Scientific Bulletin of the „Petru Maior" University of Târgu Mureş
Vol. 8 (XXV) no. 1, 2011, ISSN 1841-9267

OPEN AND INNOVATIVE TOOLS AND SERVICES FOR VOCATIONAL EDUCATION AND TRAINING IN QUALITY ASSURANCE

Liviu Moldovan[1], John Birger Stav[2]
[1]"Petru Maior" University of Tîrgu Mureş, Romania
[2]Sør-Trøndelag University College Trondheim, Norway
mliviu@engineering.upm.ro

ABSTRACT

This paper presents the employment of the Student Response System at the "Petru Maior" University of Tîrgu Mureş, achievements of the project entitled "Disseminating Open and Innovative Tools and Services for Vocational Education and Training in Quality Assurance" (acronym Do-IT) financed by European Commission. The recent developments and results obtained during pilot testing of new pedagogical models and services, in Do-IT project, targeting engaging engineering education in Romania are presented.

Keywords: vocational education and training, in-company training, student response systems, iPod touch, quality assurance

1. Introduction

The paper contributes to solve the challenging problem of human resources development of quality professionals by disseminating and deploying successful state of the art large-scale skills upgrading solutions from Norway to Romania. It disseminates and exploits activities targeting quality professionals from enterprises that are providing quality assurance (QA) training. It improves the quality of learning process, the promotion of the access to new and innovative methods and educational resources and the large implications of Information and Communication Technology [10].

Higher education institutions are the power sources on which new development in global economy relies. They are changing into marked dependent service universities where new type of students requires new ways of organizing learning [17].

In-company training is indeed one of the critical skills and key constraints to economic growth and development in Romania [9]. The project *Disseminating Open and Innovative Tools and Services for VET in Quality Assurance* (Do-IT) tries to solve this challenging problem by disseminating and deploying successful state of the art large-scale skills upgrading solutions from Norway to Romania. The project is promoted by Sør-Trøndelag University College in Trondheim Norway (HiST) in partnership with "Petru Maior" University of Tîrgu-Mures Romania (PMU) [20].

Do-IT disseminates and exploits activities targeting quality professionals, like quality managers and quality auditors from enterprises that are providing quality assurance (QA) training according to standards like ISO 9000, 9001, 9004, 19011 (auditing) and application in industry. Thus, Do-IT covers all QA educational paths.

The Do-IT training methodologies and technical solutions target other QA guidelines aiming of influencing similar educational routes. In this way Do-IT includes most of the sectorial educational paths within the QA sector. Do-IT targets central educational needs by offering institutes, Vocational Education and Training (VET) schools and industry itself access to flexible just-on-time on-the-job training activities that are independent of distance limitations. Furthermore, it targets teachers and QA instructors thus stimulating a life-long learning process through a dedicated train-the-trainer programme. This programme has a dual purpose by stimulating new teachers and instructors to apply technologies that enhance their professional

reputation and their technological curiosity, as well as offering them an educational path for upgrading of their knowledge.

Do-IT aims to disseminate a new competence transfer model, a new measurable quality assurance system, and a new pedagogical principle for organizing, delivering, and deploying effective production technology transfer within and between companies, as well as towards VET schools. The Do-IT learning approach for QA training is completely new in Romania and represents the implementation of the modern learning tool in QA processes. It is necessary to train trainers in order to be familiar with new learning methodology called Student Response System (SRS), which brings a new classroom environment for the students.

2. Student response systems for iPod Touch and iPhone

Good teachers provide more than just lecturing. They structure the components of the curriculum into a system, thus establishing a suitable learning environment where assessment tasks are integrated in order to encourage certain study paths. The learning results are obtained through stimulating, enjoyable and engaging good lectures, which utilize interactive learning methods that enhance learning [13]. One way of obtaining such an approach is by providing assessment methods that are an integrated component of a course. The impact on student's engagement from assessment methods has been observed in previous research, e.g. [1, 2].

Integration of assessment methods, curriculum, the learning and teaching environment in order to target the intended learning goals is usually referred to as Aligned Teaching methods [3].

Learning is an active process where the individuals construct their understanding when meeting, for instance, a professional culture and its accumulated knowledge base. Learning in modern educational institutions is a process-taking place within a community of others where many of the relations are mediated through media technology [14].

Departing from the traditional mobile phone, the number of devices that can be used wirelessly is also the subject of considerable innovations: Personal Digital Assistants, smart phones, tablet computers, wireless game terminals, plus many "fixed" devices. However there are still many uncertainties about who the users might be, how and where these services may be used, what infrastructure and technologies will be built to provide them and who will make profits [18].

Student Response Systems or SRS technology generally include a receiver, a collection of keypads (transmitters or "clickers") and dedicated software. Through a wireless connection the clickers enable students to answer a number of questions, or quizzes, during a lecture. Because the students use their keypads instead of raising hands to submit answers, individual responses stay confidential from the rest of the students while result overviews are available on the classroom screen [12].

There is pocket of use where universities take advantage of commercial Student Response Services (SRS) technology for learning gains in large classes. In Europe, this does not yet appear to be common practice, a main obstacle being the costs of dedicated hardware per student. For many educational institutions commercial "clickers" become far too expensive, whereby it limits the utilisation of new pedagogical methodologies based on anonymous feedback from students during training sessions.

Research shows that teachers and students perceive SRSs to be beneficial, though evidence of improved learning has been less clear [5]. SRS have been used for many years, typically in large classes to increase the level of student's engagement and learning. In literature SRS may have many different names, such as clickers, personal response systems, audience response systems, and classroom response systems. SRS are technology products designed to support communication and interactivity in classes [2] technology allows an instructor to present a question or problem to the class, and receive answers from the students through a response device. A summary of all answers is presented to the teacher and the students to see. In other words, SRS is a communication system that allows the teacher to collect and analyze large amount of data and on behalf of these investigate whether learning has taken place [4]. Research shows that's such systems have the potential to facilitate several classroom processes such as; participation [7], collaboration, physical activity [8], cognitive involvement [6], self-assessment [19].

The iPhone/iPod Touch solution for SRS is more flexible than existing on-site technological solutions, since it uses the wireless network to provide responses from students [11].

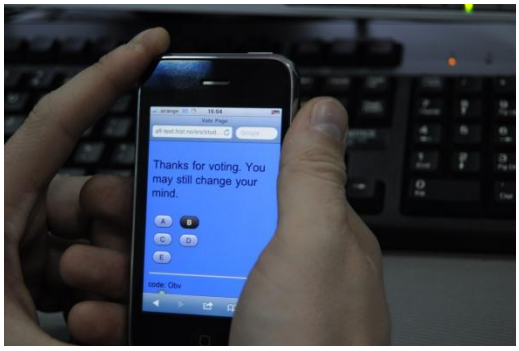

Fig. 1. *The page of the SRS system, and the interface for voting sessions on an iPod Touch.*

The teacher gives the students a task, for instance a question or a problem. The students solve the task and responds anonymously by using the SRS (Fig.1) either on their laptop or through their mobile handheld device, whereby the teacher get a "knowledge map" of the class (Fig. 2). The results show if the class struggle with the current part of the curriculum, and he/she must decide the amount of time needed for that part based on the result. Thus, the SRS provides pedagogical methods that enhance interactive teaching models by using instructional feedback loops. Finally, the teacher must decide how will provide the feedback to the class.

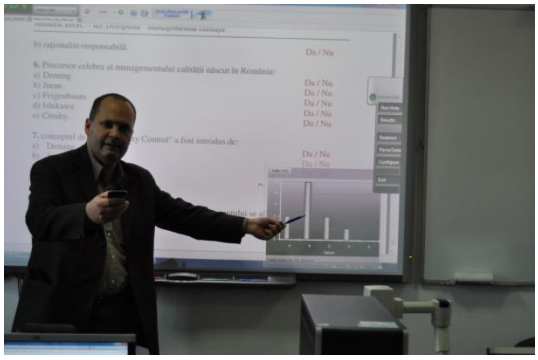

Fig. 2. *The response of a SRS vote is shown at the Smart board*

Thus, the SRS provide new pedagogical methods that enhance interactive teaching models by using instructional feedback loops.

The SRS technology may be used for in-class, laboratory, but also for distance training purposes, the latter being an entirely new option in SRS technology. The first test of SRS for iPod and iPhone was done in a physics course for civil engineers in the fall of 2009 in Trondheim [15]. In Romania, the SRS technology is used in combination with state of the art video adapted e-learning solutions, in order to provide training to vocational schools in the Central and Western parts of the country [16].

The new SRS system for hand held mobile devices has been developed for web, and all communications is solved through communication through HTTP, from web pages to web services, both from student perspectives and student perspectives. The SRS control interface solves several flow problems that the web control interface introduces in the classroom:

- The web based control interface is a web page. For the teacher to start, control and present results, he/she must have a web browser on top of all other software in the classroom,
- The applications will cover the lecture material that the teacher has, and it is difficult to show results together with the questions.

The teachers report that the control interface application is simple to use, and the interface may be use together with any presentation software. Furthermore, they appreciate that the:

- Access code is always easily available for students,
- It is possible to present the results together with the question and the alternatives,
- It is easy to hide the software when wanted by the teacher.

The teachers report that they just need a few minutes to learn to operate the SRS due to the intuitive design of the control interfaces.

The research results of HiST [14] is used in the Do-IT project to propose and disseminate a new method for organizing and delivering engineering courses, as well as in-company training solutions.

3. Experiences obtained when using SRS in teaching

A typical SRS mobile device session has the following structure [16]:

1. Handheld units (iPods) are distributed before class begins,
2. Teacher starts the SRS for mobile devices when he is ready to teach, and the students enter the session code just before the lecturing starts. The session codes allocate the class to one lecture room, whereby several neighbouring classrooms may to use the same WI-FI network in parallel,
3. Teacher presents new material from the curriculum,
4. Students are presented a conceptual quiz and asked to discuss with each other for 2-3 minutes,
5. The teacher starts a voting session by using a web interface on the digital blackboard,
6. Student casts individual votes using the handheld units,
7. The vote is closed and results are presented on the blackboard (immediately or when the teacher decides),
8. The teacher comments on the various alternatives and highlight the correct one, explaining thoroughly why it's the correct one and why the others are incorrect,
9. Go back to point 3 and repeat.

Using a SRS based on using wireless Internet connection doesn't restrict the users from being in the vicinity of the instructor. A SRS developed for

internet connection may be used also for distance teaching purposes.

A schematic outline of the SRS IP based communication infrastructure during an instruction training course is presented in figure 3. The teacher is running the SRS application on a digital blackboard and the participants can see the display on their monitors.

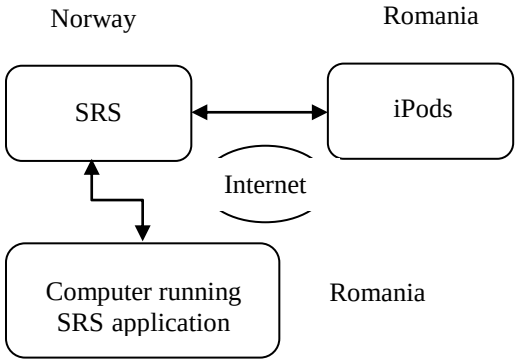

Fig. 3. *Schematic outline of the SRS IP based communication infrastructure*

The student's iPods are interconnected to a server (Fig. 4), which is located in Trondheim.

Fig. 4. *Student's iPods interconnected to a server*

The computer running the SRS application is connected to the same server, and the computer screen is displayed on the Smartboard (Fig. 5).

The system solution shown here is easy to use and fast to install if mobile video devices are used. The experiences show that this system solution yields the student very good quality of the audio as well as the video pictures.

The SRS evaluation system of courses achievements is currently used at "Petru Maior" University of Tîrgu-Mureș . In the first phase the system has been tested on a few VET courses like: Quality Management, Methods of Analysis and Evaluation of Quality, Quality Audit, Conformity Certification, Organizing and Leading Quality Management Systems, delivered for QA professionals like: quality managers, quality auditors, quality specialists [11].

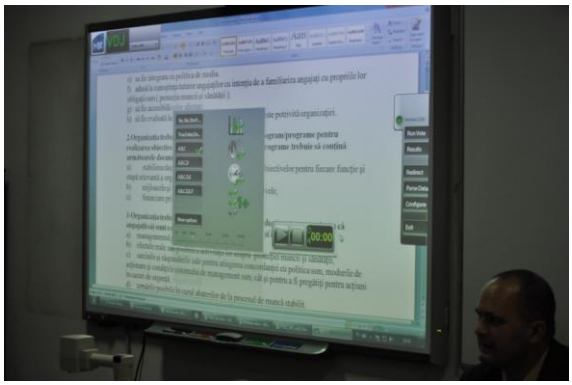

Fig. 5. *Computer screen displayed on the Smartboard*

A lesson consists of 2 lectures, each lasting about 50 minutes. During each 50 minutes period the students were usually presented for 4-6 conceptual questions. In order to start a polling session (which usually lasts 30 seconds), a "ticking clock" was used to shift the students attention away from discussion and over to the voting session in progress. The testing of SRS for mobile devices was done over a period of 6 weeks.

Students' feedbacks on the system were collected from a survey given at the end of the test period. A selection of the results obtained from 92 students is displayed in table 1 (the numbers represent number of students selecting that alternative).

Table 1.

Responses obtained in a survey from the QA courses that used the SRS.

a. **Method of evaluation**

	YES	NO
I agree to be evaluated in each course	89	3
The evaluation has to be done from the presented material	91	1
The evaluation has to be anonymus	92	
The current evaluation to be used in final grade	78	14
I agree current evaluation using answers with alternatives	92	0

b. **Personal benefit of the evaluation**

	Very good		OK		Very poor
My personal benefit of the current evaluation has been	87	1	4		
Current evaluation helps me to better understand the course	85	3	4		
Current evaluation helps me to fix ideas from the course	83	2	7		

c. **Student Response System**

	Very good		OK		Very poor
SRS facilitates quick answers	85	3	3	1	
Is a modern tool increasing my interest for course	91		1		
I would like to be used in many other courses	82	6	3		
Helps me to compare my answer with those of my colleagues	90	1			1
Prefer to use ipodtouch instead of computer	86	4	2		

d. **Previous experience in quality assurance**

	YES	YES - to some extent	NO
Have you theoretical instruction in quality assurance at licence or continuous education degree?	84	8	
Have you practiced quality assurance ?	25	13	54

e. **Personal benefit of the course**

	Very good		OK		Very poor
My personal benefit of the course has been	84	3	4	1	
How easy was the course to understand?	82	8	2		
How suitable was the content for your requirements?	79	11	1	1	
Overall rating of this course?	81	6	4	1	

f. **Courseware**

	Very good		OK		Very poor
Clarity of the handouts (how easy were they to understand)?	82	8	2		
How well did the course material follow the course?	87	4	1		
Overall rating of the course material?	85	6	1		

g. **Instructor**

	Very good		OK		Very poor
The pedagogical efforts of the teacher have been	84	7	1		
Ability to respond appropriately to questions	88	4			
How well prepared was the instructor?	90	2			
Knowledge of the subject matter	90	2			
Presentation abilities	89	1	2		

h. **Relevance of the course for quality assurance career**

	Totally agree	Agree	Neu-tral	Disa-gree	Totally disagree
The course has been very relevant for my own future activity in quality assurance (i.e. I'm more likely to use	88	4			

presented models in the future after completing this course)					
The course has made me curious about practical applications of theoretical models in quality assurance have been presented	86	5	1		
I will apply theoretical models in quality assurance have been presented in current activity	88	4			

These results together with interviews with students show a clear positive picture on using the SRS during class. Students agree that the SRS encourage the students to be active during the lecture, and they feel that using SRS helps them to learn the curriculum of the course.

After this pilot test of the SRS system PMU has decided to use system on a large scale, as described in the Operational Plan 2011 page 18 [21]: Introduction of new educational technologies: implementation of synchronous assessment technology of courses by the student response system (SRS).

4. Discussion and conclusions

Sør-Trøndelag University College of Trondheim in Norway is coordinator of the project "Disseminating Open and Innovative Tools and Services for Vocational Education and Training in Quality Assurance" (acronym Do-IT), financed by European Commission, having partner "Petru Maior" University of Tîrgu Mureş [Project Do-IT]. During the project we have employed the Student Response System a few VET courses delivered for QA professionals.

The SRS provides user interfaces that are intuitive to use. This includes session control, a flexible framework for generating questionnaires on-the-fly, easy to use interfaces for controlling the voting session by the teachers, and easy to use interfaces for voting on mobile devices by the students. The WI-FI based SRS has been designed such that it helps the instructor or teacher to:

- Break the monotony of a lecture and allow the students to actively take part in the lecture,
- Increase teacher-student interaction,
- Give both teacher and students "real-time" feedback on learning effect,
- Use modern and cheap and widely available devices which students soon have access to through their mobile phones,
- Use devices that start fast (within 2-3 seconds) in order to merge it into the story telling.

The pilot testing has used an instructor lead educational process that contained the following elements:

- Short sequential lessons, followed up by tasks where students give feedback by using SRS,
- The SRS questionnaires exploit ICT enhanced learning assets,
- Structured, critical thinking creative problem based learning activities that collect individual responses anonymously,
- A flexible in class discussion sequence that in some cases may end up with a new SRS decision process
- Summary and explanation, reflecting the profile of the response from class,
- The system solution is web based and generic, whereby it may be utilized in all kind of process and product oriented instruction and training activities.

The students provide positive feedback with respect to increased engagement and motivation. Many students feel it become fun to attend the lectures. They also point out that the SRS has become an integrated part of the teaching practices, since it is intuitive, easy and fast to operate by the teachers and by the students them self. The services are constructed for easy integration and use on digital blackboards, as well as smoothly integration into the story telling provided by the teacher. The students may use widely available mobile, wireless multi touch pressure sensitive hand held devices, or a PC/laptop, to interact anonymously with the teacher through online questionnaires and voting sessions.

Pedagogical challenges related to the new roles of the teacher and the students in the educational process have been demonstrated. Experiences from the first testing period of the SRS system have provided valuable information targeting challenges, as well as "best practices" for using such systems in large classrooms. The system must be intuitive and easy to use, both for students and the teachers. The teacher is telling a story and the SRS should be an integrated part of that story. It should not be an

additional service that is compromising the lecture by spending valuable lecture time.

The results for participants' evaluation, for SRS method, course and instructor evaluation are also presented in this article. Most of the participants did not use SRS. The personal benefit after participating at the courses was very good, also the courseware and the instructor were very good and they totally agree the relevance of the SRS method in the future.

5.Acknowledgement

Supported by a grant financed by the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use, which may be made of the information contained therein.

References

[1]. S. P. Bates, K. Howie, A. st. J. Murphy - *The use of electronic voting systems in large group lectures: challenges and opportunities*, The Journal of the Higher Education Academy Physical Sciences Centre (ISSN 1740-9888) - Issue 2 Dec 2006.

[2]. J. T. Boyle, D. J. Nicol - *Using classroom communication systems to support interaction and discussion in large class settings*. Association for Learning Technology Journal, 11 (3), 43-57, 2003.

[3]. F. Costin - *Lecturing versus other methods of teaching: A review of research*. British Journal of educational Technology, 3, 4-30, 1992.

[4]. H. Crouch, E. Mazur - *Peer Instruction: Ten years of experience and results*. American Journal of Physics, 69 (9), 970-977, 2001.

[5]. H. L. Dangel, C. X. Wang - *Student Response Systems in Higher Education: Moving Beyond Linear Teaching and Surface Learning*, Journal of Educational Technology Development and Exchange, Volume 1, No 1, November 2008.

[6]. S. W. Draper, M. I. Brown - *Increasing Interactivity in Lectures Using an Electronic Voting System*, Journal of Computer Assisted Learning, 20, 81-94, 2004.

[7]. H. M. Horowitz - *Student Response System: Interactivity in a Classroom Environment*. White Plains, NY: IBM Corporate Education Center, 1998.

[8]. G. Masikunas, A. Panayiotidis, L. Bruke - *The use of electronic voting systems in lectures within business and marketing: a case study of their impact on student learning*. Research in Learning Technology, 15 (1), 3-20, 2007.

[9]. L. Moldovan - *Design and Development of Innovative Tools and Models for E-Learning in Central and Western Romania*. The 6th International *Seminar* Quality Management in Higher Education – QMHE2010, Tulcea, Romania. Book II (pp. 543-546), 2010.

[10]. L. Moldovan, J.B. Stav - User Requirements Specifications Training Requirements for Quality Assurance in Europe. http://histproject.no/sites/histproject.no/files/User_req_report_en_DOIT_final1_compressed.pdf. 2010.

[11]. R. P. Pein, S. Scanlon, J. Lu, T.M. Thorseth, J. B. Stav, L. Moldovan - *XML-Based Approach for Ubiquitous Response Systems - A case study in localization and integrity of web services.* The 2010 International Conference on Internet Computing. Monte Carlo Resort, Las Vegas, Nevada. Editors Hamid R Arabnia, Victor A. Clincy, Joan Lu. Worldcomp 10, CSREA Press (pp. 267-274), 2010.

[12]. J. B. Stav, H. Tsalapatas, E. Engh - *New Models for Pedagogical Inclusion of High Quality Industrial Video Solutions within Distance Training Practices*, In Proc. of The European e-Learning Conference, ECEL 2006, Winchester, UK, 2006.

[13]. J. B. Stav, E. Engh, R. Bergh - *New Models for Just-in-Time Transfer of Skills and Knowledge to SME*, Proceedings from the CELDA 2007 conference, Algarve, Portugal, 2007.

[14]. J. B. Stav - *Experiences with activity based training methods in vocational education*, Proceedings from the IASTED international Conference Computers and Advanced Technologies in Education, Crete, Greece, September 29–October 1, 2008.

[15]. J. B. Stav, E. Engh - *Experiences with High Quality Video Services in Teaching, Learning and Skills Upgrading*, Proceedings from On-Line Educa, Berlin, 2009.

[16]. J. B. Stav, K. L. Nielsen, G. Hansen-Nygård, T. M. Thorseth - *Experiences Obtained with Integration of Student Response Systems for iPod Touch and iPhone into e-learning environments*, Electronic Journal of e-Learning, Volume 8, Issue 2 2010 (179-190), 2010.

[17]. J.B. Stav - *Innovative Tools And Models For Vocational Education And Training*, Proceedings of INTED2010 Conference. 8-10 March 2010, Valencia, Spain, pp. 2325-2333, 2010.

[18]. J. Stewart - *Context Perspectives for Scenarios and Research Development in Mobile Systems*. Computer Supported Cooperative Work, Mobile World, 3, pp. 161-194, 2005.

[19]. S. A. J. Stuart, M. I. Brown, S. W. Draper - *Using an Electronic Voting System in Logic Lectures: One Practitioner's Application*. Journal of Computer Assisted Learning, 20, 95-102, 2004.

[20]. Project Do-IT, online at http://histproject.no/node/97

[21]. http://www.upm.ro/conducerea/pdf/2011/PlanOperational2011.pdf