

# ACTIVITY BASED TRAINING SOLUTIONS FOR VET QUALITY PROFESSIONALS

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## Abstract

Ongoing work for designing, developing and introducing product- and process oriented training methods in combination with use of e-learning within the VET sector in several European countries is reported. This ensures cost-efficiency with respect to developing, distributing and reusing educational material.

Keywords: Activity based training, workplace training, VET training, video in education.

## 1 INTRODUCTION

EU directives, harmonized standards, and educational guidelines targeting the interplay with the expanding SME fabrication industry promote new production systems where Quality Assurance (QA) of knowledge-based production is a convenient and necessary tool. A measurable QA aspect of the production is frequently often not properly addressed within management of distributed virtual subsidiaries, resulting in a steady increase of withdrawal of products from the market with subsequent sky-rocketing repair costs that effectively slow down the modernization of industrial production systems and technologies within Europe. Though production standards, guidelines and diplomas are identical, know-how, expertise and QA associated with the new production technologies vary enormously throughout Europe when obtained on the job through the daily work.

The Leonardo da Vinci pilot project MECCA (2005-07) [1] developed a new Activity Based Training (ABT) learning environment. ABT follows the industrial production process, and the students always produce a product during a course. ABT facilitates 1) a just-in-time on-the-job production workflow competence and knowledge transfer approach, 2) a pedagogical model where theoretical training is always immediately followed by practical training, 3) coordinated use of advanced video technology, and 4) industrial quality assurance management where students exchange their products during a course.

The ongoing Leonardo da Vinci transfer of innovation Titus project [2] aims to use ABT to disseminate a new competence transfer model, a new 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. ABT [3] includes 4 basic components:

- Specification of a product from a customer, that is delivered to the students as an order when the training starts. The product must be completed and delivered to the customer within the timeframe provided in the specification. This is often done towards the end of a vocational education and training course.
- The pedagogical method utilizes ABT to produce a product by following the (industrial) production flow of an object in such that theoretical training is immediately applied into practice. The students shall apply their knowledge as fast as possible, and use it to investigate how they shall complete the next component in the product.
- It provides interactive training that may utilize students own Smartphones through modern, web-based Student Response Systems. Teachers and instructors may use these services to enhance interaction and communication in class, and to provide feedback from the class to the teacher and vice versa.
- Use of video material that provides self paced on-line education, and high quality instructional video of learning material to institutes, SME and VET schools. The training method promotes for instance the use of modern learning tools in quality assurance and quality management training.

At the end of a course, the students have produced a product based up on specifications provided through an order from the external customer. During the course they will need to learn more theory based up on the specifications in the order, and the practical problem solving process where they must decide in which sequence they are going to produce the components and afterwards assemble them. Quality assurance is integrated into the education model, since the students must check the ingoing and outgoing quality of their products during the production process, and compare the measured values with the specification in the order. Video is used as a facilitator for initiating discussions based up on cases that are illustrated by use of Do's, as well as Don't's. This is illustrated in Figure 1.

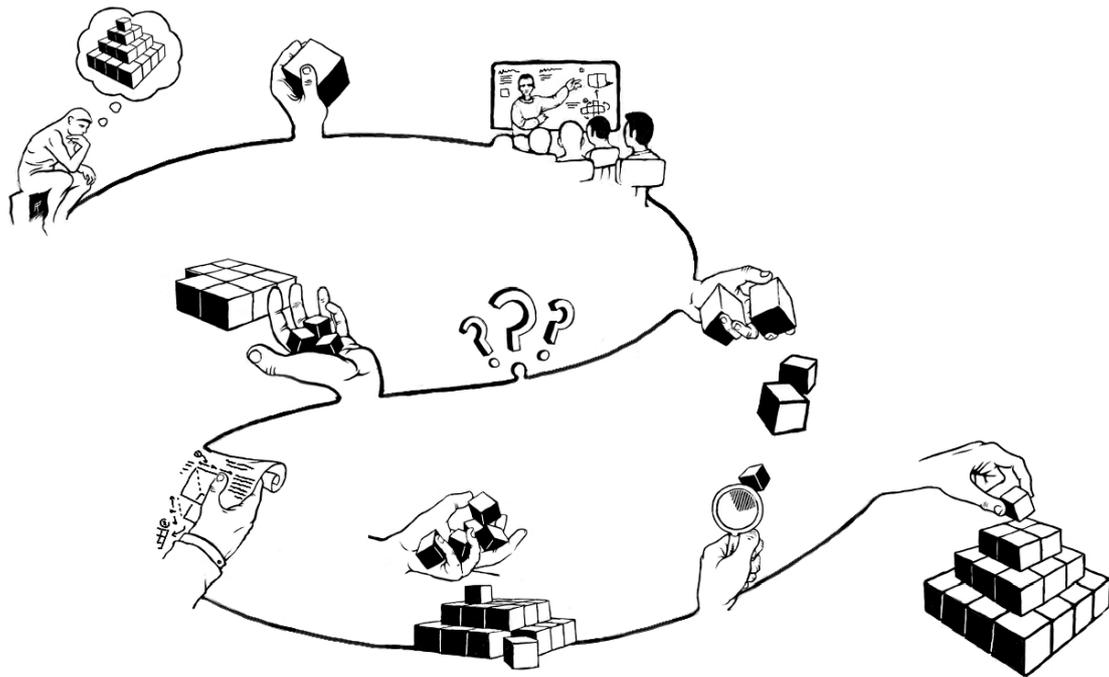


Figure 1. The customer delivers a technical and economical specification of the product (a pyramid in this example). The product constitutes of many small pieces (here: boxes) that is developed one by one, and put together into one product (here: the pyramid). In order to figure out how to construct the product, it is necessary to learn more theory, carry out practical investigations, and provide quality assurance of the components during the production.

The ongoing Leonardo da Vinci transfer of innovation project VET2Edu [6] wants to support trainers and teachers from VET sector in implementation of innovative methods by adapting, transferring and validating an e-learning course for vocational schools and training sector. This training course is based on social constructivism. The ambition is to stimulate independent learners self-direction, and support them in gaining experience from real world practice. Assignments are going to be designed to stimulate reflection, as well as conscious development of a learner in a peer group. The training activities are short and interactive, and comply with accessibility rules. Communication and interaction is very important, to be addressed by including discussion board, chatting and videoconferencing.

## 2 ABT CHARACTERISTICS

The core idea behind the ABT [2] is that the student shall produce a product during the training course. This product can be anything that is related to an industrial fabrication process, or the quality assurance of that process. During the course the product will be produced by going through a sequential production process that consists of a number of steps that can be identified and be treated as stand alone training elements. They are often referred to as work orders and work packages. A typical mechanical industry fabrication process is often given as an order, which is divided into a number of work packages (see the boxes in Figure 1). A work package is a detailed and sequential

description of the working task that is going to be done and it is normally divided into one or several activities. Delivery of the final welded product requires a number of steps from fetching the material, through cutting it into smaller pieces, which will be assembled and joined to a new product. These sequential activities will contain both theoretical and practical tasks, which also include quality assurance and quality control of the job itself. The work package contains at least the following task information in order to secure that the process meet the required quality:

- Work drawing(s) showing the structure of the final fabricated object, i.e. specific details and information for the tasks.
- Work description(s) covering how to do the job and which methods that are going to be used in the production. This includes work process description(s) containing the pre required knowledge, the working processes needed in order to produce the final product, and work package description(s) covering all the work that is going to be done.
- The quality requirements for the product to be produced and delivered. This includes quality assurance requirements for the ingoing elements, and quality assurance descriptions

Work packages consist of separate activities, which may include transfer of specific knowledge and training, as indicated in the figure. The training is carried out in the classroom (theoretical training), shop (hands-on training and practice), or in other production areas.

It should be noticed that local industry needs can be used to define the products, or local community needs for products could be utilized in the training process. For instance, a school could cooperate with local industries as subcontractors if the production is relevant for their education and training. Usually, the ABT course is organized in a number of work orders. The quality assurance (QA) training is organized in such a way that it may follows ISO 3834, and at the same time the ABT for industrial production process training as scheduled in table 1. The quality assurance topics from ISO 3834 may be structured in the same way as an ABT course for industrial production.

The training method focuses on what is learnt at the end of the learning process, while at the same time it utilize a process oriented syllabus by focusing at the industrial production process through task based learning. Thus, the training regulations include demand for process-oriented implementation of training. The goal is to adapt training to requirements in real industrial work processes, and in particular identify skills that must be imparted during a course program:

- The product prescribed must have a clear definition and description such that it may be derived and produced in a company
- The training process promotes transfer of industrial competence where the student act within the industrial production framework of a company, and at the same time shape and change the training process such that it optimize quality assurance and quality management processes

This is going to help companies to adept their training to organizational as well as technological development inside their organization. The training methods specify training tasks, while the technologies used have to be adapted to the production processes inside the company. In this way the technology and production process available inside the company, become the standard of the training provided to a class, e.g. within quality assurance training.

### **3 APPLYING ABT IN VET**

According to contemporary models of learning, individuals understand and remember new material best when they elaborate on that material in some manner [4] and [5]. Elaboration can take the form of adding details to the information, clarifying an idea, explaining the relationship between two or more of the new concepts, making inferences, visualizing an image of some aspect of the material, applying an analogy relating the new ideas to familiar things, or in some other way associating the new material with voting sessions by use of ABT methods.

A quality assurance training course within joining may be organized in such a way that it follows ISO 3834, and at the same time the ABT for industrial production process training as scheduled in table 1. The quality assurance topics from ISO 3834 may be structured in the same way as an ABT course for industrial production.

<b>Module no</b>	<b>Industrial production process ABT activities</b>	<b>Verification and control process ABT activities</b>
1. Introduction	Introduction to the course, scope of the education	Organization
2. Work Package	Delivery of contract documents including specifications and relevant documentations and delivery plan	Contract review, design review
3. Start	Organizing the work, selecting material and prepare for start production	Subcontractors, welding personnel, personnel for NDT and inspection
4. Cutting	Cutting materials, identification	Equipment, calibration, maintenance
5. Welding procedure specification (WPS)	Creating WPS and other work instructions for welding	Joining activities, filler material,
6. Assembly	Assembly of components, creating subassemblies and preparation for welding	Production planning, joining sequences, heat treatment
7. Tack	Starting the assembly into main components –preparing the welding	Joining personnel’s qualification
8. Welding	Welding the components	Control and verification before during and after joining
9. Qualification	Documentation of qualification, updating certificates, NDT-testing	Non-conformance and corrective actions
10. Delivery	Quality control of documentation. Creating document packages for product documentation	Identification and traceability, document organization, quality registers

Table 1. The extension of the work order, for use in an ABT course for industrial verification and control process training, is organized in a number of modules (10 in this case).

Apart from using the ISO 3834 itself, which is a mandatory document in a QA course, the pedagogical methodology may be designed in such a way that the tasks and exercises students are going to solve, lead to a set of procedures. Introducing relevant questions may do this. A convenient example is module 2, where the documents are delivered to the students. The documents will at minimum include:

- Drawings
- Contract with contract requirements
- Delivery Plan
- Quality requirements
- Specifications

According to ISO 3834 a “Contract Review” must be done. To develop an appropriate “Contract Review” document with relevant procedures may be part of an exercise the students should solve. It must be based up on material and the standards, and use keywords in the “Contract Review”.

Another task for the student is to create a complete “Design Review” document, which is also required in module 2. It may be developed in a similar way as the “Contract Review”, by giving the students keywords for the elements that as a minimum must be included. The exercise for the students is going to be to develop a set of procedures which are relevant for a “Design Review” of a product based on welding as the key fabrication method”. The discussion targeting the “Design Review” must include fabrication related issues, as well as other relevant material that must be defined. Afterwards, when the students enter into the production phase, by using the ideas addressed by this article, they may observe the consequences of their planning at an early stage in the course. This will serve as a hands-on feedback to the students when using such problem based learning methods.

#### **4 APPLYING E-LEARNING IN VET**

The on-going Leonardo da Vinci transform of innovation project VET2EDU [6], with 10 partners from 9 European countries, is investigating how e-learning may support vocational education and training teachers and instructors in implementing and start using e-learning methods. The project is going to adapt an e-learning course for educators from Poland, to VET providers learning needs and requirements in 8 European countries. The goal is to increase digital and didactic competences of VET instructors and teachers by raising the awareness of online educational solutions.

To transform VET systems are currently a common denominator for almost all educational systems within EU. New pedagogical approaches in line with the Quality Framework require innovative measures to stimulate development of VET students and teachers/trainers. Such practices are well developed and established within higher education. However, within VET there seems not to be enough pedagogical support, whereby it is a need to adapt, introduce, test and validate e-learning to the new context in order to enhance accessibility and quality of pedagogical content for educators and students in VET.

The general aim of the project is to support trainers and teachers from VET sector in implementation of dynamic, open and innovative methods by adapting and transferring validated e-learning course for vocational schools and training sector. The course is based on innovative pedagogical methods such as online collaboration, reflection, peer learning, and uses various open tools. The course will enable teachers and institutions to integrate them with new qualification framework and current teaching practice. The course will according to the plan be available as open resource in 9 languages together with the facilitator’s detailed manual that are going to have restricted access. The aim will be achieved by adapting an e-learning course for educators in Poland to VET teachers and trainers learning needs and requirements in partner countries. The e-learning course is a result of two previous projects (e-Teacher LDV Project, 2005-2007, and iCamp Project, 6th FP 2006-2009) as well as further developments and practice of AGH University of Science and Technology in Krakow. The course has been delivered in Poland for around 250 participants so far.

The partnership have different but significant experience in VET, e-learning and training and are interested in sustaining and exploiting the project results as a part of their training offer. The course is very practical, and participants are encouraged to interact within the group and create meaningful and relevant artifacts. The content is expected to contain 8 modules that cover the following topics:

- Introduction and warming-up (5h)
- On reflection (7h)
- Exploring various e-learning forms (5h)
- Designing learning outcomes (3h)
- Designing e-learning activities (10h)
- Designing resources (3h)
- Motivation (5 h)
- Group work (10 h)
- Moderating on-line learning (7h)
- Moderator’s competence and summing-up

The project is going to increase didactic and digital competences of VET trainers and teachers and raise awareness of online educational solutions based on innovative pedagogy. Further dissemination of innovative methods and approaches will be achieved, as the trained VET educators will be

prepared for participation in train-the-trainers activities in VET sector. Additionally, a high quality e-learning course will directly influence the training of e-skills in learners. Finally, the project will contribute to increasing the visibility and role of VET in regular education system and lifelong learning.

## **5 DISCUSSION AND FURTHER WORK**

Through the on going Titus project Activity Based Training (ABT) is going to be extended and applied to training in the quality assurance sector that targets control and verification processes. The QA training is organized in a similar way to a joining course that follows the ISO 3834 standard; while at the same time it utilizes the previously developed ABT methods for industrial production process training. The quality assurance topics addressed by ISO 3834 may be structured, as shown in table 1, in the same way as an ABT course targeting education within industrial production processes. Furthermore, such an approach enhances reuse of educational material, thus securing a high level of cost efficiency, as well as pedagogical methods that are based up on utilizing product oriented training methods.

The training method focuses on what is learnt at the end of the learning process, while at the same time it utilize a process oriented syllabus by focusing at the industrial production process through task based learning. Thus, the training regulations include demand for process-oriented implementation of training. The goal is to adapt training to requirements in real industrial work processes, and in particular identify skills that must be imparted during a course program:

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The starting approach is an order from a company that supports and produces a value for the training in form of defining a final, completed product. It starts with placing an order inside the school or class, and ends with the receipt of the agreed product by the customer. The training process can be subdivided into a number of work orders that describe the individual production tasks and activities in detail. It must include a description of the sequences and individual work steps, thus describing how work tasks should be carried out. The learning tasks will have a sequential structure, such that the students can acquire the relevant and required knowledge through their own studies and work. Each learning step provide the preconditions for the next either it is theory or practice. The system with work orders always prescribes the sequence in which the tasks and exercises are going to be dealt with.

The open e-learning course to be adapted and disseminated in the VET2EDU project will be available in 9 languages in 2014. This includes a handbook for facilitators, and use of open course environments.

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