

Transfer of Innovative Training Solutions for Vocational Education and Training of Quality Professionals

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Abstract: The purpose of the paper is to presents some results of the project entitled “Transfer of innovative training solutions for VET of quality professionals” (acronym TIT-us) financed by European Commission. It addresses to the need of designing new VET courses for training in quality assurance qualifications. The paper presents the design of a pedagogical methodology for training of quality professionals by employment of Activity Based Training (ABT) and Student Response System (SRS). The recent developments and results obtained during pilot testing of the new pedagogical models and services are presented. It is demonstrated the professional training by means of ABT learning environment, employing a generalised quality auditing process in an organization. Trainees’ outcomes are evaluated with SRS that are an integrated component of the course. The research results and practical issues deduced from the implementation phase demonstrate the quality of feedback from trainees, the effectiveness of the different discussion methods, some logistical considerations, timed versus non-timed voting sessions, the instructor’s role in explaining the alternatives of a quiz and the main problems that may become drawbacks of the evaluation system.

Keywords: vocational education and training; student response systems; mobile devices; activity based training; quality assurance; Deming cycle.

1. Introduction

The project *Transfer of innovative training solutions for VET of quality professionals* (TIT-us) [9] is promoted by Chamber of Commerce and Industry of Mures County Romania (CCIM) in partnership with HiST Kompetanse AS Trondheim Norway (HCR), Frøya videregående skole Sistranda Norway (FVGS) and Tiber Umbria Comett Education Programme Umbria, Italy (TUCEP).

The consortium has a strong industrial presence with strong ties to research within utilization of new pedagogical methodologies, and connections towards manufacturing industry leading to identification of inadequacies in existing training systems and international standards for effective train the trainer delivery.

The TIT-us consortium consists of a multidisciplinary team with a wide geographical reach and European footprint. The work plan involves a number of transfers of innovation and dissemination activities that have been executed in Romania, Italy and Norway.

2. TIT-us aims

TIT-us links together three different countries qualifications systems and frameworks on the support of Quality Assurance (QA) related qualifications, functioning in practice as a translation device that is making these qualifications more readable, but also ensuring education quality.

TIT-us is aiming at disseminating and raising the awareness of a new integrated blended learning environment that offers flexible and pedagogical delivery of level specific mechanical industry production process training to VET schools and in-company training organizations in Romania, Italy and Norway. This includes:

- Educate VET QA instructors as Activity Based Training learning environment advisers;
- Disseminate an innovative transfer system for SME in-company training, in three different European societies, that are delivered on a just-in-time basis.

3. Quality design in TIT-us VET courses

In Romania, the National Authority for Qualifications ANC has developed three occupational standards in the field of quality assurance, so VET providers may accredit courses for three occupations: Manager of Quality Systems, Specialist in Quality Systems, and Auditor in Quality. Requirements of these standards are input elements for designing courses by VET providers.

The basic approach we have considered for designing VET courses is the classic Deming PDCA cycle augmented with description of methodology. Our approach for quality design of VET courses is to add to the normal Deming cycle PDCA an additional step, the methodology. In fact, each activity in VET is a quality approach which ensures quality design of VET courses. It consists of a number of decisions made within the following five steps (Fig. 1): 1-(PLAN) to elaborate a purpose and a plan; 2-(DO) to implement the plan; 3-(CHECK) to assess and evaluate activities from the implementation step; 4-(ACT) to collect feedback and transmit to procedure for change; 5-to follow a certain methodology.

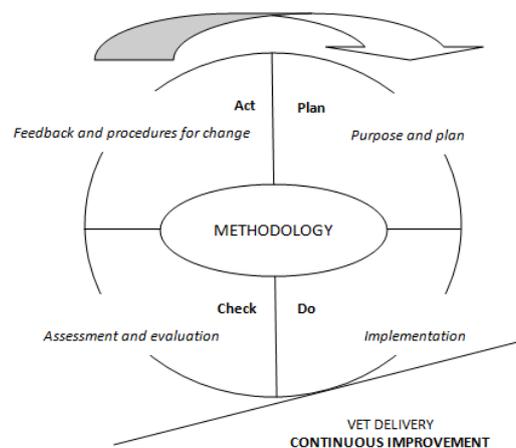


Figure 1: Quality circle in VET

The characterization of the five steps and particularization in the TIT-us project, are presented in paper [6].

4. Implementation strategy

Based on user requirements specifications, the implementation strategy for the stakeholder groups (QA personnel) consist in:

- 1) Format of courses, that are used by instructors during courses delivery: Quality Auditing in manufacturing; Quality Management in manufacturing; Quality Assurance in manufacturing, in the consortium partners languages;
- 2) Pedagogical methodologies, Student Response Systems (SRS) technology and Activity Based Training (ABT) learning environment that are used by instructors during training.

In the TIT-us project the innovative educational tools imported from Norway are ABT and SRS, that are adapted in this project to the specific context of education in quality assurance in each of the three participating countries. The ABT methodology is used for QA courses in VET [8], according to ISO 9001. Evaluation of theoretical achievements is done with SRS [7].

5. Activity based training

Activity Based Training has in theory a lot in common with *Learning by doing* [2], which improves capability of people in execution of tasks by repeating the same type of action very regularly and *Problem based learning* [3], which enables trainees to apply their knowledge to

solve matters that are directly related to their jobs, but when it comes to the practical implementation there are differences in the methodology.

The core idea behind ABT is that trainee should produce something related to their activity, which can be a physical product or a service [1]. The exemplified industrial process must be clearly defined so that each step in the process represents an added value to the process itself. The process consists of a number of defined production steps, each adding a value to the product.

To be able to actively participate in collaborative creation of knowledge objects, trainees are expected to take control of their learning, to go beyond individual efforts and to engage in productive collaboration with peers.

The idea of collaboration is central and a key element in ABT. Collaborative learning will stimulate the ability to cooperate in order to full-fill the activities that is a part of the production process. The collaboration efforts are in many cases, more important than the results.

The collaborative learning can be stimulated through the learning process by establishing a group of trainees that shall work together as a work group. Each class will then consist of two or more work groups. These work groups will work in parallel with the same activity through the production process.

At the end of each activity these work groups are going to exchange their results of activities at that stage. This means that for every activity in the production process the work groups are starting with a result from another work group, they will add a certain value to the final product during the activity and at the end they deliver their result to another work group. Through this result exchange they will experience the dependencies of other groups to perform their task in order to be able to full-fill their own task. This is a very important element of the ABT, because this is quite similar with the normal production in real life.

The result exchange is a way of letting the trainees be aware of their dependencies of other groups in order to full-fill their own tasks. It also will make them aware of that they have to deliver the correct quality as defined in the task. If the quality is not acceptable or the delivery time or scope of delivery is not correct, negative consequences will occur.

ABT may be used in any vocational training for physical products or services [8]. Since the idea is not targeting special products then it can be used with products that may be available through cooperation with local industrial companies or other sources. Through such cooperation additional practical knowledge and competence can be accessed during education and training. Activity based training is a concept suitable to apply also in quality management VET.

Following principles presented above, the CCIM has developed 3 training course supports that are employing ABT and are evaluated by means of SRS: Quality Management in manufacturing; Quality Auditing in manufacturing; Quality Assurance in manufacturing.

In the following paragraph it is exemplified the ABT methodology applied at CCIM for the Quality Auditing in manufacturing course.

6. The ABT methodology for quality auditing in manufacturing

The Activity Based Training (ABT) methodology uses an alternative pedagogical approach to education and training of personnel in industry, ensuring that theoretical content is directly relevant for the subsequent practical tasks in the industrial verification and control process.

In the ABT employment for quality auditors training the core idea is that during the training course the trainee shall follow the main steps of the real quality audit issues from an enterprise. The base processes of the enterprise can be anything that is related to industrial fabrication or services.

During the course the quality auditing training will be produced by going through a sequential process that consists of a number of steps that can be identified and be treated as standalone training elements [4].

In figure 2, we considered the idea of training with the ABT methodology by simulating quality audit issues in an organization. The main steps of the ABT training are evaluated with the SRS methodology. The key structure of the quality audit activities involves a sequential number of training activities organized in modules (1-9 in this example) consisting of theory and practice.

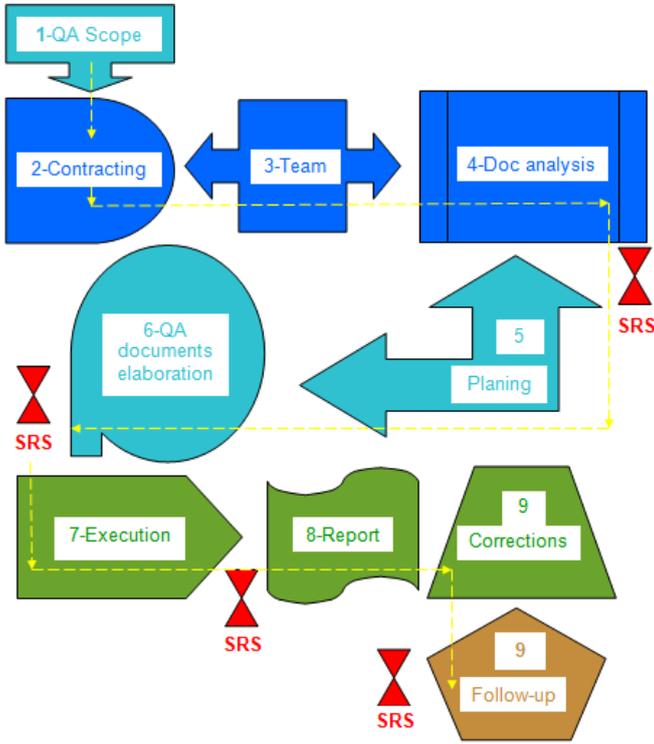


Figure 2. The sequential structure of the Quality audit training by means of ABT and SRS

The study modules for quality audit in manufacturing are exemplified with ABT practical activities, which are explored by trainees during training and then are evaluated with SRS. The content of ABT activities and the number of questions used in each module evaluation are presented in Table 1.

Table 1. The ABT modules for quality auditors training evaluated by means of SRS

Module	Module title	Quality audit process – ABT activities	Quality audit process – ABT practical exemplifications	SRS evaluation
1	Quality audit scope and domain defining	Establish of the audit scope and domain of application	Quality manual (Chap. 1) ISO9001	10 questions
2	Contracting the audit	Delivery of contractual documents according to the domain and criteria of audit	Contract review	8 questions
3	Establishing the audit team	Nomination of chief auditor, selection of auditors	Documents for qualification of auditors, Criteria for chief auditor	10 questions
4	Analysis of quality management system documentation	Analysis of QMS documentation	QMS documentation • Quality manual, • System procedures, • Operational procedures	9 questions
5	Audit planning	Elaboration and delivery of audit plan – agreements between auditors and audited organization	Audit plan according to organisational chart and system documentation	11 questions

6	Elaboration of documents for audit	Creating the format of the documents employed by the auditor in the execution and report phases	Elaboration of: <ul style="list-style-type: none"> • Audit questioner, • Nonconformities report, • Audit report • Meeting documents 	12 questions
7	Audit execution	Examination of organization; objective proofs for audit: registrations, observation, discussions	Registration of: <ul style="list-style-type: none"> • Audit questioner, • Nonconformities report • Meeting documents 	17 questions
8	Audit report elaboration	Filling the audit report and delivery to the audited organisation	Registration of: <ul style="list-style-type: none"> • Audit report 	11 questions
9	Corrections - Follow up corrections and corrective actions	Establish corrections, corrective actions Evaluation of corrections and corrective actions	Registration of: <ul style="list-style-type: none"> • Nonconformities report • Corrective actions report Proofs for: <ul style="list-style-type: none"> • Nonconformities report • Corrective actions report 	9 questions

It should be noticed that this sequence is generic and not related to any specific product. The methods are generic, whereby they are applicable to wide industry sectors. As a consequence, it may be adapted for use in any VET training where an industrial production environment is used as a model for training activities.

7. The ABT resources from the production flow

The ABT resources from production flow that have been developed in the Tit-us project and have been used for training in the 3 courses delivered by CCIM are imported from two companies in the Mures County: Matricon Tirgu Mures (producer for automotive parts) and Hirschmann Vidrasau (producer for automotive cables).



Figure 3a: The ABT resource: Collection of product defects

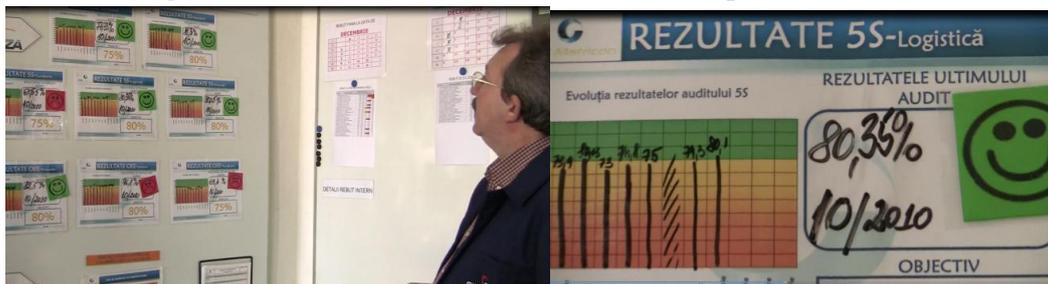


Figure 3b: The ABT resource: 5S



Figure 3c: The ABT resource: Product external inspection

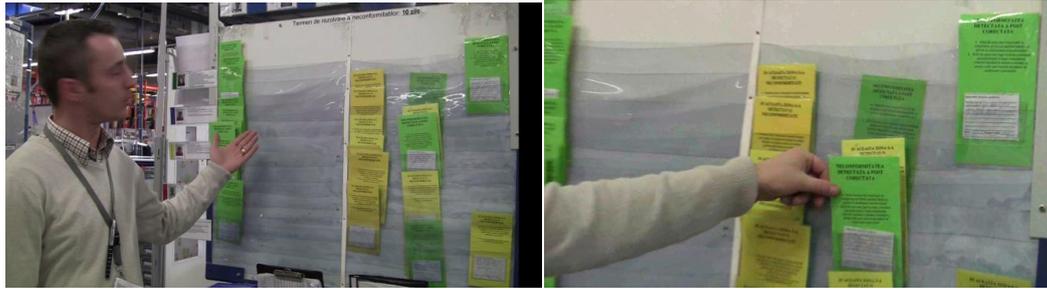


Figure 3d: The ABT resource: Compartment audit panel

Some examples of the ABT resources are: 5S – *The ABT resource presents the 5S the method, part of the continuous improvement strategy*; Internal audit - *The ABT resource presents aspects of internal audits’ planning and conducting for products, processes and system within the enterprise*; Second party audit - *The ABT resource presents aspects of second party audits performed by enterprise’s customers*; Third party audit - *The ABT resource presents aspects of the third party audits conducted by the enterprises quality management system certification body*; Product external inspection - *The ABT resource presents the external inspection of the product, used when the product cannot be controlled during production*; Reception process control - *The ABT resource presents the product quality and quantity reception, check of the accompanying documents*; Ideas and suggestions for improvement - *The ABT resource presents the steps for applying the ideas and suggestions for improvement system*; Compartment audit panel - *The ABT resource presents information displayed on a production sector audit panel,...* and many others.

Pictures from a few ABT resources are presented in figure 3a,....,d.

8. SRS evaluation for quality management in manufacturing

SRS technology includes a receiver, a collection of mobile devices and dedicated software. Through a wireless connection the clickers enable trainees to answer a number of questions, or quizzes, during a lecture. Because the trainees use their keypads instead of raising hands to submit answers, individual responses stay confidential from the rest of the trainees while result overviews are available on the classroom screen.

The SRS can be used within a multitude of methodical and educational approaches. Two approaches are of particular interest, both of which have been tested in CCIM during the quality management course:

1. “Classical” approach: letting the trainees discuss 2-3 minutes between themselves in groups before doing a voting session;
2. Peer instruction: each trainee first has to think individually through the quiz question before casting a vote. Once the vote is cast (and the result of the vote is shown to the trainees), a group discussion ensues, during which each trainee has to argue his or her position to the rest of the group. After the group discussion another vote is held, and the results between the two voting sessions can be compared.

The results for participants’ evaluation, for SRS method, course and instructor evaluation after employing SRS in the courses delivered by CCIM demonstrate that SRS has the potential 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, that start fast (within 2-3 seconds).

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.

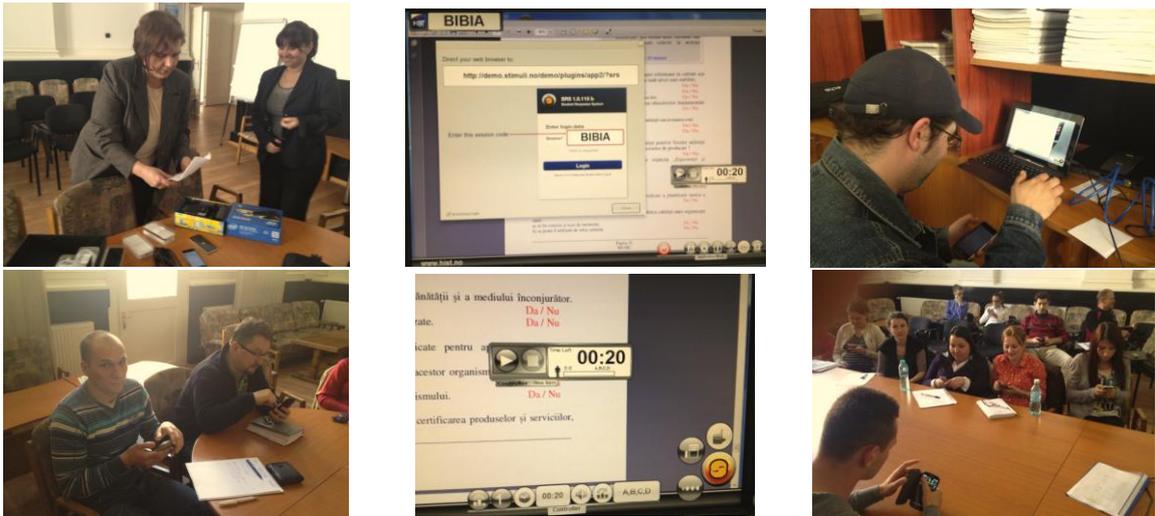


Figure 4: Pictures during course delivery and evaluation with SRS

The 3 courses have been delivered by CCIM as follows (Fig. 4): *Quality Management in manufacturing* - duration: 40 hours; status: accredited CCIM; period of delivery 3.10.2013 – 16.01.2014; number of participants: 46; *Quality Auditing in manufacturing* - duration: 40 hours; status: accredited CCIM; period of delivery 8.04 – 27.05.2014; number of participants: 36; *Quality Assurance in manufacturing* - duration: 40 hours; status: accredited ANC (National Authority for Qualifications); period of delivery 4.06 – 03.07.2014; number of participants: 30.

SRS evaluation has also been used during other training courses organised by CCIM, such as: OHS - Occupational Health and Safety – duration: 40 hours (basic level), 80 hours (intermediate level); status: accredited ANC; period of delivery 23.06 – 17.07.2014; number of participants: 26 and *Training of trainers* – duration: 40 hours; status: accredited ANC; period of delivery 14.07 – 25.07.2014; number of participants: 16.

Dissemination activities organised by CCIM comprise demonstrations to 8 VET providers from Romania and detailed info material provided to 10 other VET providers and 10 “test” companies that need to train QA personnel.

9. Discussion

In this final section we highlight some research results and practical issues deduced from the implementation phase of ABT and SRS during the quality assurance VET courses delivered by CCIM in the interval 2013-2014, which can be relevant to those who might wish to implement the interactive methods described in this paper.

Training developed in a classical fashion, does not deliver the depth of learning required by trainees to actually change behaviour. In industrial companies, the objective of training is usually not the technical knowledge but to change behaviour. A good example comes from the aviation industry for pilots that are trained on simulators. There is no linear path in their training and are supposed to complex situations. Very often they fail but they learn in every situation by reflection. In this way their further knowledge is higher and they become much better prepared for different future complex situations [5]. Starting from these observations we have developed the content of the quality professionals training programme in order to help trainees to learn from activity based examples that are making training experiential, allowing for periods of reflection

As a conclusion after delivery of training we observed that practical modules, combined with classroom training, have significantly improved the learning retention and application,

the ABT is more fun; trainees learn more also from their mistakes when they are in a relaxed atmosphere.

As regards SRS the first issue is the added value provided by classroom communication technology, the unique contribution consisting in the quality of feedback that it enables.

A second issue concerns the effectiveness of the different discussion methods. This evaluation has shown that classroom technology can support active discussion learning.

The third issue concerns some logistical considerations the simple task of handing out mobile devices for dozens of trainees can present a logistical challenge.

The fourth issue consists in exploration of the timed versus non-timed voting sessions. Our experience shows that using a “ticking clock” sound during the countdown is invaluable in shifting the trainees’ attention away from the discussion and over to the voting session.

The fifth issue refers to the instructor’s role that is critically important for the trainees to thoroughly explain what the correct alternative is, and why, but also to put a lot of effort into stimulating the discussion between the trainees.

The trainees provide positive feedback with respect to increased engagement and motivation, many of them feeling that it becomes fun to attend the lectures. Our SRS trainee experience in general as a very positive element in their lectures and a valuable tool for both the instructor and trainees.

In the 2013-2014 survey on 94 trainees, 91.5% of the trainees answered that they would want SRS to be used in their future education if they had the chance.

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References

- [1] Cattell A. Activity-based training design: Transforming the learning of knowledge. *Industrial and Commercial Training* 2008; 40(3):162-163.
- [2] Chang J, Benamraoui A, Rieple A. Learning-by-doing as an approach to teaching social entrepreneurship. *Innovations in Education and Teaching International* 2013; 50:1-13.
- [3] De Graaff E., Kolmos A. Characteristics of problem-based learning. *International Journal of Engineering Education* 2003; 19(5):657-662.
- [4] Moldovan L. Quality Assurance of VET Delivery to Quality Professionals. *Scientific Bulletin of the "Petru Maior" University of Tîrgu Mureş* 2013; 10(XXVII)-2: 62-66.
- [5] Moldovan L. Design of a new learning environment for training in quality assurance. The 7th International Conference INTER-ENG 2013 Interdisciplinarity in Engineering 10 - 11 October 2013 "Petru Maior" University of Tîrgu Mureş Romania. *Procedia Technology* 2014; 12: 483-488.
- [6] Moldovan L. Innovative Training Solutions for Quality Managers. The 8th International Conference INTER-ENG 2013 Interdisciplinarity in Engineering 9 - 10 October 2014 "Petru Maior" University of Tîrgu Mureş Romania. To be published in *Procedia Technology*.
- [7] Stav J. B., Nielsen K. L., Hansen-Nygård G., Thorseth, T. M. Experiences Obtained with Integration of Student Response Systems for iPod Touch and iPhone into e-learning environments. *Electronic Journal of e-Learning* 2010; 8(2): 179-190.
- [8] Stav J. B., Arnesen K. Activity based training solutions for vet quality professionals. *INTED2013 Proceedings, 7th International Technology, Education and Development Conference, Valencia, Spain* 2013: 3340-3346.
- [9] *** Project TIT-us, online at <http://histproject.no/node/759>.