span            class="dsi2">An</span>
<b><spanclass="dsi2">automobile</span>
</b>,<b>
<span     class="dsi2">autocar</span></b>,
<b><span         class="dsi2">motor</span>
<span          class="dsi2">car</span></b>
<span   class="dsi2">or</span>   <b>car</b>
<span               class="dsi2">is</span>
<span                class="dsi2">a</span>
<span          class="dsi2">wheeled</span>
<a              href="/wiki/Motor_vehicle"
title="Motor                       vehicle">
<span            class="dsi2">motor</span>
<span class="dsi2">vehicle</span></a>
```

Figure 3. Drag-and-drop operation over the parsed text.

This approach allows students to build knowledge into the text material from which they learn, adding the constructivist component to learning. On the other hand, it provides peer-reviewing platform, enabling the natural selection of the most accepted semantic relations. These relations are not per se the most accurate ones; however, with the increasing number of reviews, the collective mind of students is expected to achieve the objectiveness needed.

Further to the collaborative - constructive learning with elements of peer-assessment, the implemented DSi 2.0 framework is aimed at clean assessment. This branch of development has been labeled as DSi 2.0A, where A stands for Assessment. In this scenario the student is presented with chosen portions of the learning material, formulated in a different way from the one they learned from. Student is required to define as many relations as they can (via drag-and-drop action) which can then be assessed in quantitative and qualitative manner. Quantitively, the number of relations between specified pairs of words can be measured and a conclusion about the number of concepts retained. Qualitively, relations can be compared to the predefined expected answers. In case of open answers, since these relations are small, simple statements, processing is not expected to be challenging. Other than open answers, learners can be offered multiple choice questions automatically generated from the relations in the semantic document. These relations can be predefined by the contents author, or based upon the user-generated and peer-sorted relation base.

IV. RULES FOR DETERMINING THE ASSESSMENT QUALITY

According to [9] there are some pedagogical recommendations that teachers need to take into account in the development of assessment, that can insure that the pedagogical side of assesment is valid. In this typ of assessment, the most commonly used instruments are multiple and simple choice.

These pedagogical rules are given in [4], both in a spoken language and in a formal first-order logic way (as shown in Table 1).

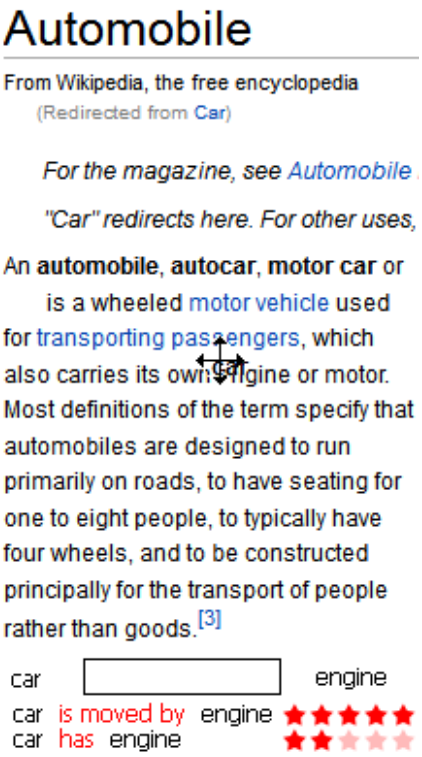

Figure 4. Adding a new relation and marking the previous ones.

TABLE 1. PEDAGOGICAL RULES FOR SIMPLE AND MULTIPLE CHOICES EXPRESSED IN FIRST-ORDER LOGIC

Description	First-Order Logic
Simple choice	
1. A simple choice activity must have at least four options	$\Im \models \forall x \in$ simpleChoices ($\exists$ y, z, w, r $\in$ Options (hasOption(x,y)$\wedge$hasOption(x,z) $\wedge$hasOption(x,w) $\wedge$hasOption(x,r) $\wedge y \neq z \neq w \neq r \wedge z \neq w \neq r \wedge w \neq r$)
2. A simple choice activity must have only one true option	$\Im \models \forall x \in$ simpleChoices ($\exists !y \in$ TrueOptions hasOption(x,y))
Multiple choice	
3. A multiple choice activity must have more than one true option.	$\Im \models \forall x \in$ multipleChoices ($\exists$ y, z $\in$ TrueOptions hasOption(x,y) $\wedge$hasOption(x,z) $\wedge y \neq z$)
4. A multiple choice activity must have more than four options.	$\Im \models \forall x \in$ multipleChoices ($\exists$ y, z, w, r $\in$ Options (hasOption(x,y)$\wedge$hasOption(x,z) $\wedge$hasOption(x,w) $\wedge$hasOption(x,r) $\wedge y \neq z \neq w \neq r \wedge z \neq w \neq r \wedge w \neq r$)
5. A multiple choice activity cannot have option like: “all of them” or “none of them”	$\Im \models \forall x \in$ multipleChoices ($\exists$ y $\in$ Options ((hasOption(x,y) $\wedge \exists$ z $\in$ attributes (hasAttribute(y, z) $\wedge$ value(z,w) $\wedge$ (w $\neq$ “all of them” $\vee$ w$\neq$ “none of them”)))

The DSi2.0A framework provides structure to implement these pedagogical rules for multiple and simple choice type questions:

- In the learning material to be presented to students, at least four options for each answer (i.e. for every relation) must be offered.
- All accurate relations need to be predefined in the RDF/XML layer.
- Proper text highlighting must be obtained, through a CSS property (like color), so the text to be brought into one single relation is easily differentiated from that to be put into multiple relations. By doing so, the choice type would be denotable (simple vs. multiple choice).
- DSi 2.0A framework can also be viewed as a space for scetching the student's definitive answer. After the analysis of the text, putting words into relations and considering the relations' star-ratings, student is to decide on the final simple or multiple choice answer. It is possible that the student creates several simple choice relations and annotate them with differen star-ratings. Same is true for multiple choice.
- Application restart (eg. by logging back on for the test) so that the student can define the final relations (by drag-drop actions) – based on the "sketch" version (choosing relations based on star-ratings).
- The student-generated RDF triples are in turn assessed against the predefined accurate triples and true/false results are generated.
- Further to the true/false assessment, the star-ratings can be assessed too, in two ways:
  - In case the retention of the previously covered learning material, the number of stars can indicate the student's level of prior knowledge (how certain they were about their answers, i.e. relations).
  - In case of a new material, greater number of stars can indicate more activity on the student's side.
- By applying these strategies, final asnwers that satisfy the rules of "pedagogical quality" in a more complex way can be obtained.

V. CONCLUSION

This paper described the DSi 2.0 Web 2.0 based collaborative framework in the context of assessment. This framework has been developed up to the testing phase and is expected to be subject to real-life university situations. Its development is expected to go in two possible directions: towards building a wiki-type relation base upon which the assessment would be implemented, and towards automated assessment usage based on predefined expected and distracting answers – both with respect to the pedagogical rules discussed in the paper.

REFERENCES

[1] B. Bloom, "The classification of educational goals. Taxonomy of educational objectives: the classification of educational goals", in: B.S. Bloom (Ed.) David McKay Company, Inc, 1956, 201–207. Chapter "Taxonomy of Educational Objectives", 1956, pp. 201–207.

[2] Rice, Diana C., Joseph M. Ryan, and Sara M. Samson. "Using concept maps to assess student learning in the science classroom: Must different methods compete?." Journal of Research in Science teaching 35.10 (1998): 1103-1127.Xxx

[3] S. Stoyanov, (1997). "Cognitive Mapping as a Learning Method in Hypermedia Design". Journal of Interactive Learning Research, 8(3), 309-323. Charlottesville, VA.

[4] Romero, Lucía, Milagros Gutiérrez, and María Laura Caliusco. "Conceptualizing the e-Learning assessment domain using an ontology network." IJIMAI 1.6 (2012): 20-28, ISSN-e 1989-1660.

[5] Dagoberto Castellanos-Nieves, Jesualdo Tomás Fernández-Breis, Rafael Valencia-García, Rodrigo Martínez-Béjar, Miguela Iniesta-Moreno, "Semantic Web Technologies for supporting learning assessment", Information Sciences, Volume 181, Issue 9, 1 May 2011, Pages 1517-1537, ISSN 0020-0255.

[6] Tosic, M.; Cubric, M. "SeMCQ – Protégé Plugin for Automatic Ontology-Driven Multiple Choice Question Tests Generation", Proceedingss of the 11th International Protege Conference. Vol. 2009.

[7] Cubric, Marija, and Milorad Tosic. "Towards automatic generation of e-assessment using semantic web technologies." International Journal of e-Assessment, 2011.

[8] Martin Jovanović, Višnja Ognjenović, "Constructivist Semantic Assessment Tool for Textual Learning Material", International Conference on Information Technology and Development of Education ITRO 2011, University of Novi Sad Technical Faculty ”Mihajlo Pupin” Zrenjanin, Serbia, 01.07.2011, Zrenjanin, Serbia, Proceedings of Papers, published by University of Novi Sad, Technical faculty „Mihajlo Pupin”, Zrenjanin, Serbia, pp. 294-297, 2011, ISBN 978-86-7672-134-4

[9] IEEE Standard for Learning Object Metadata. Learning Technology Standards Comittee of the IEEE Computer Society. 1484.12.1-2002

GEOINFORMATION TECHNOLOGIES IN EDUCATION – PERSONS WITH DISABILITIES IN EMERGENCIES

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Abstract: Within the Department of environmental engineering and occupational safety, Faculty of technical sciences in Novi Sad, students have an opportunity to attend the lectures at the subject "Disaster Risk Management". During the lectures, the special attention is devoted to a holistic problem solving approach and application of fundamental knowledge in practice. Concept of lectures is developed so that students are trained for geospatial analysis of hazardous events occurrence possibilities and modelling reaction scenarios. Special attention in planning of emergency response is given to identification of potentially exposed areas and populations with increased vulnerability, particularly persons with disabilities. The most creative students' outcome that we received at the end of the semester is described in this paper. Within Disaster Risk Reduction Research Centre at the Faculty of Technical Sciences, students have an opportunity to continue and develop their ideas through the scientific work along with their professors and teaching assistants. Since, we were inspired by students' work, we decided to extend the scope of obtained case study in order to examine possibilities for comprehensive problem solving.

I. INTRODUCTION

United Nations Educational, Scientific and Cultural Organization (UNESCO) within the theme "Education for the XXI century" and within Convention on Technical and Vocational Education [1], claim that education is essential for economic and social development, so it is the center from which all changes and developments arise [2].

Changes and developments in education trends are mostly aligned with the development of science and technology. In the last two decades, development of information technology is the most dominant. Hence, information technology and systems became indispensable in education. Technology has enabled students to accent the out-of-class information and this has caused the increase of their motivations for learning [2]. The teachers are becoming coaches and collaborators rather than dispensers of knowledge with the implementation of computer use into schools and universities [3]. Learning perspective has shifted. Students are learning through the work, dealing with the real system, learning to solve real problems using information technology and creating their own case studies.

The use of information processes, technologies and systems for creation and analysis of real system's models facilitates the understanding of processes and phenomena in nature. Natural processes occur in real space and time. In order to study the above processes, it is necessary to observe and analyze the spatial context of the selected system. Spatial analysis of obtained data provides spatial and non-spatial information based on which it is possible to draw conclusions regarding the selected system.

A powerful tool for spatial data analysis are geoinformation technologies and systems. Therefore, the development of information and geoinformation technologies and following current trends in education, Geographic Information Systems (GIS) are increasingly becoming an integral part of the teaching process in various scientific fields. By use of Geographic Information Systems we are able to combine data from various fields and integrate different systems to work together in order to provide multipurpose outcomes. [4].

The possibility of combining, processing and analyzing of different data types from different fields brings GIS to the multi-disciplinary level of research. Eminent experts of a relatively new, multidisciplinary field of disaster risk management recognized the potential of the considered tools in analyzing the phenomena and processes in the specified research area.

GIS facilitates managing large data sets, developing in models, building risk assessment, land use management, forecasting causalities, and generating risk maps [5, 6]. According to scientist, GIS can be used in risk identification, mitigations, preparedness and emergency responses which are all aspects of disaster risk management process [7].

At the Faculty of Technical Sciences, University of Novi Sad, within the study program "Environmental Engineering" students have an opportunity to choose the subject "Disaster Risk Management". Managing the risks of catastrophic events occurrence usually require joint efforts of different profile experts in solving complex problems of the field. We devote special attention to holistic problem solving as well as to applying gained knowledge to real life situations. Students are trained to use geospatial analysis of hazardous events occurrence possibilities in modeling reaction scenarios. In planning of emergency response, special attention is given to identification of hazardous risks, potentially exposed areas and populations with increased vulnerability, particularly persons with disabilities.

II. FIELD OF DISASTER RISK MANAGMENT

Identifying risks of disasters occurrence and developing strategies to reduce these risks has become one of the key tasks of the United Nations [8]. The field of disaster risk management is relatively new and takes a structured approach to managing uncertainty related to threat of natural and man-made disasters [9]. Disaster risk management (DRM) accumulates all activities, programs and measures, which can be taken up before, during and after a disaster [10]. Measures taken before occurrence of disastrous event are at least as important as the measures taken during and after the occurrence. These measures represent, among other things, identification of possible hazard realization risk, exposed area and vulnerable population.

Hazard represents a potential situation or event that could be harmful to people, property or the environment. Hazards can be classified into two categories: natural and man induced [11]. Disaster occurs when hazard affects a vulnerable population or area and causes damage, human lost and disruption of usual activities of the community [11]. It is necessary to manage disaster risk in order to minimize the consequences of a catastrophic event. The main activities of disaster risk management are: detection of vulnerable population and/or area and exposure analysis of identified population and/or area.

Vulnerability can be defined as the extent to which a society, structure, service or geographical area may submit a hazard on account of its nature and structure, and the distance from areas prone to hazardous events [12]. Exposure represents the number of people and/or other elements at risk that can be affected by a particular event [13]. By determining vulnerability and exposure of community of interest, it is possible to make decisions and take necessary actions in order to minimize consequences of a catastrophic event.

Based on analysis of catastrophic events realization frequency at the territory of Novi Sad, there have been identified increased risks of floods, fires, very high and low temperatures, industrial (chemical) accidents, terrorist attack. Also, contemporary urban risks have multiple causes and are highly interactive [14], so multi-hazard realization at the territory of Novi Sad should be as well considered. The most vulnerable population groups identified in Novi Sad are children, seniors and persons with disabilities. Universal design approach to meeting the needs of persons with disabilities before and after a disaster will benefit many people without disabilities, such as the very young or the aged [15]. Therefore, it is of most importance for disaster management process to identify types of disabilities and specific possibilities and constraints of persons with disabilities in the case of emergency evacuation.

III. POSSIBILITIES AND CONSTRAINTS OF PERSONS WITH DISABILITIES IN EMERGENCES

Disaster preparedness for persons with disabilities is critical in minimizing the impact of a disaster [15]. While planning for every situation that may occur in every type of an emergency is impossible, being as prepared as possible is important [16]. Therefore phase before the occurrence of a catastrophic event should become a priority for disaster risk management where equal attention should be paid to population with disabilities as well as to nondisabled citizens.

During the process of planning the disaster risk management strategy related to persons with disabilities, it is of most importance to keep in mind different types and subtypes of disabilities [17].

A. Classes of Constraints and Types of Disabilities Significant for Planning a Response in the Case of Emergencies

According to US NFPA Emergency Evacuation Planning Guide for People with Disabilities [16], a standard building evacuation system has three components:

- The *circulation path* - a continuous and unobstructed way of travel from any point in a building or structure to a public way. A circulation path is considered a usable circulation path if a person with disabilities is able to travel unassisted through the circulation path to a public way.
- The *occupant notification system(s)* include but are not limited to alarms and public address systems.
- *Directions to and through the circulation paths* include signage, oral instructions passed from person to person, and instructions, which may be live or automated, broadcasted over a public address system.

During construction of infrastructure for the evacuation and planning of necessary actions during and after catastrophic event, every single type of inability requires a special approach and consideration of various types of constraints. Thus, disaster risk managers have to recognize and consider at least general categories of disabilities.

According to Fair Housing Act Design Manual [18] there are five general categories of disability: mobility impairments, visual impairments, hearing impairments, speech impairments and cognitive impairments [16]. In addition to inability categories, there are different levels of disabilities, which also affect the functionality of people in a catastrophic event. Also, one person may have multiple disabilities, while another may have a disability with fluctuating symptoms [16]. Further, it cannot be predicted when anyone may need assistance, such as in the case of a broken leg or the development of heart or lung disease [15].

Mobility impairments. Persons with mobility impairments may use one or more devices (canes, crutches, wheelchair, etc) to maneuver through the environment. Typical evacuation problems include maneuvering through narrow spaces, going up or down steep paths, moving over rough or uneven surfaces and negotiating steps or changes in level at the entrance/exit point of a building. If there is a person with mobility impairment in the company or building, it should be at least two employees responsible for his/her evacuation.

Visual impairments. Persons with visual impairments may be partially (e.g. can distinguish light and dark, color, close-readable labels) or completely blind [17]. That is why exits should be marked by tactile signs that are properly located so they can be readily found by a person with a visual impairment from any direction of approach to the exit access. It may be practical to physically show new employees with visual impairments where are all usable circulation paths located in a building [16].

Hearing impairments. Hearing impairments may manifest as a complete disabling hearing when person rely on sign language as the only means of communication. Persons with hearing impairments whose sense of hearing is not fully disabled can receive sound information using hearing aids and lip-reading [17]. Persons with hearing impairments, in most cases, cannot hear alarms and voice announcements that warn of danger so it is extremely important that they know what visual notification systems and what visual devices are in place (e.g. flashing strobe lights). Another alternative is to develop push services for smart phones for notifying people with hearing impairments promptly about evacuating.

Cognitive impairments. Cognitive impairments can be caused by a wide range of conditions but they all result in some decreased or impaired level in the ability to process or understand the information received by the senses. All standard building egress systems require the ability to process and understand information in order to safely evacuate. However, persons with cognitive impairments usually do not need special physical assistence during the evacuation. To reduce the risk of injuries and suffering due to inability to evacuate to minimum, it is necessary to pre-drill and practice evacuation strategies regularly with persons with cognitive impairments.

Based on the above considerations, there is an evident need to get to know persons with disabilities with possible strategies and evacuation routes from the building in case of a catastrophic event. It is also necessary that all employees,

especially employees in the sector of security and doormen at the entrance, are aware and trained to deal with disabled persons in extraordinary circumstances [16]. In addition, persons with disabilities can be included in developing accessible communications and reliable assistance technologies [15], so disaster risk managers can cooperate with them in order to create comperhensive evacuation and rescue strategy.

For implementation of the actions for persons with disabilities to disaster risk management strategies it is necessary to acquire data about locations and places of meetings and activities of target groups at the area of interes, and to bring obtained data into appropriate context. It is necessary to integrate heterogeneous data and to provide their interoperability [17].

IV. Context and Format of Data

In the context of discussed phenomena and population of interest, it is extremly important to identify centers where persons with disabilities gather daily as well as the type and degree of disability of people who spend time in the centers. Also, there is a need for data on the temporal distribution of persons with disabilities in the centers on a daily and weekly basis. Acquiring of specified data is a process which requires different methods which includes combination of theoretical research and field work. Acquisition of data has been performed within Disaster Risk Reduction Research Center at the Faculty of Technical Sciences.

Collected data about centers and institutions where persons with disabilities gather in Novi Sad, as well as types of activities they perform, are a set of raw data in the form difficult for use for the purpose of disaster risk management. The way these data are used should be in accordance with the aim of their application and prescribed standards. Type of information necessary for the decision making process in the field of disaster risk management defines, to a great extent, the way of processing raw data. Bringing data into spatial relation and database organization of attribute data provides a comprehensive approach to problems of persons with disabilities in emergency situations.

It can be concluded that geoinformation technologies are an inevitable tool for geospatial analysis and modeling of vulnerable population exposure in the case of catastrophic events occurrence. Based on the previous considerations, we decided to use Quantum GIS software for modeling and geospatial analysis of possible actions during and after disaster, for the purpose of students' education.

V. Geospatial Analysis of Persons with Disabilities in Catastrophic Events and Modelling of Rescue Actions with the Aim of Students' Education

During the realization of practical exercises of the subject "Disaster Risk Management", students were trained to model possibilities of emergency situation realization and planning of evacuation actions and rescue of people with disabilities in the case of catastrophic events. Spatial data analysis has been performed in QGIS software for the purpose of real system modeling. The initial input for the creation of the model, students received in the form of Quantum GIS vector layer with the locations where persons with disabilities gather at the teritory of Novi Sad. Attribute data about address of center and type of activity that persons with disabilities perform in each center are associated to the vector layer. For the details about technological framework of described vector layer creation please see *J. Simic et all, Persons with Disabilities in Catastrophic Events – Exposure and Geospatial Analysis* [17].

A. Student's Task

The task of each student was divided into several phases:

1. Choose, from received vector layer, one center of interest for modeling necessary actions in a case of emergency.
2. Consider hazardous situation with the highest probability of realization in the context of the selected center.
3. Identify data that has to be collected for planning of the successful response in the case of predicted event realization. Consider if the format of necessary data is suitable for further processing and analysis.
4. Develope a method for data organisation and creation of disaster risk management model for the predicted event (visual representation of the real situation and organization of attribute table about selected elements of the physical system in Quantum GIS).
5. Based on the realized model consider possibilities and constraints in planning

disaster risk management actions for designed case study.

B. Realized Case Study

Case study graded with the highest mark is shown in the Figure 1. Selected center is a primary school for persons with disabilities called "Milan Petrovic" and is located in Braće Ribnikara street. Primary school represents a center with a high frequency of arrival and departures as well as with long time of retention of persons with disabilities during the work days. Also, high percentage of the total number of the persons with disabilities between the ages from 7 to 14 at the teritory of Novi Sad attend this school. In the vicinity of the school, at the distance of 280 meters, there is a petrol station where the services of pouring the fuel into the cars are performed daily and service of refilling depot for the fuel is performed from time to time. During mentioned activities at the petrol station accidental situations such as leakage of oil products, fire or explosions could happen. According to discussed parameters, selected school represents a site with increased level of exposure and vulnerability in terms of potential hazardous events realization in the considered spatial environment.

With the aim of planning responses to potential catastrophic events and rescue and evacuation of people with disabilities from exposed location, additional vector layers are produced in Quantum GIS. Vector layer which displays location of the petrol station contains data about the type of fuel in use, capacity of fuel storage, address and phone number of petrol station and the distance of petrol station to the school. Specified data are organized in the form of attribute table of described vector layer. To the vector layer which displays locations of the services responsible for reactions in emergencies (ambulance, fire department and police station) location of the nearest taxi station were added. Attribute table of the vector layer contains information about address, phone number, total number of vehicles that are available during the day, for any particular emergency service listed above.

Figure 1. Map of the case study graded with the highest mark

In order to analyze the possibilities of evacuation in the case study, vector layer which displays the most suitable access roads to the location of accident from the emergencies services were produced. By the use of Quantum GIS function for calculating a length of the LineString geometry, data about distance in meters were assigned to the each road. In addition to data about the lenght of each road, attribute table of the vector layer contains data about the number of traffic lights on every road, type of road and the time necessary for arrival of the emergency service vehicle to the school. For calculating of the time neccessary for arrival of each vehicle to the school, Web service Google Maps was used. This service represents remote sensing source of spatial and raster data neccessary for defining spatial reference system and for integration of base maps into Quantum GIS.

The overlap of described vector layers provides a model of the real system. Decisions regarding disaster risk management of the predicted event could be made by analysis of the model. By brief examination of the case study display in Quantum GIS, necessary information are ensured for planning evacuation of particularly vulnerable population of persons with disabilities from the spatial environment of the realized accident at the petrol station. By bringing data into spatial relations, interoperability is achieved, which enables exchange of information between experts from different fields whose promptly and coordinated cooperation is necessary in a case when time for reactions and decisions making is limited.

VI. Possible Influence on Legislation Regarding the Issue

Beside significance of realized case study in the education process, described model can be a trigger for different aspects of change in the field of disaster risk management. Also, importance of care about the most vulnareble citizens in the case of emergency can be magnified by dealing with such topics. Persons' with disabilities situation deservs equal attention in all aspects of contemporary civilization changes. Their capabilities and limitations in terms of disaster risk management should be considered equally and from different points of view. Beside hazardous risk identification and modeling, social, economic and, above all, administrative aspects are of great importance for raising the level of equality and safety of persons with disabilities in modern world's chalenges.

In accordance with aplied methods for research of examinated case study, and in addition to student's work, we identified and analyzed the most important legislation that can influence the improvement of disaster risk management strategies regarding vulnerable population.

A. Legislation Concerning the Rights of Persons with Disabilities

The proactive method for reducing the effects of catastrophic events in the rescue and evacuation of people with disabilities is to establish and implement appropriate legislative regulation. The following is an overview of the current situation in the field of research.

At the General Assembly of the UN, the Convention on the Rights of Persons with Disabilities [19] was adopted. The purpose of the Convention was to promote, protect and ensure the full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities, and to promote respect for their inherent dignity (Article 1). The Convention was enforced in 2008 [20], while the National Assembly of the Republic of Serbia ratified the Convention in 2009, with a Law on Ratification of the Convention on the Rights of Persons with Disabilities [21]. According to the Convention, The States parties have to take all necessary measures to ensure the protection and safety of persons with disabilities in situations of risk, including situations of armed conflict, humanitarian emergencies and natural disasters (Article 11).

At the national level, the Law on Prevention of Discrimination against Persons with Disabilities [22] represents the basis for development of other laws in this domain. Furthermore, the Law on Emergency Situations of the Republic of Serbia [23], states that among other population groups, ill persons, persons with disabilities and others in need of assistance and care are subject to the evacuation (Article 57). In addition, this Law specifies rescue forces: emergency staff, fire and rescue units, police, the Serbian Army, the Red Cross of Serbia, Serbia Mountain Rescue (Article 8) that represent the services that are required to actively participate in the rescue and evacuation of affected populations.

It is necessary to match real needs of people with disabilities in emergency situations. At

locations where citizens with disabilities are gathered in larger groups on every day bases, it is necessary to ensure high technical and technological standards of care and protection as well as additional personal assistance, for instance: professionals trained for the case of emergency or volunteers. Also, non-govermental organization can play an important role in providing appropriate human and organizational resources, therefore, it is necessary to provide appropriate regulations and financial mechanisms to ensure their envolment in the disaster preparedness actions.

B. Infrastructure for Spatial Information in European Community

As it is mentioned before, Disaster Risk Management represents multidisciplinary field and requires involment of different field experts in the process of hazard, risk and vulnerability indetification and quantification. Multidisciplinary expert's involment and interconnection is reflected in existence of disaster risk management community. Communication within DRM community should be provided in an easy and interoperable way. This communication is based on necessary data communication and interchange. In order to achive an interoperability of different types of spatial and non-spatial data acquired from differnt sources, it is necessary to build appropriate spatial data infrastructure (SDI) in accordance with recommended and adopted standards.

A SDI encompasses data sources, systems, network linkages, standards and institutional issues involved in delivering geospatial data and related information from many sources to the widest possible group of potential users [24]. Infrastructure for Spatial Information in Europe (INSPIRE) [25], was launched by the European Commission aiming at „making available relevant, harmonised and quality geographic information to support formulation, implementation, monitoring and evaluation of Community policies with a territorial dimension or impact“ [26].

According to Directive 2007/2/EC of the European Parliament and of The Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) ‘infrastructure for spatial information’ means metadata, spatial data sets and spatial data services; network services and technologies; agreements on sharing, access and use; and coordination and monitoring mechanisms, processes and procedures, established, operated or made available in accordance with this Directive [25].

Within Chapter I, general provisions and the purpose of the Directive is defined: to lay down general rules aimed at the establishment of the Infrastructure for Spatial Information in the European Community, for the purposes of Community environmental policies and policies or activities which may have an impact on the environment [25, Article 1]. Outcomes of this Directive are reflected, not only in the legislative scope, but also, in technical domain. Naimly, within Annex I, II and III of the Directive specific data themes are listed, and Commisson should adapt detail description of that themes. For the field of Disaster Risk Management, among all described spatial data themes, the most important are: elevation, land cover, orthoimagery, land use, population distribution, production and industrial facilities, meteorogical geographical features and natural risk zones.

Detail description of above listed spatial data themes is of significant importance for creation of risk and hazard maps. Therefore, hazard map that have been described in this paper should be created in accordance with considered INSPIRE Directive and its data specifications for certain spatial data themes.

VII. CONCLUSION

Use of geospatial analysis in the field of disaster risk management is an example of comprehensive approach to solving practical engineering problems. During the process of teaching in the field, it is necessary to use examples from real situations. Geospatial analysis of exposure to risks of persons with disabilities and modeling appropriate responses allows students to understand complexity of the risk management concept, as well as to learn how to use the GIS software. Use of geoinformation technology develops spatial thinking skills among students and the ability to observe interrelations between acquired data. By putting data into the proper context and bringing obtained information into relation with previously acquired fundamental knowledge in the field of risk management, students are trained to independently draw conclusions and decide about future reactions. Also, dealing with practical engineering problems through application of current software during lectures broadens their minds in direction above the scope of engineering. They become able to comprehend additional aspects of the problem

solution possibilities: social, institutional and financial which considerably increases their quality and competence on the job market.

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REFERENCES

[1] Convention on Technical and Vocational Education, Resolution adopted on the report of Comission II at the 29th plenary meeting on 10 November 1989, UNESCO

[2] F. Hamidi, M. Meshkat, M. Rezaee, M. Jafari, "Information Technology in Education", Procedia Computer Science 3, 2011, pp. 369–373

[3] F. N. Alfahad, "Effectiveness of using information technology in higher education in Saudi Arabia", Social and Behavioral Sciences 46, 2012, pp. 1268 – 1278

[4] M. G. Korucu, „GIS and types of GIS education progammes", Social and Behavioral Sciences, 2012 , 46, pp. 209 – 215.

[5] G. Iglesias, "The Adoption of Geo-information and Geographic Information Systems for Natural Disaster Risk Management by Local Authorities In: S.Z.a.E.M.F", Geo-information for Disaster Management, Springer Berlin Heidelberg, 2005, pp. 1009-1019.

[6] A. L. Montoya, I. Masser, "Facing the unexpected: GIS for urban disaster management. Geospatial today: strategic renewal to geospatial world, 2(2), 2003.

[7] N. P. Hapuarachchi, "The usage of geo-information technology in disaster management by sub national level organizations case study – Ratnapura in Sri Lanka", master thesis, International institute for geo-information science and earth observation enschede, Netherlands, 2008.

[8] J.Simic et al., "Disaster risk management Web enabled information technology", *Proceedings of International Conference on Applied Internet and Information Technologies 2012: AIIT 2012*, Zrenjanin, Serbia, October 22, 2012, pp. 219-223.

[9] G. Dyke et al., "Dream project: Applications of earth observations to disaster", *ActaAstronautica*, 2011,Vol. 68, pp. 301-305.

[10] H. Khan, L.G. Vasilescu, A. Khan, "Disaster management cycle - a theoretical approach"

[11] D. Sakulski, Đ. Ćosić, „Floods and vulnerability of built environment", Proceedings of Conference of Modern Building Practice 2011, Andrevlje Fruška Gora, Serbia, May 19-20, 2011, pp. 131-149

[12] Đ. Ćosić et al., „Importance Of Vulnerability In Disaster Risk Management", International Journal of Industrial Engineering and Management – IJIEM, Faculty of thechnical sciences Novi Sad, Novi Sad, Serbia,Vol 2, Issue 2, pp. 51-60

[13] K. Thywissen, "Components of risk, A comparative glossary",United Nations University, Institute for Environment and Human Security, Bon, Germany, 2006.

[14] D. Parker, J. K. Mitchell, "Disaster vulnerability of megacities: an expanding problem that requires rethinking and innovative responses", GeoJournal, 1995, 37(3), pp. 295-301.

[15] "Orientation Manual for First Responders on the Evacuation of People with Disabilities", FA-235, US Department of Homeland Security, 2002.

[16] "NFPA Emergency Evacuation Planning Guide for People with Disabilities", US National Fire Protection Association, 2007.

[17] J. Simic et al., "Persons with Disabilities in Catastrophic Events – Exposure and Geospatial Analysis", *Proceedings of International Conference on Risk and Safety Engineering 2013*, 1st Book, Kopaonik, Serbia, February 2-9, 2013, pp. 146-151.

[18] "Fair Housing Act Design Manual, A Manual to Assist Designers and Builders in Meeting the Accessibility Requirements of the Fair Housing Act", U. S. Department of Housing and Urban Development, Office of Fair Housing and Equal Opportunity, Office of Housing, 1998.

[19] Convention on the Rights of Persons with Disabilities, General Assembly of UN, 13 December 2006, A/RES/61/106

[20] Laura Theytaz-Bergman, Stefani Tromel, Guidance Document, Effective Use of International Human Rights Monitoring Mechanisms to Protect the Rights of Persons with Disabilities, International Disability Alliance, 2010, Serbian translation: Gordana Rajkov, Center for an Independent Life of Persons with Disabilities, Belgrade, 2011.

[21] Law on Ratification of the Convention on the Rights of Persons with Disabilities, Official Gazette of the Republic of Serbia - International Agreements, 42/2009

[22] Law on Prevention of Discrimination against Persons with Disabilities, Official Gazette of the Republic of Serbia, 33/2006

[23] Law on Emergency Situations, Official Gazette of the Republic of Serbia, 93/2012

[24] G. Giuliani, N. Ray, A. Lehmann, "Grid-enabled Spatial Data Infrastructure for environmental sciences: Challenges and opportunities", Future Generation Computer Systems, 27, 2011, pp. 292-303.

[25] Directive 2007/2/EC of the European Parliament and of The Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

[26] P. Kohler, "Towards an Open Information Infrastructure for Disaster Research and Management: Data Management and Information Systems Inside DFNK", Natural Hazards, 46, 2006, pp. 141-157.

REFLECTIONS ON SOME METHODOLOGICAL ISSUES IN USING QUALITATIVE RESEARCH METHODS IN EDUCATION

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Abstract - Qualitative research originated in social sciences such as sociology and psychology and recently gains attention in education. This article outlines some reflections on using qualitative research in education from the perspective of disciplinary outsiders, or more precisely, researchers with the background in computer science. The article is based on comprehensive literature review and personal experience in using qualitative research methods in few studies. The central part of the article is discussion of general methodological issues in qualitative research. The article also presents some illustrative samples that use qualitative research methods in education.

I. INTRODUCTION

Studies that employ various quantitative approaches dominate in literature on education. However, using qualitative methods can be very fruitful in situations where the goal is to explore the state of the practice or the human aspects of the education. According to Koro-Ljungberg and Douglas [1] well-designed qualitative studies built on epistemological consistency across theoretical perspectives and research methods can answer research question that can not be answered through quantitative methods. Qualitative research methods have been recently adopted in engineering education because they offer alternative approaches in collecting knowledge about the practice (empirical world). Quantitative studies, based on prediction and randomized controls, cannot capture the complexity of human behaviors in the ways that can do qualitative methods. According to Jacob [2], different traditions and research approaches give educational researchers new viewpoints, open up new problems for study, and expand the range of ways available for addressing educational problems.

If the goal of the research is to provide numerical evidence about selected issues, the right choice is to use quantitative methods. If the goal is to get in depth descriptive accounts about a phenomenon, the right choice is to use qualitative methods. Qualitative studies facilitate in depth and detailed study of phenomena. The basic assumption for qualitative inquiry is that fieldwork should be done without any predetermined categories that set constraints to the analysis of field data. According to Silverman [3], "the particular strength of qualitative research, for both researchers and practitioners, is its ability to focus on actual practice *in situ*, looking at how organizations are routinely enacted". With this statement, Silverman reject the fashionable identification of qualitative method with an analysis of how people "see things", preferring to focus instead on how people "do things".

Fieldwork is the main source of qualitative data, which means that researcher spends time in the setting under the study [4]. Therefore, the important issue for understanding qualitative inquiry is the context because it influences all aspects of human behaviour. This means that a description and interpretation of a person's social environment, or an organization's external context, is essential for overall understanding of a qualitative study.

By stressing the importance of context in the research design, King [5] distinguished two very

TABLE I. BASIC CHARACTERISTICS OF POSITIVIST AND INTERPRETIVIST RESEARCH APPROACHES [5]

	Positivism	**Interpretative research**
Scope	Context-free	Context-based
Methods	Quantitative	Qualitative
Researcher role	Detached observer	Actively involved
Goal	Predetermined	Negotiated
Outcomes	Laws, generalizations	Context-dependent insights

different versions of social science research: positivism and interpretative research. The main characteristics of these two approaches are presented in Table I. Positivism aims at testing hypotheses through examination of correlations between variables, which is characteristics of quantitative methods. On the other hand, interpretative approaches are concerned with observations and description, or generating hypotheses. Interpretative approaches are used in qualitative research.

II. Methodological Issues in Qualitative Research

Detailed understanding or exploration of a phenomenon or a problem can be achieved only if the research is conducted in the context where they occur. This is even more important if the research goal is to investigate human behavior in the real context or setting or to get their opinions about studied problem. Understanding the context or the settings in which problems or issues occur is appropriate case for qualitative research techniques. According to Morse [6]:

> *... qualitative methods not only provide us with the means to explore such complex and chaotic real-life situations, but also provide us with methodological choices - multiple options about how to tackle such a setting according to one's identified research problem and long-term research goals.* (p. 393)

Qualitative research consists of a set of interpretive, material practices that make the real world visible. The main characteristic of qualitative research is that qualitative researcher studies things in their real settings and attempts to interpret phenomena based on information obtained from people in the field.

A. Qualitative Data

Generating useful and credible qualitative findings from collected qualitative data requires discipline, knowledge, training, practice, creativity, and hard work [7]. In most cases, qualitative studies are based on a relatively small number of special cases and provide a valuable source of lessons learned from practice. According to Patton, qualitative findings grow out of three kinds of data collection [7]:

- *In-depth, open-ended interviews*. Interviews with open-ended questions are used to collect in-depth responses about people's experiences, perceptions, opinions, feelings, and knowledge. Interviews are usually unstructured or semi-structured.
- *Direct observation*. Data collected during the fieldwork aimed at observing human experience in the real setting consist of field notes. Field notes contain rich, detailed descriptions of activities, behaviors, interactions and processes, including the context within which the observations were made.
- *Written documents*. Data consist of excerpts from documents captured in a way that records and preserves context. Typical documents used as a source of qualitative data are: memoranda and correspondence, official publications and reports, personal diaries, letters, artistic works, photographs and memorabilia, and written responses to open-ended surveys.

Qualitative data are collected as unstructured text. These data are considered as rich, full, holistic and grounded in the field. Despite attractiveness of qualitative data, they have serious weaknesses and problems as well. These problems are [8]:

- Collecting and analyzing the data is a highly labor-intensive activity.
- Qualitative fieldwork is traditionally demanding.
- Qualitative data tend to overload the researcher badly at almost every point.
- Methods of analysis are too flexible or not well formulated.

B. Qualitative Findings

The qualitative findings are longer, more detailed, and variable in content comparing to the quantitative findings [7]. Due to the fact that responses are neither systematic nor standardized, analysis of qualitative data is difficult and time-consuming process. Knafl and Howard [9] argued that the author should indicate the nature and scope of the data underlying conclusions through inclusion of representative quotes from the data in the study report. In addition, detailed description of the context and characteristics of the population that participate in the research contribute to better understanding of research findings.

Findings are intrinsic part of research. Sandelowski and Barroso [10] defined findings as the data-driven and integrated discoveries, judgments, and/or pronouncements researchers offer about the phenomena, events, or cases under

the investigation. In practice, findings transforms field data to produce grounded theories, ethnographies, or otherwise fully integrated explanations of some phenomenon. Well-developed findings should re-present the target phenomenon in a new way.

C. Approaches in Qualitative Research

Qualitative research can be undertaken by using variety of available approaches. These approaches are classified by using different topologies [11]. Creswell [11] distinguished five qualitative approaches as the most representative and mostly used in the social, behavioral and health science literature:

- *Narrative research*. The usual approach to narrative research assumes that researchers collect descriptions of events or happenings and then configure them into a story about a single individual. Types of narrative research are biographical studies, a life history and oral history. Researcher collects comprehensive information about a participant, which requires deeper understanding of the context.
- *Phenomenology*. This type of research enables deeper understanding of experience of a concept or phenomenon for several individuals. Phenomenology is usually used to discover knowledge common for groups such as therapists, teachers, health personnel, and policy makers. Data are usually collected during multiple interviews.
- *Grounded theory*. Grounded theory research goes beyond a description of a phenomenon and generates or discovers a theory as an abstract analytical schema of a process. Grounded theory is both the methodology for research and the final product of the research. As a final product, grounded theory explains the practice and provides a framework for further research. The basic idea is that theory is generated or *grounded* in data collected from participants who have experienced the process. Methodology is based on *constant comparative method* that takes information from data, compares them with other data and emerged categories in order to develop a theoretical framework.
- *Ethnography*. Ethnography describes and interprets the shared and learned patterns of values, behaviors, beliefs and language for entire group. Ethnography involves observation of the group, most often through participant observations and in depth interviews. This assumes that researcher is involved in the day-to-day activities of the observed group of people.
- *Case study*. Case study research involves the study of an issue explored through one or more cases within a bounded system. Researcher explores a bounded system (a case) or multiple bounded systems (cases) over time through detailed data collection involving multiple sources such as observations, interviews, documents, and audio and vide material. The research reports a case description or description of case-based themes.

Practical research design is influenced by chosen methodology, with the set of suitable methods, and underpinning philosophy. Understanding the philosophical background, and methodological issues is necessary for researcher to take appropriate position during the research. This position includes the positioning towards research participants, field data, and final product of the study. In practice this mean that researcher take either position of distance or acknowledged inclusion in both the field and in the final product of the study [12]. Therefore, it is necessary to clearly state the philosophical and methodological backgrounds that govern research. This becomes even more important for researcher with computer science background that decided to use research methodology originated in social science (in this case sociology). The main challenge in conducting research using sociological methods was related to understanding methodology, set of methods, but also philosophical stand points that influence methodology and the research design.

D. Philosophical Background

Research work is situated within the paradigm, or paradigms, which refers to a set of very general philosophical assumptions about the nature of the world (ontology) and how we can understand it (epistemology) [13]. Epistemology is the study of the nature of knowledge and justification that includes: defining components of knowledge, identification of substantive conditions and sources of knowledge, and the limits of knowledge and justification [14].

Each paradigm should identify particular studies that exemplify these assumptions in set of methods that are used by researchers in a specific

field or tradition at any particular period of time. The term *paradigm* is derived from the work of the historian of science Thomas Kuhn. In the book *The Structure of Scientific Revolutions*, Kuhn defines a scientific paradigm as collection of universally recognized scientific achievements that provide models for problems and solutions for researchers in a specific community or a field [15]. The following quotation illustrate the significance of adhering to paradigms for researchers [15]:

> *… one of the things a scientific community acquires with a paradigm is a criterion for choosing problems that, while the paradigm is taken for granted, can be assumed to have solutions.*(p. 37)

Paradigms are defined at the most abstract and general level, and they embody different ideas about reality and how we can gain the knowledge of it. Paradigms are practically *philosophical positions* for thinking about the reality. Typical paradigms related to scientific research are positivism, constructivism, realism and pragmatism, while paradigms relevant for qualitative research include interpretivism, critical theory, feminism, postmodernism and phenomenology. Maxwell [13] identified the following reasons for explicit decisions related to using paradigm(s) in research design:

- Clear paradigmatic stance helps to guide research design decisions and justify these decisions. Paradigm allows coherent and well-developed approach to research. It is always better to use established and developed paradigm than constructing an approach yourself.
- Aspects of different paradigms and traditions could be combined in a single research design. However, this required careful assessment of the compatibility of the elements borrowed from each paradigm.
- Researcher personal preferences and assumptions influence adoption of a paradigm that best fit.

The researcher background and experience play crucial role in adopting a particular paradigm. The influence of researcher own background and identity, treated as *bias*, cannot be neglected, but it should be minimized or even eliminated from the design. However, Anselm Strauss, one of the co-developers of grounded theory methodology, emphasized that bias, that include researcher technical knowledge, research background, and personal experience should not be ignored because of the usual canons govern research [16].

Many scholars emphasize the importance of defining a philosophical position and orientation towards the inquiry, and some of them recommend considering philosophical background early in the research process [17]. However, for novice researcher, or researcher with the background in technical disciplines the adoption of philosophical position can be difficult task, because of large amount of literature focusing on different philosophical roots [18].

According to Bernhard and Baillie [19], methodological and epistemological awareness and consistency significantly influence the way of conducting research and the quality of the qualitative research. Unfortunately, many researchers have neglected these aspects of the research.

E. Validity

Validity depends on research methodologies and paradigms that guide each particular research project. It refers to the *goodness* or *soundness* of a study. Validity is not fixed concept, but rather it is complex construct grounded in the processes and intentions of particular research [20]. In practice, most researchers that do qualitative work agree that the validity of the research should ensure that research procedures remain coherent and transparent, research results are evident, and research conclusions are convincing. In Encyclopedia of Sociology Bohrnstedt stated [21]:

> *Validity refers to the degree to which evidence supports the inferences drawn from a score rather than the scores or the instruments that produce the scores. Inferences drawn for a given measure with one population may be valid but may not be valid for other measures.*

According to Koro-Ljungberg [22], the researcher is responsible for doing meaningful, trustworthy and valid research, which means that researcher should consider all conditions that influence research and also be aware of the limits of her or his knowledge. This means that validity should be framed in the context of researchers' responsibility and decision-making during the research process. Continuous reflexivity and self-scrutiny of researcher are essential in qualitative research to ensure research validity.

Ethical issues

Ethical issues are part of the everyday practice of doing research in all scientific fields. Qualitative research is concerned with social problems and interpersonal relationships, and therefore, should be guided by important ethical principles. According to Clark and Sharf [23], the primary ethical principle is related to our responsibility for informants. Researcher is challenged to accurately interpret informants' voices in order to construct new understanding of the researched phenomenon through research. In practice, researcher will deploy her or his good professional judgment that should be guided by the broad guidelines set by the researcher's discipline.

Guillemin and Gillam [24] distinguish two different dimensions of ethics in research: procedural ethics that is govern by standards or requires approval from a relevant ethics committee, and ethics in practice or the everyday ethical issues that arise in the doing the research.

Christians [25] emphases the following general ethical guidelines, or codes, that should be considered in qualitative research:

- *Informed consent*. This document describes the research in order to provide all relevant details for informants. By signing this document informants accept to participate in the research based on his/her free will.
- *Deception*. Both the researcher and informants should avoid any kind of deception during the all phases of the research.
- *Privacy and confidentiality*. In many cases, it is important to preserve informants' privacy and anonymity (for example, students, ill persons, employees) in order to avoid unintended consequences.
- *Accuracy*. It is concerned with the fabrication of research results, fraudulent materials and omissions.
- *Beneficence*. It is the obligation of researchers to act in ways that benefit other people, or at least in ways that do not harm them. The principle of beneficence applies not only to the individual subject, but also to groups of subjects, like particular socio-economic groups, professional communities, organizations or companies.

Ethical principles should help in preventing or reducing harm and in coping with the unpredictable nature of qualitative research [26].

Ethical issues that should any research consider are possible risks and benefits for all participants. Newman and Willard [27] suggest that collecting and understanding participant reactions about the research study can help in assessing the quality of the study and promoting the scientific integrity of research findings.

III. SAMPLE STUDIES

The following samples illustrate the usage of various qualitative methodologies in education research.

Devlin and Gray [28] presented qualitative study on the possible reasons for plagiarism within Australian universities. They use a series of group interviews, and gathered views of 56 students. Analysis included reading of interviews, identification and refinement of themes and categories. Categories were illustrated with quotations from interviews. The authors identified the following categories: inadequate admission criteria, poor understanding of plagiarism, poor academic skills, teaching/learning issues, laziness/convenience, pride in plagiarizing, pressures.

Paper [29] reports an exploratory study of qualitatively different ways in which teachers experience change in their understanding of subject matter they have recently taught. In the study participated 31 teachers from the major disciplinary fields (Business and Law, Health Sciences, Humanities and Social Sciences, and Science and Engineering). Each teacher was interviewed related to their experience of understanding of their subject matter. The interviews were transcribed and analyzed using analytical procedures developed for similar phenomenological studies. Through analysis was identified an initial set of categories based on reading of transcripts, and later, stable categories were refined and their relationships were established.

The paper [30] reports the outcomes of a phenomenological study of academics' ways of experiencing or understanding being a university teacher. Study was based on semi-structured interviews with 28 academicians. Participants were asked what being teacher meant to them, how they went about teaching, what they were trying to

achieve, and why they did things that way. Interviews were transcribed and analyzed in an iterative manner, which resulted with the ordering of categories and the positing of hierarchical relationships between them. The outcome was a structured space of variation, representing key aspects of the qualitatively different ways of understanding being a teacher. The following categories were constituted: a teacher transmission focused experience, a teacher–student relations focused experience, a student engagement focused experience, and a student learning focused experience.

Article [31] presents the authors experience of employing qualitative research to explore the advantages and disadvantages of software maintenance services in a virtual networking laboratory, which have been used for teaching computer networks concepts at the university [32]. The students from the final year of bachelor studies, and students of master studies at the Information Technology Department participated in the research. The experimental sessions lasted between 120 and 150 minutes. The first step was to inform students about all relevant experiment details through an informed consent document [25]. After that, a short presentation was made about the research topic. During the experiments, students had the opportunity to specify an arbitrary number of software change requests (SCR) by using three approaches: a paper document, the web form, a service integrated in the software. After that, each student filled in the questionnaire with open-ended questions [33]. The questionnaire related to the evaluation of SCR services was divided in three sections that corresponded to the stated research goals: discovering advantages and disadvantages of three approaches for specifying SCR (research goal 1), comparing technical complexity of services (research goal 2), and comparing user-friendliness of services (research goal 3). Data analysis is based on grounded theory analysis guidelines proposed by Charmaz [34]. In the article are discussed relevant ethical issues related to informed consent, participant anonymity and benefits.

A three-phased study, based on grounded theory methodology, on a teachers' virtual community in order to understand the knowledge flows among community members from different organizations is presented in [35]. The study objective was to identify essential factors in individual, group, organizational, and environmental contexts, which affect the knowledge sharing and creation in the professional virtual community. The study was organized in three phases. The first phase included six special interest groups (SIG) and lasted for two months. The second phase also included six new SIGs and lasted two months. The third phase included ten SIGs and lasted for seven months. The last phase is conducted in order to ensure theoretical saturation. Researchers collected various data by using: information shared in SIGs, activity logs of members in corresponding SIGs, semi-structured interviews and questionnaires. The study presents and links the causal conditions, knowledge sharing strategies, and consequences of a virtual community. Research findings were discussed on both individual and group levels. For example, consequences at individual level are self-efficacy and professional social network enlargement, while consequences at group level are goal attainment and product quality.

IV. CONCLUSIONS

This article presents some basic methodological issues related to qualitative research. Qualitative research is an approach that has been widely used in social and behavioral sciences, health science and education. Qualitative research can be implemented by using different approaches. Since the research is oriented towards humans, ethical issues should be seriously considered. Some illustrative samples from education field are also presented.

Although in literature dominate studies that employ various quantitative approaches, using qualitative methods can be very fruitful for some situations where the goal is to explore the state of the practice. A qualitative approach yields results that cannot be gathered using quantitative methods, which is especially important when the goal is to gain deeper understanding of behaviors, organizational functioning, social movements or interactions.

Case and Light [36] argued that methodological decisions should be more explicitly elaborated in research reports. In addition, the researchers should consider a broad range of methodological options in their research study design. Case and Light also noted that a number of studies use more than one methodology. Creswell and Garrett [37] argued that mixed methods are suitable for addressing complex and interdisciplinary research problems in education.

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REFERENCES

[1] M. Koro-Ljungberg and E. P. Douglas. State of Qualitative Research in Engineering Education: Meta-Analysis of JEE Articles, 2005–2006. Journal of Engineering Education, vol. 97, issue 2, pp. 163–175, pp. 163–175, 2008. DOI: 10.1002/j.2168-9830.2008.tb00965.x.

[2] E. Jacob. Clarifying Qualitative Research: A Focus on Traditions. *Educational Researcher*, vol. 17, no. 1, pp. 16-24, 1998.

[3] D. Silverman, "Qualitative research: meanings or practices?", *Information Systems Journal*, Volume 8, Issue 1, pp. 3-20, 1998, DOI: 10.1046/j.1365-2575.1998.00002.x.

[4] Z. Stojanov and D. Dobrilovic. Qualitative Research in Education: Issues and Samples. *In Proceedings of the 4th International Conference on Information Technology and Development of Education (ITRO 2013)*, pp. 368-372. June 28th 2013. Zrenjanin, Serbia.

[5] S. F. King. CASE tools and orgaizational action. *Information Systems Journal*, Volume 6, Issue 3 173–194, July 1996. DOI: 10.1111/j.1365-2575.1996.tb00012.x.

[6] J. M. Morse. "Qualitative Methods: The State of the Art". Qualitative Health Research, vol. 9, no. 3, 1999, pp. 393-406, DOI:10.1177/104973299129121938.

[7] M. Q. Patton, Qualitative research and evaluation methods. Third Edition. Sage Publications, Thousand Oaks, USA, 2001.

[8] M. B. Miles. Qualitative data as an attractive nuisance: The problem of analysis. *Administrative Science Quarterly*, vol. 24, no. 4, pp. 590-601, 1979. DOI: 10.2307/2392365.

[9] K. A. Knafl and M. J. Howard. Interpreting and reporting qualitative research. *Research in Nursing & Health*, vol. 7, no. 1, pp. 17-24, 1984. DOI: 10.1002/nur.4770070105.

[10] M. Sandelowski and J. Barroso. Classifying the findings in qualitative studies. *Qualitative Health Research*, vol. 13, no. 7, pp. 905-923, 2003. DOI: 10.1177/1049732303253488.

[11] J. W Creswell. Qualitative inquiry & research design: Choosing among five approaches, Second Edition. Sage Publications. Thousand Oaks, California, USA. 2007.

[12] M. Birks and J. Mills. Grounded theory: a practical guide. SAGE Publications. Los Angeles, USA. 2011.

[13] J. A. Maxwell, Qualitative Research Design, An Interactive Approach, 2nd Edition, Sage Publications. Thousand Oaks, CA, USA. 2005.

[14] P. K. Moser, The Oxford Handbook of Epistemology (Oxford Handbooks), Oxford University Press, USA, 2002.

[15] T. S. Kuhn. The Structure of Scientific Revolutions, 3rd Edition. University of Chicago Press. Chicago, USA. 1996.

[16] A. L. Strauss, Qualitative Analysis for Social Scientists, Cambridge University Press, Cambridge, UK, 1987.

[17] A. M McCallin. Designing a grounded theory study: some practicalities. *Nursing in Critical Care*, vol. 8, issue 5, pp. 203–208, September 2003. DOI: 10.1046/j.1362-1017.2003.00033.x.

[18] B. Graham and K. Thomas. Building Knowledge – Developing a Grounded Theory of Knowledge Management for Construction. *The Electronic Journal of Business Research Methods*, vol. 6, issue 2, 2008, pp. 115 – 122.

[19] J. Bernhard and C. Baillie. Standards for quality of research in engineering education: A prolegomenon. *In the Proceedings of the 40th SEFI Conference*, 23-26 September, 2012, Thessaloniki, Greece.

[20] G. Winter. "A comparative discussion of the notion of 'validity" in qualitative and quantitative research". *The Qualitative Report*, vol. 4, no 3&4, March 2000.

[21] G. W. Bohrnstedt. "Validity". In E. F. Borgatta and R. J. V. Montgomery, editors, *Encyclopedia of Sociology*, volume 5, pp. 3207-3212. Macmillan Reference USA, New York, NY, USA, 2nd edition, 2000.

[22] M. Koro-Ljungberg. "Validity, responsibility, and aporia". *Qualitative Inquiry*, vol. 16, no. 8, pp. 603-610, 2010. doi: 10.1177/1077800410374034.

[23] M. C. Clark and B. F. Sharf. "The dark side of truth(s): Ethical dilemmas in researching the personal". *Qualitative Inquiry*, vol. 13, no 3, pp. 399-416, 2007. doi: 10.1177/1077800406297662.

[24] M. Guillemin and L. Gillam. "Ethics, reflexivity, and 'ethically important moments' in research". *Qualitative Inquiry*, vol. 10, no. 2, pp.261-280, 2004. doi: 10.1177/1077800403262360.

[25] C. G. Christians. "Ethics and politics in qualitative research". In Norman K. Denzin and Yvonna S. Lincoln, editors, *The Sage Handbook of Qualitative Research*, chapter 6, pp. 139-164. Sage Publications, 2005.

[26] A. Orb, L. Eisenhauer and D. Wynaden. "Ethics in qualitative research". *Journal of Nursing Scholarship*, vol. 33, no. 1, pp. 93-96, 2001. doi: 10.1111/j.1547-5069.2001.00093.x.

[27] E. Newman and T. Willard. Empirically supported ethical research practice: The costs and benefits of research from the participants' view. *Accountability in Research: Policies & Quality Assurance*, 8(4):309-329, 2001. DOI: 10.1080/08989620108573983.

[28] M. Devlin and K. Gray. "In their own words: A qualitative study of the reasons Australian university student plagiarise". *Higher Education Research and Development*, vol. 26, no. 2, pp. 181-198, 2007.

[29] K. Trigwell, M. Prosser, E.Martin and P. Ramsden. "University teachers' experiences of change in their understanding of the subject matter they have taught". *Teaching in Higher Education*, vol. 10, no 2, pp. 251-264. 2005.

[30] G. S. Akerlind. "A new dimension to understanding university teaching". *Teaching in Higher Education*, vol. 9, no. 3, pp. 363-375, 2004.

[31] Z. Stojanov, D. Dobrilovic and B. Perisic. "Integrating software change request services into virtual laboratory environment: Empirical evaluation". *Computer Applications in Engineering Education*, vol. 22, issue 1, pp. 63–71, 2014. DOI: 10.1002/cae.20529, 2011.

[32] D. Dobrilovic, V. Brtka, I. Berkovic and B. Odadzic, "Evaluation of the virtual network laboratory exercises using a method based on the rough set theory", *Computer Applications in Engineering Education*, vol. 20, issue 1, pp. 29–37, March 2012. doi: 10.1002/cae.20370.

[33] L. M. Give, The SAGE Encyclopedia of Qualitative Research Methods, Sage Publications, Thousand Oaks, USA, 2008.

[34] K. Charmaz, Constructing grounded theory: A practical guide through qualitative analysis, 1st edition, Sage Publications Ltd, London, UK, 2006.

[35] F-R Lin, S-C Lin, T-P Huang. "Knowledge sharing and creation in a teachers' professional virtual community", Computers & Education, vol 50, Issue 3, April 2008, pp. 742-756, doi: 10.1016/j.compedu.2006.07.009.

[36] J. M. Case and G. Light. "Emerging Research Methodologies in Engineering Education Research". Journal of Engineering Education, vol. 100, issue 1, pp. 186–210, January 2011. doi: 10.1002/j.2168-9830.2011.tb00008.x.

[37] J. W. Creswell and A. L. Garrett. The "movement" of mixed methods research and the role of educators. *South African Journal of Education*, vol. 28, no. 3, pp. 321-333, 2008.

LIFELONG LEARNING WITH THE HELP OF DISTANCE LEARNING

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Abstract – This paper presents opportunities for lifelong education through distance learning.

I. INTRODUCTION

In today's age of economic and social change, and quick transition of society into 'knowledge society', and the demographic situation in Europe where the population is getting older, there are challenges for a new approach to education and learning. Therefore there is much discussion about the so-called lifelong learning, which is the learning activity throughout life with the aim of improving knowledge, skills and abilities within the basic civic, social and business perspective.

Learning takes place on a daily basis, sometimes on purpose while sometimes the learning process is unplanned, often unavoidable.

A human learns on a daily basis much more than he is aware of that. Even organizing our daily activities involves continuous learning, so we can say that life is unthinkable without continuous learning.

The term lifelong learning is understood and accepted different in different cultures and countries. In English speaking countries continuing education generally refers to the continuing professional education of adults, while their permanent (lifelong) unprofessional education is called adult education.

Lifetime (permanent, continuing) education is often occurred as a synonym for the concept of lifelong education. The difference between lifelong education and lifelong (permanent) education is that the lifelong education refers to education throughout life (from birth to death), while the lifelong (continuing, permanent education) refers to education after the end of a degree of formal education (usually after compulsory education) until death or until the end of working life. While lifelong learning encompasses and coordinates the education of children, youth and adults (according to the principle of vertical relatedness), with lifelong education are adjusted only forms of formal, non-formal and informal education (according to the principle of horizontal relatedness, which means education in a variety of forms, not just formal).

II. LIFELONG LEARNING

Lifelong education, as the word says, is an active learning which does not stop on completion of schooling but goes on lasting through until the human is capable of assimilating new concepts and connecting them logically. It includes:

Formal learning takes place in chronological graded system from primary school to university. It leads to the acquisition of a specific qualification in a profession or vocation.

Non-formal learning means conscious and organized education, learning and training adults in order to cater for their educational needs.

Informal learning is a lifelong process in which information, attitudes, skills and knowledge are assimilated. It may be deliberate or unintentional, and it is encouraged by the development of technology and engineering. This education is assimilated through experience in a variety of situations in life through reading, travelling, using the Internet and so on.

Scientific disciplines such as Andragogy (Adult Pedagogy) and Gerontology are related to the concept of lifelong education. Andragogy is the science that studies the problems of adult education. Gerontology studies education and self-education of elderly.

Lifelong, continuing or permanent education is often used as a synonym for lifelong education. However, this equalizing is not correct. Lifelong education refers to education throughout life (from birth to death) while the continuing, permanent education refers to education after the end of a degree of formal education until death or working life.

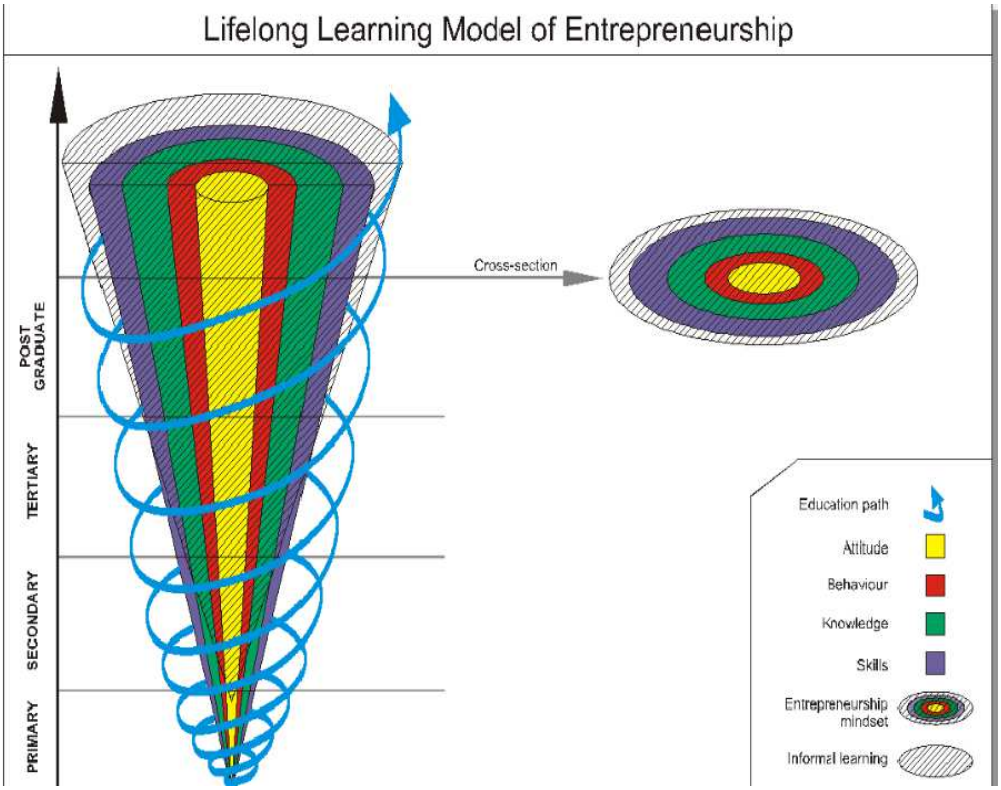

Figure 1. Simplified concept of lifelong learning

III. BENEFITS OF LIFELONG LEARNING

The way of lifelong education is a basic assumption of growth and development and it becomes essential in a time of rapid change in required skills and knowledge. The idea of lifelong learning comes from the assumption that the human is the greatest wealth of the society and that is why it should be invested in. The fact that European population aging rapidly means that the need for new knowledge and skills cannot rely on a workforce who are new entrants to the market because it will be too few young people, and the rate of change in technology is increasing.

Education and training, more than ever, have become an important factor in determining an individual's opportunities to progress and succeed in life. Employment opportunity is evidently a major success of successful education, but social integration rests on more than just paid work.

IV. LIFELONG LEARNING CONTEXTS

Although the term is widely used in a variety of contexts its meaning is often unclear. There are several established contexts for lifelong learning beyond traditional "brick and mortar" schooling:

- Home schooling involves learning to learn or the development of informal learning patterns
- Waldorf education which teaches children to love learning for its own sake .
- Adult education or the acquisition of formal qualifications or work and leisure skills later in life
- Continuing education which often describes extension or not-for-credit courses offered by higher education institutions
- Knowledge work which includes professional development and on-the-job training
- Personal learning environments or self-directed learning using a range of sources and tools including online applications

E-learning is available at most colleges and universities or to individuals learning independently. There are even online courses being offered for free by many institutions.

One new (2008 and beyond) expression of lifelong learning is the Massive Open Online Course (a MOOC), in which a teacher or team offers a syllabus and some direction for the participation of hundreds, sometimes thousands, of learners. Most MOOCs do not offer typical "credit" for courses taken, which is why they are interesting and useful examples of lifelong learning.

V. WHAT IS THE DISTANCE LEARNING?

In the context of technological fast-developing and market conditions that are constantly changing, the education system is forced to provide an improvement in educational opportunities without increasing costs. In response to this challenge, educational institutions have developed a program for distance education.

Distance learning means that the teacher and the student (or students) are physically separated and technology (i.e. voice, video, data and printed material) is used to bridge the gap that exists in the classroom. These programs are very useful for the education of those who could not afford it because of the limited time, distance or physical disability, and to provide updating and brushing up knowledge of workers in their workplaces. They also can give adults a second chance for a higher education.

VI. HOW DOES THE DISTANCE EDUCATION WORK?

A person who performs distance education has a wide range of technical possibilities. These possibilities can be summarized in four main categories:

Voice – Instructional audio tools include interactive technologies such as the telephone, audio conference and the short-wave radio. Passive audio tools include tapes and a radio.

Video – Instructional video tools include immovable images such as slides, pre-prepared movable images (eng. film, videotape) and movable images in real time combined with an audio conferences (one-way or two-way audio communication).

Data – Computers send and receive information electronically, and therefore, the term 'data' is used to describe this broad category of instructional tools. Computer applications for distance education are varied and may include:

- Computer assisted teaching – it uses computer as a stand-alone machine to present individual lessons.
- Computer controlled teaching – it uses computer for organizing instruction and observing student's accomplishments and progress.
- Education mediated by computers – it represents computer applications that enable beaming of instruction. For example: e mail, World-Wide Web applications, fax, etc.

Printed material – is the basic element of distance education and also the basis from which all other delivery systems have evolved. There are printed materials at disposal in various forms: course books, manuals, programs of courses, materials for detailed study.

VII. DISTANCE LEARNING ADVANTAGES

Lots of flexibility. With distance learning courses, students can complete their course work from just about anywhere, provided there's a computer and internet connection. This allows students to work when and where it is more convenient for them without having to squeeze in scheduled classes to an already busy life.

No commuting. Taking a course online can be one way to cut down on costly gas or public transportation. Since students can often work from home to complete their class assignments, both time and money are saved in cutting out the trips to and from class.

Numerous choices for schools. Even if you live in a community with few or no colleges distance learning allows you to choose from a wide variety of schools to complete your education. You may find online schools that specialize in your particular field or one that can provide a great general education. Either way, your options for education will be greatly expanded.

Lowered costs. Prices for online courses are generally cheaper than their on-campus counterparts and you won't have to worry about commuting, moving or getting meal plans on campus, some additional benefits to learning from home.

Learn while working. As distance learning can usually be completed on your own schedule, it is much easier to complete distance learning courses while working than more traditional educational programs. Keeping your job gives you more income, experience and stability while completing your degree giving you less to worry about and more time to focus on your studies.

VIII. WHAT IS THE E-LEARNING?

E-learning (or eLearning) refers to the use of electronic media and information and communication technologies (ICT) in education. E-learning is broadly inclusive of all forms of educational technology in learning and teaching.

E-learning is inclusive of, and is broadly synonymous with multimedia learning, technology-enhanced learning (TEL), computer-based instruction(CBI), computer-based training (CBT), computer-assisted instruction or computer-aided instruction (CAI), internet-based training (IBT), web-based training (WBT), online education, virtual education, virtual learning environments (VLE) (which are also called learning platforms), m-learning, and digital educational collaboration. These alternative names emphasize a particular aspect, component or delivery method.

E-learning includes numerous types of media that deliver text, audio, images, animation, and streaming video, and includes technology applications and processes such as audio or video tape, satellite TV, CD-ROM, and computer-based learning, as well as local intranet/extranet and web-based learning. Information and communication systems, whether free-standing or based on either local networks or the Internet in networked learning, underly many e-learning processes.

E-learning can occur in or out of the classroom. It can be self-paced, asynchronous learning or may be instructor-led, synchronous learning. E-learning is suited to distance learning and flexible learning, but it can also be used in conjunction with face-to-face teaching, in which case the term blended learning is commonly used.

IX. History of E-learning

In 1960, the University of Illinois initiated a classroom system based in linked computer terminals where students could access informational resources on a particular course while listening to the lectures that were recorded via some form of remotely-linked device like television or audio device.

In the early 1960s, Stanford University psychology professors Patrick Suppes and Richard C. Atkinson experimented with using computers to teach math and reading to young children inelementary schools in East Palo Alto, California. Stanford's Education Program for Gifted Youth is descended from those early experiments. In 1963, Bernard Luskin installed the first computer in a community college for instruction, working with Stanford and others, developed computer assisted instruction. Luskin completed his landmark UCLA dissertation working with the Rand Corporation in analyzing obstacles to computer assisted instruction in 1970.

Early e-learning systems, based on Computer-Based Learning/Training often attempted to replicate autocratic teaching styles whereby the role of the e-learning system was assumed to be for transferring knowledge, as opposed to systems developed later based on Computer Supported Collaborative Learning (CSCL), which encouraged the shared development of knowledge.

Computer-based learning made up many early e-learning courses such as those developed by Murray Turoff and Starr Roxanne Hiltz in the 1970s and 80s at the New Jersey Institute of Technology, and the ones developed at the University of Guelph in Canada. In 1976, Bernard Luskin launched Coastline Community College as a "college without walls" using television station KOCE-TV as a vehicle. By the mid-1980s, accessing course content become possible at many college libraries.

The Open University in Britain and the University of British Columbia (where Web CT, now incorporated into Blackboard Inc. was first developed) began a revolution of using the Internet to deliver learning, making heavy use of web-based training and online distance learning and online discussion between students. Practitioners such as Harasim (1995) put heavy emphasis on the use of learning networks.

With the advent of World Wide Web in the 1990s, teachers embarked on the method using emerging technologies to employ multi-object oriented sites, which are text-based online virtual reality system, to create course websites along with simple sets instructions for its students. As the Internet becomes popularized, correspondence schools like University of Phoenix became highly interested with the virtual education, setting up a name for itself in 1980.

In 1993, Graziadei described an online computer-delivered lecture, tutorial and assessment project using electronic mail. By 1994, the first online high school had been founded. In 1997, Graziadei described criteria for evaluating products and developing technology-based courses include being portable, replicable, scalable, and affordable, and having a high probability of long-term cost-effectiveness.

By 1994, CAL Campus presented its first online curriculum as Internet becoming more accessible through major telecommunications networks. CAL Campus is where concepts of online-based school first originated, this allowed to progress real-time classroom instructions and

Quantum Link classrooms. With the drastic shift of Internet functionality, multimedia began introducing new schemes of communication; through the invention of webcams, educators can simply record lessons live and upload them on the website page. There are currently wide varieties of online education that are reachable for colleges, universities and K-12 students. In fact, the National Center for Education Statistics estimate the number of K-12 students enrolled in online distance learning programs increased by 65 percent from 2002 to 2005. This form of high learning allowed for greater flexibility by easing the communication between teacher and student, now teachers received quick lecture feedbacks from their students. The idea of Virtual Education soon became popular and many institutions began following the new norm in the education history.

The emergence of e-learning is arguably one of the most powerful tools available to the growing need for education. The need to improve access to education opportunities allowed students who desire to pursue their education but are constricted due to the distance of the institution to achieve education through "virtual connection" newly available to them. Online education is rapidly increasing and becoming as a viable alternative for traditional classrooms. According to a 2008 study conducted by the U.S Department of Education, back in 2006-2007 academic year, about 66% of postsecondary public and private schools began participating in student financial aid programs offered some distance learning courses, record shows only 77% of enrollment in for-credit courses being for those with an online component. In 2008, the Council of Europe passed a statement endorsing e-learning's potential to drive equality and education improvements across the EU.

Recent studies show that the effectiveness of online instruction is considered equal to that of face-to-face classroom instructions but not as effective as the combination of face-to-face and online methods.

X. E –LEARNING CONCEPT

Distance learning is:

- providing access to learning materials, various course texts (scripts) and educational resources on the Internet, with a strong possibility of testing and knowledge testing, electronic communication with teachers and also with other students on the course,
- the process of convergence of educational resources – providing the conditions for learning from more distant places from the school classroom or centre in multimedia form,
- formalized teaching and learning system specifically designed to be functional at a distance using electronic communication,
- convergence and merging the Internet and learning, actually that is an Internet enabled learning.

XI. E-LEARNING IN LIFELONG EDUCATION

Living and working skills that people used to have are not enough nowadays. Lifelong learning means that people are given the opportunity to learn at all ages and at numerous contexts: at work, at home and through the activities during their spare time and not just the usual way as, for example schools. Lifelong learning is the ultimate result of computer literacy.

E-learning enters our educational system. What have been done concretely so far is introduction of Informatics and Computing science as a subject into primary and secondary schools and into colleges. However, other subject are still taught in the traditional manner or with the possible use of presentations in classes and particularly with teachers who are mostly on their own initiative enrich their teaching by introducing ICT (Information and Communication Technologies) in their own teaching.

Good support for investing into the sphere of lifelong education will be passing into law that is currently in the drafting stage.

REFERENCES

[1] Erika Eleven, Dragana Glušac,"Učenje na daljinu-dopuna ili deo savremene nastave, konferencija Čačak 9.-11.maja 2008

[2] www.tfc.kg.ac.rs

[3] http://www.mudremisli.com/2012/04/nelson-mandela/

[4] www.masht-gov.net

[5] www.link-elearning.com

[6] http://www.distancelearningnet.com/advantages-and-disadvantages-of-distance-learning/.

COMPARISON OF STATE SPACE SEARCH ALGORITHMS - SUDOKU PUZZLE GAME

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Abstract - This paper deals with differences between two algorithms used for solving Sudoku problems. Algorithms used are Brute Force algorithm and Backtracking algorithm. The project is done in Java programming language. The goal of this project is to show the differences between those two algorithms. There are also some examples of classic algorithms for solving problems that were used along Backtracking and Brute Force algorithms.

I. INTRODUCTION

Search algorithms can be compared with different parameters: speed, memory consumption, ability to work with heuristics and others. Comparison between two search algorithms will be shown in this paper using a Sudoku solver that was created on Technical Faculty "Mihajlo Pupin" in Zrenjanin, Serbia.

For solving a Sudoku problem we have investigated two search algorithms: Brute Force algorithm and Backtracking algorithm. These two were chosen because even if they are similar there is a very distinct difference in speed.

The goal of this research is to show the difference in speed between these two algorithms based on the difficulty of the given Sudoku problem. Since they work similarly, it is expected that the speed would be similar too, but that is not the case.

The paper is organized as follows: After brief introduction to state space search algorithms, the logic-based puzzle Sudoku is described. Section III contains an description of Brute Force search algorithm, as well as Backtracking search algorithm. Section IV describes project "Sudoku solver", followed by some development environment description in Section V, and constraints description in Section VI. Finally, conclusions are given in Section VII.

A. State Space Search

State space search algorithm is commonly used in domains of Artificial intelligence and Computational intelligence. The problem is represented via successive states organized as graph. The root of the graph represents initial state, while leafs (tips) of the graph represent solution or goal. Obviously, it is possible that there are more solution to the problem defined by tips of the state space graph. Formally, as in [1, 2] state space is defined as 4-tuple:

<S, O, I, G>, where:

S is a set of all states.

O is a set of arcs of the graph.

I is a set of initial states, this is a subset of S.

G is a set of goal states, this is a subset of S.

In the state space graph nodes correspond to states, while arcs correspond to the operators or "legal moves". There are two basic search algorithms: breadth-first search (BFS) - all nodes of the parent node are visited (e.g. from left to right), and depth-first search (DFS) which recurrently opens just one child of current node until there are no more nodes to open. DFS algorithm implies a return (backtrack) to the previous level state space graph. Depth-first search is commonly used blind search strategy. Both, BFS and DFS can be implemented as pure blind search algorithm (Brute Force) or with tree pruning routines (Backtracking).

II. SUDOKU

Sudoku is a logic-based puzzle. The objective is to fill all the fields so that rows, columns and boxes contain all of the digits from 1 to 9. Any digit can not appear twice in any row, column or box.[3]

There are many variants of the original Sudoku that include letters, different rules and so on. Completed Sudoku puzzles are a type of Latin squares with the additional property of no repeated digits in rows, columns and boxes.

The number of classic 9×9 Sudoku solutions is 6.67×10^{21}. If we take into account that you can apply rotation, reflection and permutation to any

solved Sudoku, the number of essentially different solutions drops down to 5.47×10^9, which is still a lot.[4]

Figure 1 shows a typical Sudoku problem for a 9×9 Sudoku puzzle. On Figure 2 there is a solution to the same Sudoku puzzle.

5	3			7				
6			1	9	5			
	9	8					6	
8				6				3
4			8		3			1
7				2				6
	6					2	8	
			4	1	9			5
				8			7	9

Figure 1. An example of a typical Sudoku puzzle

5	3	4	6	7	8	9	1	2
6	7	2	1	9	5	3	4	8
1	9	8	3	4	2	5	6	7
8	5	9	7	6	1	4	2	3
4	2	6	8	5	3	7	9	1
7	1	3	9	2	4	8	5	6
9	6	1	5	3	7	2	8	4
2	8	7	4	1	9	6	3	5
3	4	5	2	8	6	1	7	9

Figure 2. The solution to the puzzle in Figure 1

III. BRUTE FORCE ALGORITHM AND BACKTRACKING ALGORITHM

A. *Brute Force algorithm*

First algorithm that we are going to talk about is Brute Force algorithm. It is basically an algorithm that tries every possible scenario in a problem until it finds a correct one.

Brute Force algorithm first fills all the fields with ones (1 - one) and then starts changing the first number that isn't locked (locked numbers are ones that were a part of the puzzle). Every time it increments that number it checks to see if the puzzle is solved. If it is not, then it continues incrementing that same number until it reaches number 9, then it resets to 1 and increments the number in the next field. Since it checks for solutions after each step, it is really slow and can take from minutes to days to complete a puzzle considering the difficulty. It is going through every possible solution until it finds the right one. Example of Sudoku puzzle and the start of solving one with Brute Force using Java was shown in Figure 3 and Figure 4.[5]

Advantage of Brute Force is that a solution is guaranteed (as long as Sudoku is valid).

The disadvantage is that it is much slower than other algorithms including Backtracking.

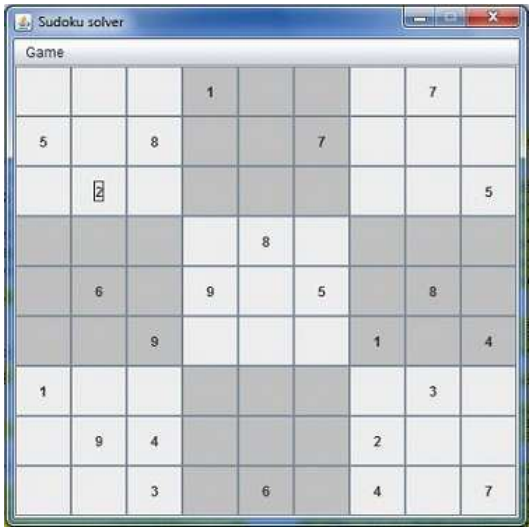

Figure 3. Example Sudoku

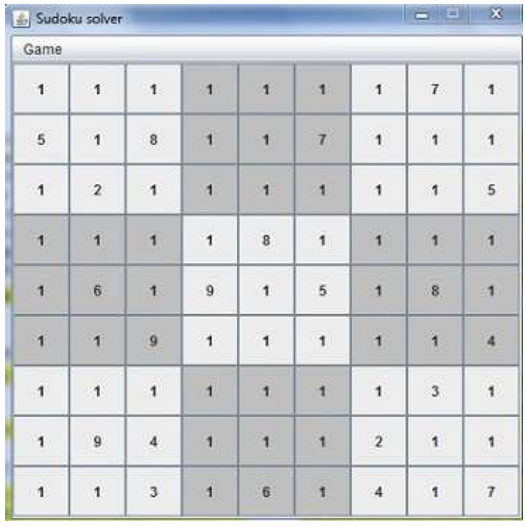

Figure 4. Start of solving the puzzle in Figure 3

B. *Backtracking algorithm*

The second algorithm is Backtracking algorithm.[1] This algorithm is a form of a Brute

Force but it is much faster. Backtracking is a general algorithm for finding all or part of solutions for particular computational problem. This algorithm incrementally builds candidates to the solutions, and abandons each partial candidate ("backtracks") as soon as it determines that candidate cannot possibly be completed to a valid solution.

Backtrack is probably the most basic Sudoku solving strategy for computer algorithms. This algorithm is a brute-force method which tries different numbers, and if it fails it backtracks and tries a different number. This means that the backtrack algorithm does an exhaustive search to find a solution, which means that a solution is guaranteed to be found if enough time is provided. Even thought this algorithm runs in exponential time, it is plausible to try it since it is widely thought that no polynomial time algorithms exists for NP complete problem such as Sudoku.

The way it works is that it starts from the first empty field and starts filling it with digits from 1 to 9. If the digit can be written it writes it and goes on to the next empty field and starts doing same. If no numbers can be written to one field it then clears that field and backtracks to the previous field and increments that number by one. Then it goes on to the next field and repeats all the steps. It will backtrack any amount of times it is necessary to fill the fields correctly.[5]

The algorithm finishes when it fills the last field in the puzzle with the correct number.

The advantages are that a solution is guaranteed (same as with Brute Force algorithm) but also that it is much faster for this kind of problems.

There are no disadvantages that we encountered for this algorithm while solving Sudoku puzzles.

IV. PROJECT SUDOKU SOLVER

This project was done in an IDE "NetBeans"[6, 7] (see Figure 5) using Java programming language [8, 9]. The project helped in understanding Object Oriented Programming while developing this Sudoku solver. The development process was not hard but there were some setbacks. Several methods were used until satisfactory one was found.

For determining the uniqueness of the solution the digging holes algorithm [4] is used.

According to [10] in order to successfully solve a puzzle you have to have an algorithm that generates a valid Sudoku problem. That algorithm is called "digging holes" [4] and contains several steps. First step is creation of solved grid. At the start, the fields should be filled diagonally. First 3 numbers on diagonal have to be different and this process have to be repeated 3 times. Second step is process of solving the grid. It is solved by usage of backtracking algorithm, which is already described.

The program now selects field randomly and tries "to dig a hole". If the grid with dug cells has a unique solution, digging will be confirmed. If not, the program tries to dig next field. This process is repeating until the grid satisfies certain level.

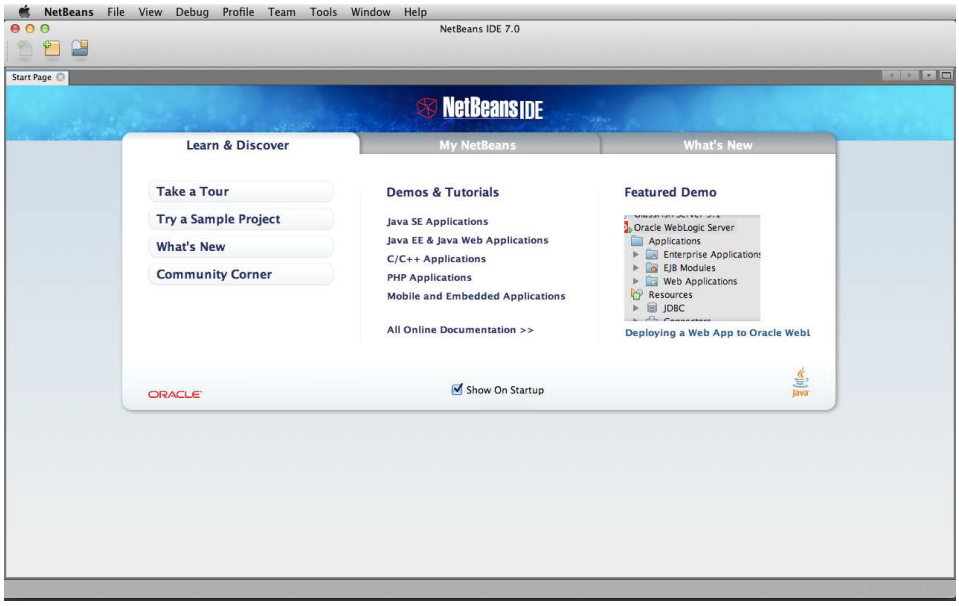

Figure 5. NetBeans IDE

V. DEVELOPMENT ENVIRONMENT

NetBeans IDE provides first-class comprehensive support for the newest Java technologies and Java enhancements before other IDEs. It is the first IDE providing support for JDK 7, Java EE 7, and JavaFX2. With constantly improving Java Editor many rich features and an extensive range of tools, templates and samples, NetBeans IDE sets the standard for developing with cutting edge technologies out of the box [10]. In order to solve the software aspect of the research easier, we used NetBeans IDE along with some basic UML support with class diagram with our classes.

The class diagram of Sudoku application is shown on Fig. 6.

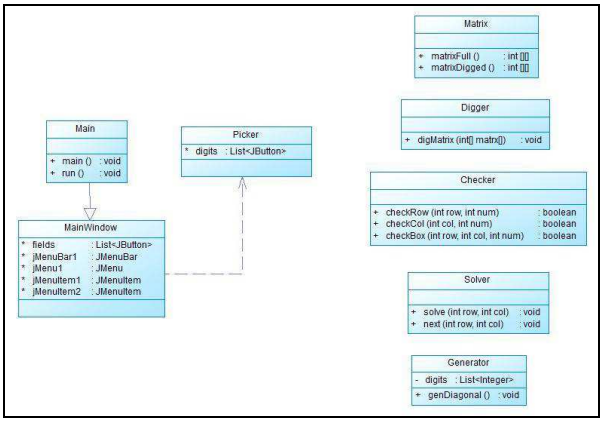

Figure 6. Sudoku application class diagram

VI. CONSTRAINS

During the development of this application, several problems were encountered. Most of them were solved easily, and one them is still pending.

The hardest task in the development process was implementation of "digging holes" algorithm in the program. The problem was encountered in the case when the program does not "dig" the entire matrix, but only half of it. The core of the problem lies in error in implementation of backwards backtracking solving algorithm.

VII. COMPARING ALGORITHMS

The goal was to compare the speed of solving specific Sudoku problems with those two algorithms on 3 levels of difficulty, easy, medium and hard.

Three levels of difficulty are as following:

- Easy: An entry level Sudoku. Number of given digits ranges from 36 to 49. For these tests we chose one with 36.[4]
- Medium: A standard level Sudoku. Number of given digits ranges from 32 to 35. For these tests we chose one with 32.[4]
- Hard: A difficult level Sudoku. Number of given digits ranges from 28 to 31. For these tests we chose one with 28.[4]

Sudoku puzzles where chosen using a random puzzle generator found on the internet using the number of given digits as a reference.

In the Table 1 you will see the time needed to solve each of the three Sudoku puzzles using these two algorithms. Tests were done three times with each puzzle and an average time was taken as a result.

Times are in milliseconds (ms) and minutes (min).

TABLE I. AVERAGE TIME NEEDED TO FINISH THE PUZZLE

Name of the algorithm	Easy	Medium	Hard
Brute Force algorithm	> 90 min	>90 min	>90 min
Backtracking algorithm	6ms	42ms	46ms

Brute Force is very slow for this type of problem. The time needed for it to finish rises exponentially depending on the number of givens (locked numbers). More givens means less time to finish. If we were to try and use it to solve a Sudoku with 17 givens (the minimum number of givens which give a unique solution) it would mean that it needs to calculate $1{,}179 \times 10^{61}$ possible combinations which would take a very long time [5].

There is also a difference in memory consumption between Brute Force and Backtracking algorithm.

Since Brute Force after each iteration checks if the puzzle is solved its memory usage can be high considering it does a lot more computations than Backtracking algorithm.

VIII. CONCLUSION

This research deals with the comparison of two different search algorithms, Brute Force and Backtracking algorithm, used in solving complex mathematical problems. It is shown that there is a big difference in speed between the two algorithms and that Backtracking algorithm is much more suited for solving Sudoku puzzles than Brute Force

algorithm. Project Sudoku Solver will continue to develop and in the future it will incorporate Sudoku Generators and other features.

Using and comparing these algorithms helped us plan the future of the application. Understanding these algorithms will be an important step towards the next iteration of the Sudoku game solver. Some of these expansions will be OCR scanning of Sudoku problems from newspapers with built-in cameras on smartphones or scanners.

ACKNOWLEDGMENT

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REFERENCES

[1] Petar Hotomski, "Sistemi veštačke inteligencije", Tehnički fakultet "Mihajlo Pupin", Zrenjanin, 2006.

[2] G. Luger, W. Stubblefield: Artificial Intelligence - structures and strategies for complex problem solving, University of New Mexico, Albuquerque, The Benjamin/Cummings Publishing Company Inc, 1993.

[3] Timo Mantere and Janne Koljonen, "Solving and Rating Sudoku Puzzles with Generic Algorithms", http://www.stes.fi/scai2006/proceedings/step2006-86-mantere-solving-and-rating-sudoku-puzzles.pdf

[4] "Sudoku Puzzles Generating: from Easy to Evil", http://zhangroup.aporc.org/images/files/Paper_3485.pdf

[5] Matt Moss, "Ai-Sudoku", http://codertao.com/projects/ai-sudoku/index.php?page=0.

[6] Heiko Böck, The Definitive Guide to the NetBeans Platform 7, Apress, USA, December 2011.

[7] Jürgen Petri, The NetBeans Platform 6.9 Developer's Guide, PACKT Publishing, UK, August 2010.

[8] Andrew Davison, “Killer Game Programming in Java”, O'Reilly, 2005.

[9] Wei-Meng Lee, “Programming Sudoku”, Springer, 2006.

[10] N. Bilinac, M. Eremic, R. Adamov, D. Dobrilovic, V. Brtka, “Game Development in Java NetBeans Platform – Sudoku Application”, International Conference on Applied Internet and Information Technologies, ICAIIT 2013, Technical Faculty "Mihajlo Pupin", Zrenjanin

METHODOLOGY FOR TEACHING SUPPORT VECTOR MACHINES IN ARTIFICIAL INTELLIGENCE CLASSROOM

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Abstract - There is a growing need for solving nondeterministic problems. This need has influenced research in the field of artificial intelligence. Support vector machines, nonlinear Kernel methods in particular, have been proved to be the most accurate methods currently available for classification. Students must be familiarized with these methods in order for them to be competitive in the current market.

This paper will present Support Vector Machines and some of their learning methods, analyze their performance, hopefully add some insight into teaching them to students, and answer the question of whether there is a place for them in Artificial Intelligence classroom. Paper showcases methodology -what should be considered when constructing a Support Vector Machine and tools readily available for teaching and researching them.

I. INTRODUCTION

Support Vector Machines are in wide usage in the industry. Most common examples are for text categorization, image recognition, hand-written digit recognition, but they are used also in fields such as bioinformatics.

Classification of natural text or hypertext documents into a fixed number of predefined categories based on their content has many different applications such as email filtering, web searching, office automation, sorting documents by topic, etc.

Automatic categorization of images is crucial in many areas such as information retrieval, filtering internet data, medical applications, object detection, etc.

Currently introductory courses in Systems of Artificial Intelligence across most of the colleges are teaching several similar topics.

After the introductory class, that takes one week, the main part of the curriculum starts with Heuristic search algorithms, which is a solid starting topic for introduction into artificial intelligence. This segment currently lasts four weeks.

Curriculum continues with teaching formalization of reasoning and automated proving of theorems with resolution methods and refutation procedures. The main part of the course lasts for eight weeks.

Third, final part in the practical part of the curriculum, is working with logical programming language Prolog. Formalization and Prolog are considered the main theme of the course and are currently taught for eight weeks.

Systems of Artificial Intelligence curriculum concludes the semester with introduction into machine learning. This introduction takes three weeks covering themes such as Decision Trees, Naive Bayes and Perceptrons.

In the following text we will introduce Support Vector Machines and see how and where they can find their place in this course.

II. SUPPORT VECTOR MACHINES

Support Vector Machine (SVM) is a family of machine learning algorithms. They belong in a supervised learning category of algorithms.

This means that it expects to be given a set of training samples, where each is marked as belonging to a specific category. Support Vector Machine training algorithm uses those samples to build a model that is used then to categorize newly inputted data.

Simple, linear hyper-plane Support Vector Machine is composed of a set of support vectors z and set of weights w. The computation for the output with n support vectors z_1, z_2, z_3, ..., z_n and weights w_1, w_2, w_3, ... , w_n is given by 2.1.

$$F(x) = \sum_{i=1}^{n} w_i (z_i, x) + b \qquad (2.1)$$

III. KERNEL BASED SUPPORT VECTOR MACHINES

Kernel based algorithms were invented in 1992 by Boser, B., Guyon, I., and Vapnik, V. as an improvement on Vapnik's linear SVM algorithm, from 1963, by applying kernel trick.

This algorithm replaces inner products of support vectors with a nonlinear kernel function (3.1). This function still encompasses the old one (2.1) by simply making k(z, x) = <z, x> = $z^T x$. [1]

$$F(x) = \sum_{i=1}^{n} w_i k(z_i, x) + b \tag{3.1}$$

Kernel trick is a powerful tool that provides a bridge between linearity and nonlinearity for every algorithm that depends on the inner product of two vectors.

Problem with linear classifiers was that if we map the input into higher dimension space, our algorithm would not behave linearly in the input space.

Kernel trick never computes the mapping. It replaces the inner product of our vectors with inner product of another, more suitable space (3.2). [1]

$$k(z, x) = \langle \varphi(z), \varphi(x) \rangle \tag{3.2}$$

For any consistently labeled data set, there exists a kernel function that maps the data to a linearly separable set as shown in Figure 1.

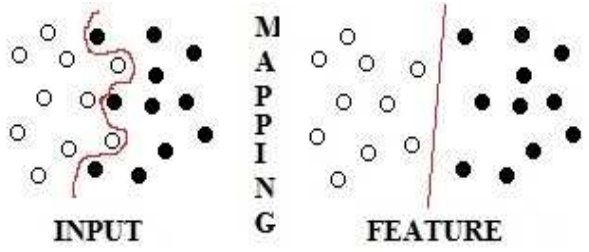

Figure 1. Mapping in Kernel Space

Kernel function can carry algorithm into a higher dimension space without explicitly mapping the input into this space. This is desirable because feature space can be infinite, and thus not computable.

IV. COMMON KERNEL FUNCTIONS

Most common Kernel functions include linear, polynomial and Gaussian kernel. [1, 5]

Linear Kernel

Linear Kernel function is the simplest one. The function is composed of the inner product <z, x> added with a constant c (4.1).

$$k(z, x) = z^T x + c \tag{4.1}$$

These are often the equivalent of its linear counterpart.

Polynomial Kernel

This Kernel is a non-stationary kernel (4.2) it is suited for working with normalized data.

$$k(z, x) = (\alpha z^T x + c)^d \tag{4.2}$$

Slope is represented by α and d represents the degree.

Gaussian Kernel

Gaussian Kernel is one of the most versatile kernels. It is radial basis function kernel (4.3) and is preferred when you are working without a lot of knowledge about the input data.

$$k(z, x) = exp\left(-\frac{\|z - x\|^2}{2\sigma^2}\right) \tag{4.3}$$

Major role in the performance plays parameter σ and should be carefully tuned for each problem. Overestimation would make algorithm behave almost linearly and the higher dimensional projection will start to lose its non-linear power. Underestimation would cause the lack of regulation and the algorithm will become sensitive to noise in training data.

Exponential Kernel is similar to Gaussian. It only leaves out the squaring of norm. Laplacian Kernel is another variation. It leaves out multiplication and squaring of sigma parameter. That makes it less sensitive to changes to sigma parameter.

There are many others, including Sigmoid Kernel, Rational Quadratic Kernel, Circular Kernel, Spherical Kernel, Power Kernel, Log Kernel, Spline Kernel, Bayesian Kernel, etc.

V. LEARNING ALGORITHMS

There are many uses for Support Vector Machines, and even more learning algorithms made for teaching them in the most optimal fashion for the given problem.

Early learning algorithms used quadratic programming solvers. Later were developed systems that used chunking to split problems into smaller parts that were solved then in a more efficient fashion.

Here we will present two of the most commonly used general purpose learning algorithms.

For the resulting point to be used in creating a new Support Vector Machine, it has to fulfill Mercer's condition (5.1).

$$\iint K(x,y)g(x)g(y)dxdy \geq 0 \quad (5.1)$$

A. *Sequential Minimal Optimization*

Sequential Minimal Optimization algorithm was invented by Platt, J.

This algorithm breaks the problem into two dimensional sub problems that are then solvable using analytical methods. This method removes the need for numerical optimization algorithms that were used previously.

This algorithm iterates over all the points until convergence to a tolerance threshold. It examines all examples, finding two points to be optimized jointly. Two points are jointly optimized then using analytical method.

When the algorithm finishes its job, a new Support Vector Machine is created using only those points whose Lagrange multipliers are higher than zero. Expected outputs y_i will be then individually multiplied by their corresponding Lagrange multiplier a_i to form a single weight vector w (5.2). [2, 3]

$$F(x) = \sum_{i=1}^{n} \alpha_i y_i k(z_i,x) + b = \sum_{i=1}^{n} w_i k(z_i,x) \quad (5.2)$$

B. *Sequential Minimal Optimization for Regression*

Platt's Sequential Minimal Optimization algorithm was modified for solving regression problems. Retaining most of its original structure, it uses two Lagrange multipliers $\hat{a}_i$ and a_i for each input.

On completion of the algorithm, new Support Vector Machine is formed by using only points whose Lagrange multipliers are higher than zero. Multipliers are then subtracted to form a single weight vector w (5.3). [4]

$$F(x) = \sum_{i=1}^{n} (\hat{\alpha}_i - \alpha_i) k(z_i,x) + b = \sum_{i=1}^{n} w_i k(z_i,x) \quad (5.3)$$

VI. SUGGESTIONS FOR INCORPORATION INTO CURRICULUM

Systems of Artificial Intelligence class tries to teach quite a broad subject matter. It is taught in only one semester, two forty-five minute classes a week. It would be a stretch to expect to go into depth of every subject it touches in that time span. At the best it can be seen as introductory course for latter classes, and that is indeed its main purpose.

Current curriculum of Systems of Artificial Intelligence could incorporate Support Vector Machines into its Machine Learning segment.

It is unadvisable to cut either Decision Trees or Perceptrons from the curriculum. They are fundamental for understanding Machine Learning, and arguably more important than Support Vector Machines. Taking that into account, current timetable of the course would have to be changed to incorporate the new subject.

Results that are currently available show that students are learning heuristic search with relative ease. This allows for shortening the length of this segment down to three weeks, at least for a trial period. The same results are showing that cutting of the Formalization classes is not advisable.

That still leaves one more week for Machine Learning to be extended into. New Machine Learning segment would start with teaching Naive Bayes for the first week. Second week would be given to teaching Decision Trees, followed with third week and Perceptrons. Final week could be reserved for introduction into Support Vector Machines.

Ninety minute is not nearly enough time to present all of the matter described earlier in this paper, so the time should be rationed properly.

It is our suggestion that the optimal approach is to introduce linear Support Vector Machines, followed by presenting important terms such as Kernel and Learning Algorithms, without going into depth.

Optional work can be distributed for broadening students' knowledge about Support Vector Machines. Homework and seminars are ideal to incentivize students with their self-study. Themes for seminars could include various specific learning algorithms, kernels and research into practical, real-world uses of Support Vector Machines.

VII. METHODOLOGY

Based on presented kernels and learning algorithms there are two integral parts to teaching Support Vector Machines. First part is its integral components (about kernel, learning algorithms, constructing training set and important parameters). Second part is taking those components and implementing them (whether through available tools, programming or combination of both).

A. Support Vector Machine components

When selecting a kernel, Linear Kernel is comparatively simple to understand and implement. Good second choice is the Gaussian Kernel, which could be more difficult to understand, but is a good general purpose, widely used kernel.

Sequential Minimal Optimization training algorithm is a clear choice for a learning algorithm. While not quite trivial to understand, it is well used and documented.

Choosing a right training set for a job, even for something perceived as a trivial task, is not an easy step. Support Vector Machine will not get stuck in local minimums or maximums, so the order of inputs in the training set is not important. There is no "right" way of doing this so students should be taught to experiment with various inputs until they get acceptable results.

Input and output parameters are specific for each task. Unary vector w_i teaches local classifiers their importance. Pairwise vector w_{ij} learns the importance of smoothing or penalization.

B. Tools for teaching Support Vector Machines

There are several readily available solutions for presenting, teaching and researching Support Vector Machines.

Software package MATLAB is widely known and used in research institutes, schools, colleges and companies. It has in built functions for working with Support Vector Machines. It is simple and easy to work with (Fig. 2). [10]

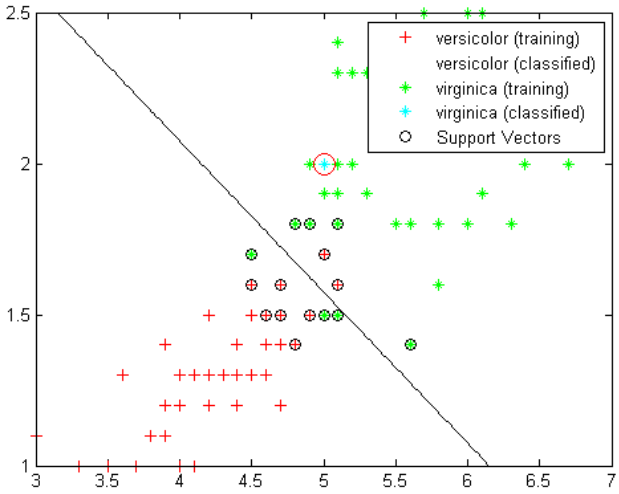

Figure 2. Support vector machine classifier structure created using the svmtrain function

Popular free alternative is LIBSVM, an integrated software for support vector classification, regression and distribution estimation with support for multi-class classification. [11]

Open source implementations for various purposes are available in many different programming languages. These can be used as examples of Support Vector Machines. Their open source is a good way for a student to learn how to implement their own Support Vector Machine. [12]

C. Example

Following example is a trivial implementation given in MATLAB code. For a training set Fisher's Iris Data is used as it is available in MATLAB. This example showcases multiclass classification on a train dataset of size 60x4, and test dataset of 90x4 samples.

```
load fisheriris;
data = meas;

trainset = [data(1:20, : );
data(51:70, : ); data(101:120,
: )];
testset = [data(21:50, : );
data(71:100, : );
data(121:150, : )];
class1 = zeros(60, 1);
class(1:20, 1) = 1;
class(21:60, 1) = 2;
SVMStruct = svmtrain(trainset,
class);
Group = svmclassify(SVMStruct,
testset);
class1 = zeros(60, 1);
class1(1:40, 1) = 1;
class1(41:60, 1) = 2;
SVMStruct1 =
svmtrain(trainset, class1);
Group1 =
svmclassify(SVMStruct1,
testset);
GroupF=zeros(90,1);
for i=1:90
  if Group(i,1)==1
        GroupF(i,1)=1;
  else
        if Group1(i,1)==2
              GroupF(i,1)=2;
        else
              GroupF(i,1)=3;
        end
  end
end

GroupF
```

VIII. CONCLUSION

Students taking this class have an opportunity to broaden their knowledge in later courses that concentrate on particular subjects, such as Soft Computing and Neural Networks.

Support Vector Machines could be viably incorporated into the current Systems of Artificial Intelligence course. For the results to be visible it is necessary to deal additional, extracurricular work to students.

Presented methodology is recommended, but should be implemented with the consideration to the rest of the course. If there is less time available it is recommended to use available showcased tools in which a presented example should be a good starting point.

All changes should be tracked and results documented for further research.

REFERENCES

[1] Christianni, N., and Shawe-Taylor, J. An Introduction to Support Vector Machines and Other Kernel-based Learning Methods. Cambridge University Press, Cambridge, 2003.

[2] Platt, J.C. Sequential Minimal Optimization: A Fast Algorithm for Training Support Vector Machines. Microsoft Research, 1998.

[3] Platt, J.C. Using Analytic QP and Sparseness to Speed Training of Support Vector Machines. Microsoft Research, 1999.

[4] Shewade, S.K., Keerthi, S.S., Bhattacharyya, C., and Murthy, K.R.K. Improvements to the SMO Algorithm for SVM Regression. IEEE Transactions on Neural Networks, Vol. II, No.5, 2000.

[5] Ben Ayed Mezghani, D.,Zribi Boujelbene, S., Ellouze,N. Evaluation of SVM Kernels and Conventional Machine Learning Algorithms for Speaker Identification. National School of Engineer of Tunis, 2010.

[6] Dumais, S., Platt, J., Heckerman, D., and Sahami, M. Inductive learning algorithms and representations for text categorization. 7th International Conference on Information and Knowledge Management, 1998.

[7] Joachims, T. Text categorization with support vector machines. Proceedings of European Conference on Machine Learning (ECML), 1998.

[8] Chapelle, O., Haffner, P., and Vapnik, V. SVMs for histogram-based image classification. IEEE Transaction on Neural Networks, 1999.

[9] Brown, M., Gundy, W., Lin, D., Cristianni, N., Sugnet, C., Furey, T., Ares, M., and Haussler, D. Knowledge-based analysis of microarray gene expression data using support vector machines. Technical report, University of California, Santa Cruz, 1999.

[10] MATLAB, Software package with support for working with SVM, 2013, http://www.mathworks.com/help/stats/svmtrain.html

[11] LIBSVM, Free software package for working with SVM, 2013, http://www.csie.ntu.edu.tw/~cjlin/libsvm/

[12] de Souza, C., Handwriting Recognition Revisited: Kernel Support Vector Machines, 2012, http://www.codeproject.com/Articles/106583/Handwriting-Recognition-Revisited-Kernel-Support-V