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Service e-Learning Project: State Graduation Online Demo Exam

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Summary

The service e-learning project described in this paper presents the online demo exam in informatics designed as a preparatory step for the state graduation. It was created in the midst of turbulence caused by the introduction of the state graduation at the end of secondary education in Croatia. With this project we wanted to engage grammar school students in service e-learning and present them with the opportunity to design their own test materials through the collaboration with college students who are experts in the field. We also aimed to gain our own benefit of connecting the theory learned during the study with new practical experiences while at the same time helping the students to achieve at a high level in the state graduation exam. Finally, since its free available online, our project should benefit everyone who wants to test their knowledge in informatics and/or learn something new in an easy and interesting way.

Key words: service e-learning, state graduation, informatics

Introduction

In this paper we present the service e-learning (SL) project, delivered within the course "Service Learning in Information Sciences". The goal of the paper is to present the online exam for the state graduation elective course - informatics, designed to help pupils graduating from grammar school to better prepare for the state graduation. Since this was our first service learning project (actually,

our first project at all), we decided to summarize our theoretical knowledge and skills in the field of computer sciences and information sciences and create a demo application that covers the complete information and computer science curriculum of the four-year grammar schools in Croatia. Our ultimate goal was to cover all the curriculum material at all levels, and to address the theory as well as its application in the form of problem solving and design of simple algorithms.

The online demo application is very straightforward: the student gets the results instantly and he can move through the exam at his own pace. The advantage of taking such online exam is that students can get prepared for the real one, reduce stage fright, update and verify their knowledge and discover the areas they are not confident before the real exam.

Basics of Service Learning and its development in Croatia

Service learning (SL) is a teaching method that connects the goals of higher education with the needs of society by providing programs of public service that encourage students to utilize classroom knowledge to improve local communities [1]. It was introduced in the largest faculty of the University of Zagreb (Faculty of Humanities and Social Sciences) in academic year 2006-07 through the series of faculty workshops and through academic courses, with the goal to transform the traditional ex-cathedra teaching style [9]. Goals and requirements for this teaching and learning method were based upon the U.S. experience, gained at the George Washington University. Since then around 50 SL projects in the field of information technology (IT) have been completed and evaluated. Service learning was also introduced in the Faculty of Economy, University of Rijeka in 2008. In 2009 it was added as a regulation of the Croatian National Youth program 2009-2013, approved by the Croatian Government. Also, in the same year the Croatian translation of the "service learning" term ("društveno korisno učenje") offered by one of the authors of this paper became accepted as a common term at the JFDP (Junior Faculty Development Program) Regional Conference. Since the academic year 2009/2010, the Department of Information Sciences at the Faculty of Humanities and Social Sciences in Zagreb offers the stand-alone elective course on service learning (5 ECTS credits). The course "Service Learning in Information Sciences" achieved remarkable student enrolment in a short time and students find this methodology effective, because (according to their course evaluations) it increases their awareness of the world and their personal values and facilitates their engagement and interactivity in the classroom [2, 8].

Since information sciences cover a wide range of topics and due to the fact that information literacy is an important social issue, while the social need for a visual identity (especially in the electronic environment) is constantly growing, information science students truly have a great field for activity where they can meet different interests and apply specific knowledge and skills [3]. Therefore,

all the service learning projects in our Department aim at linking the goals of information science studies with IT problems to meet specific community needs.

Comparison with similar research in the USA

Service learning is a teaching strategy currently present in all institutional types and across all fields of study in the United States colleges and universities (see: www.compact.org). As a relatively new teaching strategy, it gained prominence in the U.S. higher education since its emergence in the early 1990s. Its growth in the U.S. is both due to the work of Campus Compact (a national coalition of more than 1,100 college and university presidents supporting student education for responsible citizenship; see: www.compact.org) and Learn and Serve America (a program initiative of the Corporation for National and Community Service - U.S. agency of the federal government; see: <http://www.national-service.org>).

The information science curriculum in the United States applies service learning to facilitate students helping local NGO's on projects related to course topics, such as database design [5] or to connect the students of information science courses with the local schools to provide tutoring in the software applications they are using in class.

Benefits of these service learning projects are reciprocal to both the non-profit organizations that lack monetary resources [7] and to the students learning the problems of the organizations and the potential solutions through technology [11]. Benefits to students also include interacting with real clients and learning interpersonal skills critical to their future [4].

Reflective citizenship and social sensitivity developed on the projects contributes to effective integrated student experiences in the field of information sciences.

State graduation exam

Starting with the school year of 2009/2010, all pupils who complete the fourth grade of grammar schools in Croatia take the state graduation exam (based on the Act on Primary and Secondary Education¹). Pupils who complete vocational or art schools take the state graduation only if they plan to enroll into polytechnics and universities.

The main aim of the exam is to objectively and impartially test and evaluate the acquired knowledge, skills and abilities of pupils in accordance with the prescribed primary and secondary school curriculum and thus get a comparable assessment of all pupils on the national level.

¹ Official Gazette, 87/08

State graduation exam has two parts: mandatory exams in general education subjects: the Croatian language, mathematics and foreign language, and elective exams in one or more optional subjects if these subjects serve as a prerequisite for the enrolment into higher education [6].

In the past graduation system, the results were mutually comparable only on the single school level. In addition, they were susceptible to the subjectivity of the examiners (school teachers). Success on the state graduation is, on the contrary, managed and evaluated by the National Centre for External Evaluation of Education, not by the school teachers. The exam is conducted at the same time, with the same materials and in the same way for all pupils in Croatia, so that the result depends only on the pupil's knowledge and preparedness, not on the secondary school he graduated from. State graduation exam gives pupils a chance to show their real knowledge and skills, since the results are entirely independent from the subjective assessment of any individual teacher. Passing the state graduation exam on the national level, pupils become aware that their success in enrolling into polytechnics or universities depends on the very transparent criteria: their own efforts, hard work and studying. Therefore, the state graduation exam becomes a reliable and objective indicator of pupils' achievement during their primary and secondary education and the valuable motivator for the teachers to increase the quality of elementary and secondary school education. The introduction of state graduation exam promotes and ensures the quality of education, making the selection procedure for continuing education more transparent.

Description of the State Graduation Online Demo in Informatics

State Graduation Online Demo Exam in Informatics² consists of 50 multiple-choice questions written in ActionScript³. ActionScript is the object-oriented programming language integral to the Adobe Technology Platform, used to create full-featured Web applications [12]. We have chosen this programming language, because it allowed us to create the exam that can be easily extended and maintained and because it required simple programming techniques, most of which we have already learned during our study. Our aim was to make the elegant code that can easily handle any number of questions.

Pupils usually prefer multiple choice exams, since they find them easier than open questions. They often think that they can recognize the correct answer when they see it, while formulating a correct and complete answer from memory is judged as more difficult. However, being skilled information science students and future teachers, we formulated such options of a multiple choice question so that pupils really need to show the mastery of the subject in order to select the only 100% correct and complete answer.

² http://cal.ffzg.hr/Ispit_informatika_za_drzavnu_maturu/projekt.html

Multiple choice questions are composed of a question with multiple possible answers, including the correct answer and several incorrect answers (distractors). In order to make the test challenging for the pupils, we did not copy the statements from the textbook but rather used our own words for the question part. Regarding the distractors, we used at least 3 alternatives, plausible and homogeneous distractors, as well as true responses that do not answer the questions [13]. Throughout the test, we avoided responses too close to the correct answer, completely implausible statements and overlapping statements. Finally, we avoided long and complex sentences in the question part, along with trivial responses, negatives, ambiguity and broad generalization.

Although being easy to mark, the questions and answers in the multiple choice exams have to be well formulated. If the pupil interprets the question differently from what we intended, he may give an answer that is correct in a different context, but actually wrong in our interpretation. In this demo exam we applied the following ActionScript3 aspects: variables, control of the playhead of a movie with functions, button event handlers, simple conditionals and text field variables for on-screen display of information. Each question comes with three to four multiple-choice answers. The pupil submits the answer by clicking on the radio button that corresponds to his desired selection. Each selected answer is stored in a variable. Variables with response values are used to grade the user upon completion of the test, with the final scores being displayed on the screen. Timeline scripts are kept on a single isolated layer, while the series of content layers store various content assets. We define and initialize our main timeline variables before any other scripting occurs. In the next step, we invoke the *stop()* function to keep the user paused on the first frame (where the exam starts). The answer buttons advance the pupil through the exam and keep track of his answers along the way. A message is displayed after each click, showing whether the selection is correct or not. When the playhead lands on our end frame, the calculation script (determining the user's score and displaying it on the screen) is being executed. At the end, a summary screen shows the percentage of the questions answered correctly.

Project evaluation

In order to obtain the objective evaluation of the project, which was initially planned as a support and / or a potential tool for knowledge assessment in informatics, we prepared the evaluation covering all pupils' issues raised during the testing of the applications.

State Graduation Online Demo Exam in Informatics was tested and evaluated by the third grade pupils of Velika Gorica grammar school³ who will take the state graduation exam at the end of the school year 2011/2012.

³ <http://www.gimnazija-velika-gorica.skole.hr>

The evaluation was performed as an online survey that aimed to identify the impact of our project on pupils and to discover suggestions that could improve the effectiveness of the exam. The survey consisted of 21 questions that tried to encourage students to critically reflect on the demo exam, but also to reflect on how this way of learning and assessment can further advance the process of preparing for graduation state exam.

Male pupils were slightly overrepresented in our sample: 76.2% of pupils taking the survey were male. The interesting result is that although 33.3% of the pupils in Velika Gorica grammar school never participated in an online exam before, the number of pupils who would like to write the state graduate exams in online environment (47.6%) was only a bit lower than the number of pupils who desire to take the pen-and-paper-based state graduation exams (52.4%).

In regards to the design of the demo exam, 81% of the pupils found it satisfactory, 19% of them thought it was too simplistic, while none of them found it complex.

The overall rating of the demo test was high. We used a five-point rating scale, with "1" being "poor" and "5" being "excellent." The results show that 57.1% of the pupils rated the exam as good, 33.3% gave it a very good mark, while 4.8% of the pupils evaluated it as excellent.

Many of the questions in this survey invited the pupils to state the extent to which they agreed or disagreed with a statement. These responses were then scored as followed: agreement = 3, partial agreement = 2, disagreement = 1. This enabled an average value to be calculated. The Table1 presents the statements divided in two parts: **part A** shows statements related to the pupils' attitudes towards online exams in general, while **part B** covers the statements that refer to the design and usefulness of this specific demo exam in informatics. A high score indicates a high general level of agreement with the statement. Finally, open-ended questions, where pupils were able to offer essay or short answer, sought the subjective pupils' evaluations of this kind of test.

This survey stimulated both us (students) and pupils to critically evaluate the demo project we designed and implemented and raised some new questions regarding its functionality and possible future application.

All of the pupils' suggestions will be used in the further development of the project, and thus will naturally increase the benefit for all future users who will take this exam in order to prepare for the state graduation exam.

Number of points that each pupil has earned in this demo exam was used to prepare the statistical results for the school teachers, but also to assess the level of knowledge needed to successfully complete the online exam and to modify the exam in terms of facilitating questions or by introducing more complex tasks.

Table 1: Online survey results

Question/statement	Average score (3 for agreement, 1 for disagreement)
PART A	
Before taking this demo exam, I had positive attitude towards online exams.	2.38
After completing this demo exam, I have positive attitude towards online exams.	2.38
I feel more comfortable with taking test on a computer instead of pen and paper.	2.24
In my further education, I want ALL written exams to be conducted online.	2.09
In my further education, I want for SOME written exams to be conducted online.	1.05
PART B	
State Graduation Online Demo in Informatics was useful and interesting.	2.52
The immediate feedback in online test was comprehensible and useful.	2.38
The immediate feedback in online test provided me with the opportunity to learn from wrong answers	2.48
This demo exam would be more appealing and more usable if it had time constraints.	1.90
In order to be effective, this demo exam should also contain another type of questions, such as fill-in-the-blank or short answer	1.95
The type of questions in the demo exam is not important, as long as it covers the entire content in a subject of informatics for the 4-year grammar schools	2.29
Clicking the "Check" button next to each answer in the test is unnecessary and time consuming	2.10
Clicking the "Check" button next to each answer in the test is useful and efficient.	2.19

Although the project has received overall positive feedback and response, opinions on the online demo exam are divided. Our assumption is that the reason for this is the fact that the majority of pupils never had a chance to take exams via computer and get immediate feedback on the accuracy of their answers. In any case, the pupils expressed their motivation and positive attitude towards online tests and learning. They have recognized the usefulness of knowledge assessment through the online examination, since they received feedback on accuracy, but also the opportunity to learn from the incorrect answers, which was particularly stressed as an advantage of this application.

Furthermore, pupils assessed the extent of the material covered as more important than the interface design but they also believe that the multimedia component would strengthen a pupil's interest and appreciation of the both subject material and this type of examination.

Finally, the type of questions and time constraints of the exam were not considered too important, although most of the pupils shared the opinion that the exam would be more appealing if the response-time constraints were introduced. They believe that these constraints would encourage pupils to provide answers to more questions in the same amount of time.

Regarding the service e-learning component, this project contributed to the pupils' preparedness for the state graduation exam in elective subject - informatics and offered them an insight into new technology and new ways of knowledge acquiring and its evaluation. The questions in the demo exam cover the entire content of the subject of Informatics for the 4-year grammar schools, while the simple but interactive online application enables pupils to take the exam and test their knowledge anytime and anywhere, getting the immediate feedback.

Conclusion and future work

Amid all the turmoil surrounding the introduction of the state graduation exam in Croatia, we came up with the idea to unify our knowledge in e-learning, programming and theory of information sciences and to turn it into hands-on experience that will satisfy at least one community need. This type of the project can be developed for any school subject, with different types of questions. Apart from the objective type questions, such as true-false, matching, multiple choice, fill-in-the-blank, numeric response or some combination of the above mentioned, online exam in some subjects, such as the Croatian language, can also consist of subjective type of questions, such as short answer or essay.

One of the main benefits of the online exam is the immediate availability of the results. Physical presence at a given location is not necessary for both the pupil and the teacher since it's published on the Internet and available anywhere in the world. It is economical (there is no need for printing and copying materials), it can be designed with the use of multimedia, which increases the attention and the motivation of the user and exam can be given to pupils as extensive training even for subjects that are hardly to have the actual examination conducted in an online environment. The main disadvantage is its high dependence on the connection speed: for instance, dial-up would limit the use of graphics or media files.

This project is important for all elementary and secondary school teachers searching for ways to incorporate the e-learning into classrooms on both a short-term and long-term basis, to address individual learning traits and spark learning excitement. One of the ways to do this is by providing pupils with online tests to prepare for hand-written tests [10], but also to adapt to the new conditions in the higher education institutions where the use of online exams, online courseware, tutorials and modular internet-based courses is rising dramatically.

Regarding our benefit in this service learning project, we gained a substantial understanding on how teaching informatics in school looks like. Working with

pupils, we gained the ability to adapt to their feedback and learned the importance of listening to their voice and to be opened to the ideas of others. We realized that we have to work with both school teachers and pupils to select strategies to increase popularity of online exams among pupils. Therefore, we believe our project is only the first step towards the collaborative design and implementation of the new educational environment in which pupils can use and further develop their IT skills in a productive and satisfying way.

Finally, apart from the real-world experience and strengthened portfolio, this project gave us the opportunity to make real decisions, to engage our knowledge and skills and to use them to do something that has impact on others beyond ourselves. We gained insight into our strengths and weaknesses and learned more about each other as well.

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