EXPERIENCES WITH USE OF ACTIVITY BASED TRAINING IN VOCATIONAL EDUCATION AND TRAINING

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Abstract

This paper aims at describing the experiences after using Activity Based Training (ABT) environment in plastic welding, which follows the industrial production process in a number of European Countries. ABT offers flexible and pedagogical delivery of level specific manufacturing industry process training to Vocational Education and Training (VET) schools and SME organizations. It disseminates new methods for delivering in-company skills upgrading processes, and enhances production competence and know-how transfer to VET schools

Keywords: Online Student Response Systems, SRS, Activity Based Training, Plastic welding, Peer Learning Assessment Systems.

1 ACTIVITY BASED TRAINING IN PLASTIC WELDING

ABT follows the industrial production process and the students always produce a product during a course. The ABT method has some key characteristics [1,2] that are facilitated by:

- Specification of a product that is delivered to the students as an order
- A pedagogical tool that utilizes ABT to produce a product by following the industrial production flow of an object in such a way that theoretical training is directly connected to practice.
- Onsite training.
- Self paced on-line education, and high quality instructional video of learning material to institutes, SME and VET schools. The training method promotes the use of modern learning tools in quality assurance and quality management training.
- Coordinated use of video technology
- Industrial quality assurance management where students exchange their products during a course.

It is important to address an general issue within upgrading of skills in lifelong learning processes: How to efficiently transfer advanced production process knowledge to students who are looking for a profession, which to a large extent has required practical training with a minimum of theoretical education and where the students have limited knowledge of theory? This is of particular importance in the plastic welding industry where failures related to incorrect operating procedures result in complex repairs and increasing life cycle costs.

- The ABT methodology uses an alternative pedagogical approach to education and training of personnel in industry. ABT utilizes learning methods that mix and merge the following components into one competence transfer model:
- A pedagogical tool that utilizes ABT to produce a product by following the industrial production flow of an object in such a way that theoretical training is directly connected to practice.
- Onsite training where theoretical education is immediately followed up by practical training
- Self paced on-line education, and high quality instructional video of learning material to institutes, SME and VET schools. The training method promotes the use of modern learning tools in vocational education and training of plastic welders.

The core idea behind the ABT [3] 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

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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.

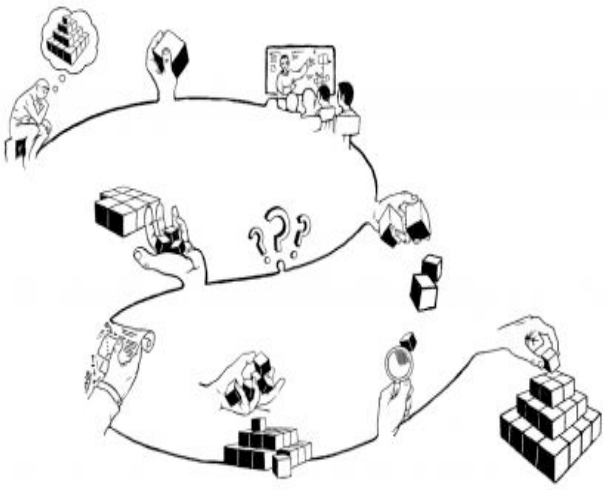

Figure 1. Activity Based Training starts by receiving a technical and economical specification of the product (a pyramid in this example). The product constitutes of many small pieces (here: boxes) that is developed one by one, and put together into one product (here: the pyramid). In order to figure 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.

A typical mechanical industry fabrication process is often given as an order, which is divided into a number of work packages (se 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 welded 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

2 EMERGING PEER LEARNING ASSESSMENT SYSTEMS

Work packages consist of separate activities, which may include transfer of specific knowledge and training, as indicated in figure 1. 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 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 work order is created on the basis of an industrial order or contract, which in detail describe the product and the delivery condition. Thus, the work order is the basis for the education and training

schedules, and for the planning of the training activities. For an ABT course the work order needs to contain a minimum of relevant documents like:

- Delivery plan
- Drawings
- Welding Drawings
- Part lists and material lists
- Assembly descriptions
- Reference to International standards
- Reference to contract requirements
- Control documents
- Non-conformance documents

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 plastic welding.

It should be noticed that this sequence is generic and not related to any specific product. As a consequence, it may be adapted for use in any country where an industrial production environment is used as a model for training activities. The various documents available in the work package can therefore be tailored to the actual industrial application, which is relevant for the VET school, This helps ensuring effective use of previous knowledge. Furthermore, 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.

Table 1 outlines a high level description of the training activities in each of the 10 modules in the work order

Number of module	**Industrial plastic production process ABT activities**
1. Introduction	Introduction to the course, scope of the education
2. Work package outline	Delivery of contract documents including specifications and relevant documentations and delivery plan
3. Start	Organizing the work, selecting material and prepare for start production
4. Cutting and preparation	Cutting materials, identification

5. Welding procedure specification (WPS)	Creating WPS and other work instructions for welding
6. Assembly	Assembly of components, creating subassemblies and preparation for welding
7. Tack	Starting the assembly into main components –preparing the welding
8. Welding	Welding the components
9. Qualification	Documentation of qualification, updating certificates, Non Destructive Testing (NDT)
10. Delivery	Quality control of documentation. Creating document packages for product documentation

Table 1. The work order, for use in an ABT course for industrial production process training, is organized in a number of modules (10 in this case), as outlined in figure 1.

Through the EuroPlast project Activity Based Training (ABT) is going to be extended and applied to training in the plastic welding sector that includes control and verification processes. The training is organized in such a way that it follows the EN requirements, while at the same time it utilizes the previously developed ABT methods for industrial production process training.

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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This is going to help companies to adapt 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.

The starting approach is an order from a company that supports and produces an added value for the training in form of defining a complete product that is going to be produced during the course. 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.

At the end of a course, the students have produced a product based up on specifications provided through an order. 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. Video is used as a facilitator for initiating discussions based up on cases that are illustrated by use of cases that illustrate *DO`s*, as well as *DON'T´s*.

The courses with supporting educational material are going to be implemented and evaluated in a number of courses in Norway, Slovakia, Slovenia and Hungary during the period 2011 to 2012. By implementing a strategy for inclusion of practical experience of quality assurance and quality control, it is expected that it is going to stimulate the students, and give them a new practical dimension in their educational framework by use of cases that utilizes problem-based training. This includes mastering specific technologies and manufacturing methods, as well as industrial work processes that are part of the production environment.

At the end of the courses certificates may issued to students by EN 13067.

3 CONCLUSION

Plastic joining technology has been refined positively in recent years thanks to the good cooperation between the manufacturers of raw material, semi-finished products, systems, machines and devices as well as the training and research establishment. This is opening up new fields of activity for the plastics processing industry. Inside this is of course very important education of the welding personnel.

On the field "Training and Qualification" of welding personnel, is possible to elaborate a guideline which qualifies the plastic joining personnel in the areas of welding on the base of the new Activity Based Training (ABT) learning environment. ABT follows the industrial production process, where the students always produce a final product. ABT facilitates

- Immediate transfer of the results of education into practice
- ABT follows the industrial production processes where theoretical training is always immediately followed by practical training
- Coordinated use of advanced video, other IT, distance learning and
- Promotion of industrial quality assurance management designs processes

The main aims are to expanded learning skills, disseminating and validating brand new inquiry- and problem based blended learning training methods in Hungary, Slovenia, Slovakia, and Norway. The new pedagogical method mixes cases from industrial production; problem based learning methods where theory and practice are closely interconnected with new video solutions on modern, widely accessible for use digital blackboards, videocommunication systems, Student Response System [6], Peer Learning Assessment Systems [7] and Internet resources developed in another projects.

The consortium has a strong industrial presence with strong ties to training organizations (Vitec), distance learning methods, blended learning, video technologies (HiST), and plastic welding industry (MHtE, VUZ and IzV) leading to identification of inadequacies in current training systems and standards for effective instructor training delivery. The partnership has complementary expertise and tasks. The outcomes are

- Multilingual plastic welding courses which will increase the competence and knowledge in the welding community
- Level specific instructor training VET schools and in-company trainers
- Disseminating new pedagogical methodologies, exploring advanced video streaming technology, digital blackboards and harmonized skills transfer within a set of training courses towards SME`s
- EuroPlast portal based on European standards
- National seminars that promote European harmonized guidelines in order to secure free movement of personnel.

Europlast is aiming during the project to involve the welding institutes, VET schools and companies may utilize the new ABT learning environment to offer a broad range of courses at a European level.

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