DESIGN OF LEARNING SEQUENCES FOR VET (VOCATIONAL EDUCATION AND RANTING) COMMUNITY USING LAMS. EXPERIENCE FROM LEONARDO DA VINCI PROJECTS

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Abstract

Through different Leonardo da Vinci projects in the period 2005-2010 new pedagogical principles for organizing and delivering more cost- and time-efficient blended learning and training has been developed. This model may lead to new synergies for effective and pedagogical inclusion of state of the art high quality real-time visual collaboration tools into current training principles with a combination with Learning Design Tools such as LAMS.

The basis for this framework has been a new pedagogical methodology for the training of the students themselves, named Activity Based Training (ABT). It was found that by using LAMS as a design tool, the teacher has to reflect on the activities introduced to the students in a structured and logical manner. In this way the structural facilities in LAMS fits the structure needed in the ABT methodology.

Mechanical industries utilize traditional training methodologies by separating theoretical learning and training from practical training of skills. In such a pedagogical framework hands-on practice comes after the theoretical content descriptions. Activity Based Training (ABT) is closely connected to practical production activities. The training follows the same steps or phases as the industry follows when producing a product. It is then structured logically by giving the students a set of job orders which is broken down into job packages.

However, drawing on previous experience based on the framework developed, new ideas will now be exploited and tested in a new set of course developments and frameworks for courses during 2009 – 2010.

1. Introduction

The European Welding Federation (EWF) has made up a unique harmonized set of Guidelines for education and training of welding personnel targeting the welding professionals in all European countries. This system has also been adopted on a wider international basis through the International Institute of Welding (IIW). It is founded on joint equal user requirements specifications and learning design principles that are based on welding as a skills process. Most of the training has so far been delivered through classroom based teaching methods and practical skills upgrade through traditional laboratory testing.

The European welder-trainers have neither any significant experience of using integrated distance teaching environments nor any experience of using learning design tools such as LAMS. The pedagogical model that has been used, ABT, has been based on a case- and instructional working process that has shown very promising results in spite of the fact that it had been deployed on a limited user scale.

2. Activity based training (ABT) courses

A typical mechanical industry fabrication process utilizing welding is often given as a work order that is divided into a number of tasks (Figure 1). A work package is a detailed and sequential description of the work that is to be done. The work itself is normally divided into one or several activities, each with a detailed description of what has to be done during the activity; the work includes other descriptions, drawings, documents and so forth that enables the student to carry out that very activity (Stav & Engh, 2006).

Delivery of the final welded product requires a number of steps which starts at reading the work order and understanding the drawing material and other documents, to fetching the material from the storage room, through to cutting it into smaller pieces. These pieces are then controlled and assembled and later welded into 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 information in order to ensure that the process can meet the required quality:

Table 1. Table listing essential documents.

1	Drawing of the structure to be fabricated
2	Work description explaining which methods shall be used in the production
3	Process description of the work process for reaching the target and the knowledge required
4	Work package description for the work to be done
5	Reference to available resources for the work
6	Reference to environmental resources or requirements or restrictions
7	Quality assurance requirements for the ingoing elements
8	Quality assurance description of the outgoing elements
9	Requirements for knowledge, prerequisite or knowledge that has to be obtained
10	Cooperation strategy with others or other person in a defined group or to related groups

The table highlights some of the information that must be given to the students in order to carry out the order. Some of this information may be given verbally, such as items 9 and 10, while the other information will be given as written documents and drawings.

However, the production staff must master some basic prerequisite knowledge in order to follow the knowledge requirements. The knowledge and competence requirements in today's international production environment may include:

- Ability to work in a multicultural environment with colleagues due to exchange of personnel across cultural and national boundaries and among mechanical industry companies situated in different countries, exchanging products or part of products.
- Ability to understand and communicate the content in the job packages to the colleagues in a multilingual working environment
- Ability to understand his/her responsibility in the production chain and to communicate the need for knowledge.
- Ability to search for relevant learning and training material when needed.

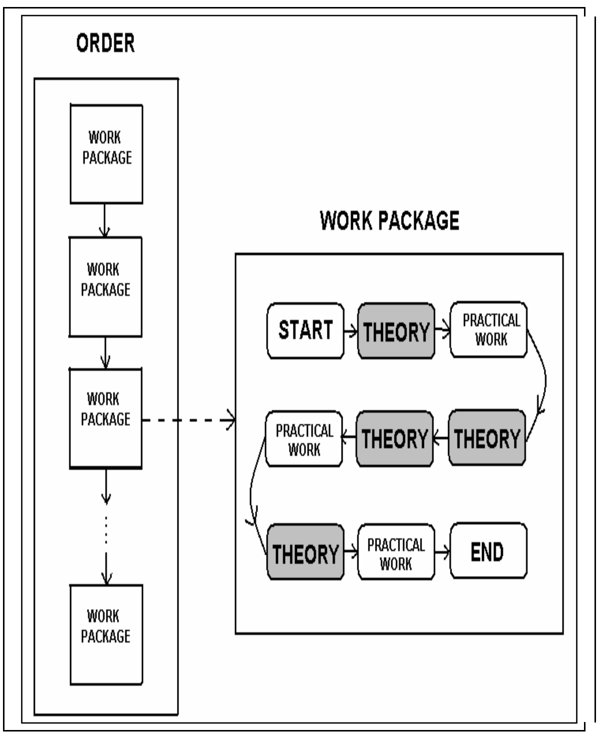

Figure 1. The structure of a work order.

The figure shows an example of a work order structured into different tasks. 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, here indicated with the word Theory, consists mostly of theoretical subjects, discussions and reflections), in the workshop (hands-on training and practice), or in other production areas, where a combination of practical skills upgrade takes place. However some theoretical training will necessary also take place in the workshop as the subject matter is available for study (Stav & Engh, 2008)**.**

The fundamental principle is that educational content shall be available and delivered through activity based learning services when needed. The students enter new training elements by following a sequential structure, ensuring that theoretical content is directly relevant for the subsequent practical tasks in the process, thus highlighting the importance of the theory when this is relevant for the practical tasks and triggering reflective cognition processes.

The teacher may mix different delivery technologies for the content and use different types of multimedia content, promoting a more flexible, engaging and motivating blended educational training environment.

3. Designing the courses

Designing the courses created a number of new tasks and problems. First of all, the specification of the IIW Guidelines (2005) had been developed with a traditional teaching concept in mind, focusing on special topics and letting a number of topics be grouped into a module. In a traditional course, a number of modules would be grouped together in order to cover the thematic subject.

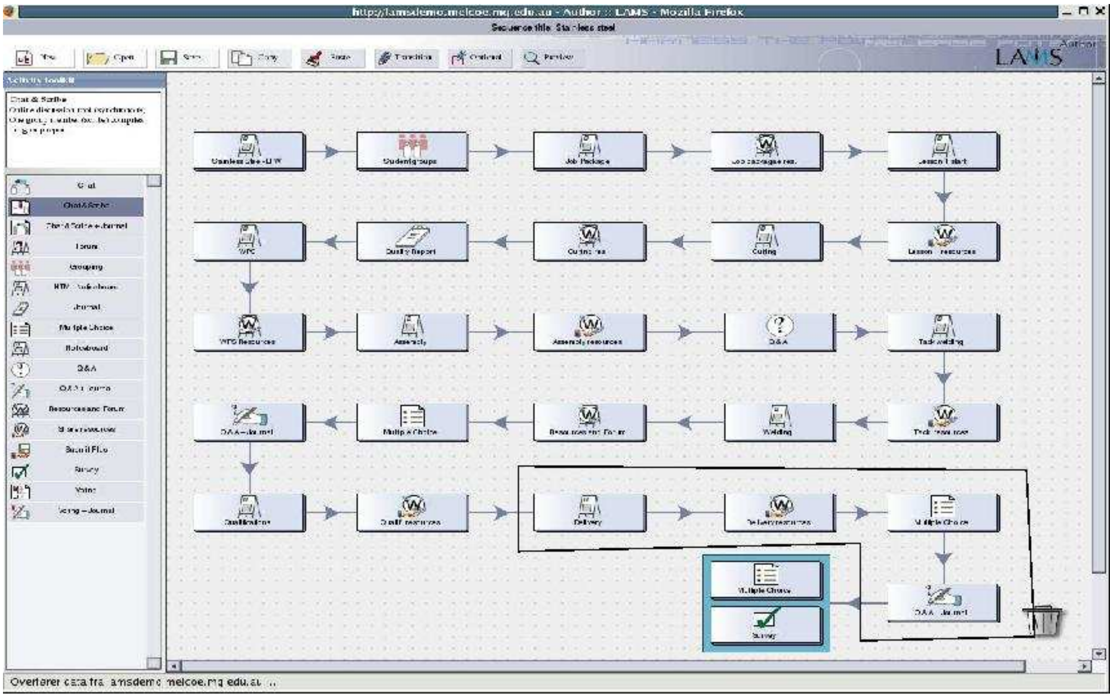

Figure 2. A LAMS structure covering the production flow.

The production steps have been modelled and in addition, common resources for each step have been added as well as other resources and tasks deemed important for the educational activities and for the verification of students' status at each step.

The structure was established with the intention to have a model for the design sequences of the course. The sequence could then be of a general nature rather than being dependent on methods, processes or materials. The intention was to create a standard set of resources that covers the minimum set that is necessary for the course to meet the requirements according to the IIW Guideline. The course will then be released for use as a template with a "template" set of resources. It is assumed that approximately 60% of the course content can be added to such a template, leaving the remaining 40% to be tailored to the individual course. Furthermore, one could even add another 15% to 20% of content if a metallurgy section was added as a general resource.

When the teacher wants to use this template, a copy is made and given a course specific name. The teacher may add additional resources when this is deemed necessary for the specific course. The teacher may also use his/her version as a personal template as well. By doing so we would obtain a number of benefits, examples of key benefits are highlighted below:

- Create an ability to tailor the courses for special needs of a company
- Create an ability to tailor a course that focuses on a special material and joining process without too much use of additional resources
- Flexibility to tailor the courses to different industrial applications which are relevant for the student group
- Create an area for cooperation and an environment where teachers could exchange courses and course ideas in a flexible way

To the structure in Figure 2 a new table, Table 2, was created in order to specify the topic and purpose for each activity. The table was used to give further structure to the ideas, and to start the process with preparing the required content elements. It could also be used for developing subtasks or creating short sequences that could be built into a loop forward or backward in the sequences. Table 2 was used as a short manuscript for planning purposes and for discussions around the topics, focusing on the purposes for each task. The description here is only a short abbreviation of what was actually added in order to list alternative solutions for the activity.

Table 2. The table shows a module which has been broken into activities.

Activity no	**Name/Topic**	**Purpose**	**Description**
1	Stainless Steel	Introduction to the course.	This shall be a general introduction that shall highlight the course content and scope. Direct link to a video introduction would be preferable.
2	Student Groups	Establish the student group and create smaller subgroups for later parallel activities.	The teacher may either create one group or divide this group into smaller units, in case these units later will work with parallel activities and have different roles in the production.
3	Job Package	Introduction to this course module. The introduction specifies the scope of the module and the expected knowledge that shall be attained after this module.	A standard introduction is used, or the teacher modifies it. Alternatively the teacher may create this from scratch.
4	Job Package	The teacher adds the resources,	This is a multi task activity where the students

Activity no	**Name/Topic**	**Purpose**	**Description**
	Resources	learning content into this element. A standard set of resources according the requirements of the Guideline will be added.	in addition are asked to discuss the topic Job Package. The teacher can add more topics.

The activities were specified each with a given purpose and further with a short description of what should be done within the topic. Note that we here may have many topics within a course module.

Additional work was then carried out to specify the content for each course module and divide this into categories of content or topics. These topics were grouped into a primary content element, which was mandatory in the course, or a secondary content element that may be used as complimentary or descriptive content which was nice to have but not strictly needed according the course requirements. Additionally the content was divided into two elements, content where we could use video as the source for information or content that depended on a textual presentation. The video was divided into different classes, depending on what purpose it should solve and for what purpose the teacher wanted to use it in the educational context (Stav, Engh and Tsalapatas, 2006).

Table 3 The table list the content for a module and divides it into different categories.

Reference	**Topic/Content**	**Primary**	**Secondary**	**Video – V Text -T**
	Stainless steel process	x		V-L
	Characteristics mild steel versus stainless		x	V-L
	Safety procedures	x		V-I
	Working environment in the fabrication shop	x		V-I
	Personal protection	x		V-I
	Handling of stainless steel-use of tools and consequences, pitting		x	V-I-C
	Suitable cutting processes for different types of steel	x		T

Reference	**Topic/Content**	**Primary**	**Secondary**	**Video – V Text -T**
	to achieve a suitable cutting surface			
	Surface quality and its impact for the welding process		x	T
	Personal protective equipment and clothing	x		T
	Company procedures for personal protection		x	T
	Role of inspection and quality control	x		T
	Stainless steel compared to unalloyed steel and aluminium alloys	x		T
	Definition of stainless steel	x		T
	Identification of stainless steel	x		T
	The working environment of the fabrication shop, general hazards, dust, heavy and hot material, cables	x		T
	Handling of stainless steel in the workshop and the use of tools for stainless steel	x		T
	Pitting corrosion examples		x	T

Each module was divided into a number of topics. Again the topics were grouped into primary content, or mandatory content, and secondary content. Additionally the topic was identified as an important topic for use of video or if textual content could be sufficient for describing the topic.

Further design activities were made to establish the relation between theoretical education and practical tasks that needed to be carried out in the workshop or laboratory. A more in depth evaluation of the theoretical content to be presented in the workshop was carried out in order to evaluate the direct connection between the content itself and the practical activities that could be related to the theory.

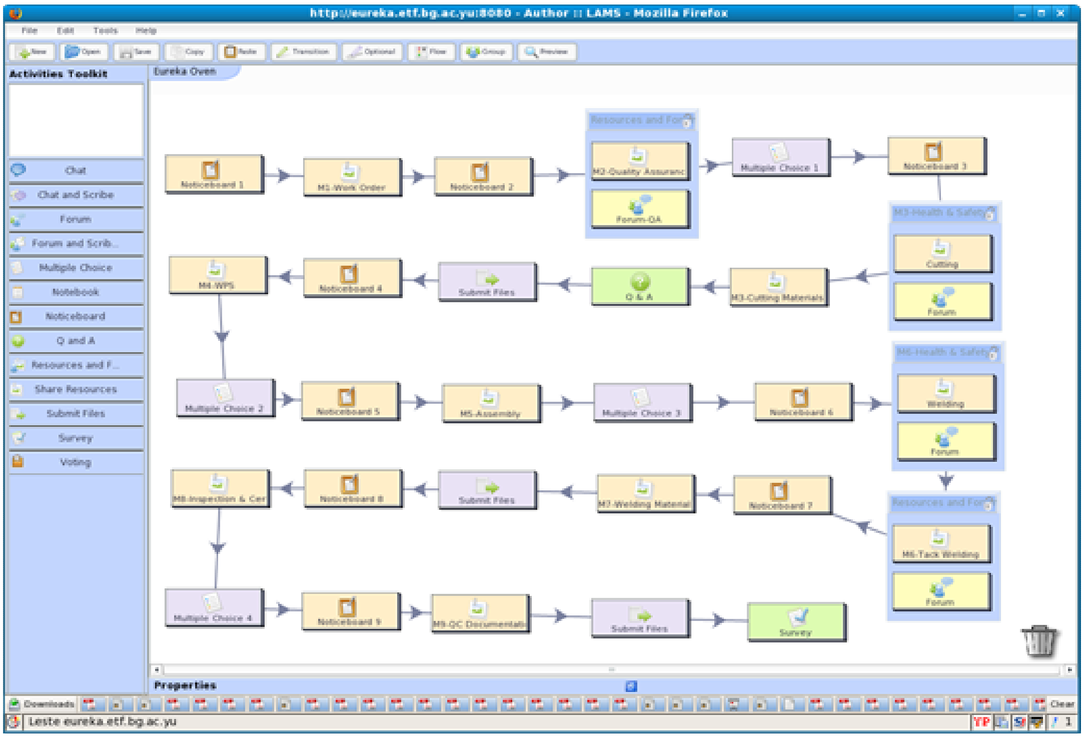

Figure 3. The LAMS design when all learning elements have been added for the course.

At the end of the design process, a complete LAMS sequence was designed in order to cover all teaching elements for the course. Activities such as delivering reports, multiple choice questions, question and answer and discussions were added.

The required resources were added so that the student could access the documents. Additional video material was also referred to as URL link to a streaming server used for this purpose and this could be accessed when needed. Smartcom, a leading supplier of video services in Norway, hosted the videos in order to have a powerful streaming backbone.

It was also planned that, if required as a part of the process, discussions were initiated on particular topics.

4. What were the results?

The courses appeared to be a success anecdotally speaking, but LAMS was used only for course design and for evaluation of the course material and its availability for the students. The LAMS system was also used for structuring of material and highlighting the sequences in which the material should be used.

The design aspect of LAMS has perhaps been underestimated. By using LAMS as a design tool, the teacher has to reflect on the activities introduced to the students in a structured and logical manner.

The visual presentation of the learning structure with its tasks, resources and additional resources is ideal for creating a course structure even if it is not used for the students itself. A flexible tool for creating a structure for HOW to present the content, WHEN to present it and in WHAT context the content shall be presented, is highly relevant when an ABT methodology is used. The LAMS flexibility in creating templates that easily can be modified, altered, merged with other templates and so forth, gives the course designer a powerful tool to exploit.

5. Conclusion

LAMS has been used in designing an ABT course for welders according IIW Guidelines (IIW, 2005). The tool has been used as a course design tool with great success. The structure and functionality allows the course designer to select an educational path that can be altered and manipulated to suit the task in the best way possible.

Although the work described here has not been the main focus in the development of LAMS, it has been shown that LAMS can also be used as a development tool for creating structured courses. By applying the LAMS structure a teacher may be able to create a framework for the teaching process and also for structuring the course content in such a way that later alterations will be easy to handle and incorporate into the structure.

In an environment where changes, flexibility, international cooperation, new opportunities are some of the key words, the LAMS structural approach to course design will give the designer a set of powerful tools where courses can be designed up to a certain level as templates. Then the complete course can be designed just-in-time for the course participants when needed. Focused courses can be delivered with a content that may be highly relevant for the course participants.

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