Design of Learning Sequences for VET community using LAMS Experience from Leonardo da Vinci projects

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ABSTRACT

Through different Leonardo da Vinci projects in the period 2005-2008 new pedagogical principles for organizing and delivering in-company skills development have been tested and a new model for delivering more cost- and time-efficient in-company mixed (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.

The basis for this framework has been an innovative train the trainer program facilitating virtual mobility in companies and VET schools, combined with a new pedagogical methodology for the training of the students themselves, named Activity Based Training (ABT).

Mechanical industries still frequently often utilize traditional training methodologies by separating theoretical learning and training, from practical training of skills. In such a pedagogical framework hands on practice follows after the theoretical content descriptions. Activity Based Training (ABT), is closely connected to the practical production activities according to the production path of a predefined structure or product through job orders and job packages.

LAMS has been used as a modeling tool for the first ABT courses developed in 2007 and 2008.

KEYWORDS
Audio and video, videoconferencing, Activity Based Training (ABT), work order, Learning Design

INTRODUCTION

The European Welding federation (EWF) has made up a unique standardized certification system targeting welding 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. The European welder-trainers have any significant experience of using integrated distance teaching environments nor any experience of using learning design tools like LAMS. The pedagogical model that has been used, ABT, has been based on a case- and instructional working process that have shown very good results although being deployed on a limited user scale. The pedagogical framework utilizes activity based learning in combination with harmonized content as defined in the international guideline (IIW, 2005). This document is the Guideline for the International Welder Education and creates a framework for harmonized education in most countries in the world.

ACTIVITY BASED TRAINING (ABT) COURSES.

A typical mechanical industry fabrication process utilizing welding is often given as an work order that is divided into a number of tasks (Figure 1). A work package is a detailed and sequential description of the working task that is

to be done and it is normally divided into one or several activities (Engh, 2006). Delivery of the final welded product requires a number of steps from fetching the material, through cutting it into smaller pieces, which then 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 can meet the required quality:

i. Drawing of the structure to be fabricated
ii. Work description with describing which methods shall be used in the production
iii. Work description with process description of the work process for reaching the target and the knowledge required
iv. Quality assurance requirements for the ingoing elements
v. Quality assurance description of the outgoing elements
vi. Work package description for the work to be done
vii. Reference to available resources for the work
viii. Reference to environmental resources or requirements or restrictions
ix. Requirements for knowledge, prerequisite or knowledge that has to be obtained
x. Cooperation strategy with other in a defined group or to related groups

However, some basic prerequisite knowledge must be mastered by the production staff in order to follow the knowledge requirements. The knowledge and competence requirements include:

- Ability to work in a multicultural environment with the colleagues due to exchange of mobile personnel across borders and among mechanical industry companies
- 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.

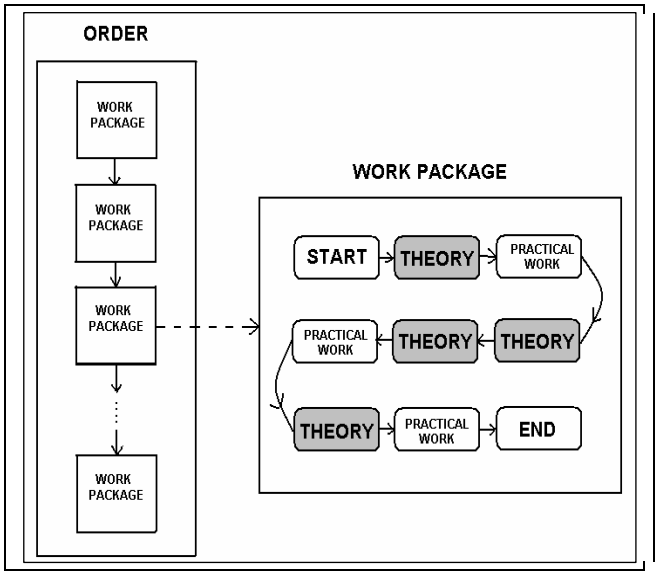


Figure 1 Displays an example of an work order structured into different tasks. Work packages consist of separate activities, which may include transfer of specific knowledge and training, as indicated in the figure. The training is carried out in the classroom (theoretical training), shop (hands-on training and practice), or in other production areas.

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 subsequent practical tasks and trigging reflective cognition processes.
The project has mixed different delivery technologies for the content and used different types of multimedia content, promoting a more flexible, engaging and motivating blended educational training environment. The educational material is delivered as learning objects in various multimedia formats, though still standardized for presentations through different LMS (Moodle) and Learning Design systems (LAMS)

DEVELOPING THE COURSES

Developing the courses created a number of new tasks and problems. First of all, the specification of the EWF/IIW Guidelines had been developed in a traditional manner focusing on special topics and let 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.
As an example:

A.3 Health and Safety (2h)
Objective:
Know and understand hazards and basic safety requirements when welding.
Scope:

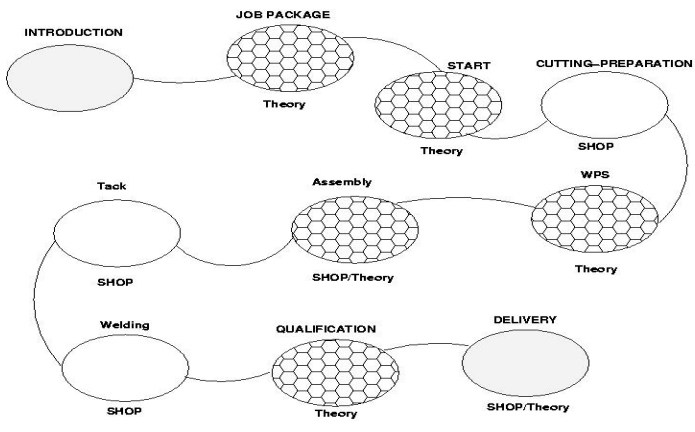
- *Electric shock*
- *UV- and heat radiation*
- *Eye hazards*
- *Burns and fires, fire prevention, fire fighting*
- *Welding fumes*
- *Respiratory hazards*
- *Personal protective equipment and clothing*
- *Noise hazards*
- *Specific rules and regulations*

Expected result:

1. *Know dangerous situations in relation to electricity, humidity, DC and AC.*
2. *Know the health risks of welding fumes.*
3. *Know the signals for escape routes.*
4. *Name adequate means of personal protection.*
5. *Know measures to be taken to prohibit fire.*
6. *Know measures to prevent noise hazards.*
7. *Know the specific rules and regulations.*

But in an ABT course the course elements must follow the production process and consequently the next logical step will be to structure the content according the need of in this flow.

Figure 2. The production flow was established in order to to see which logical elements or modules that the course should contain. This production flow is of a generic nature and can be used far beyond welding technology.



When this first draft model was established, the LAMS system was used to create an overview of this model, adding some more detail information of the flow itself.

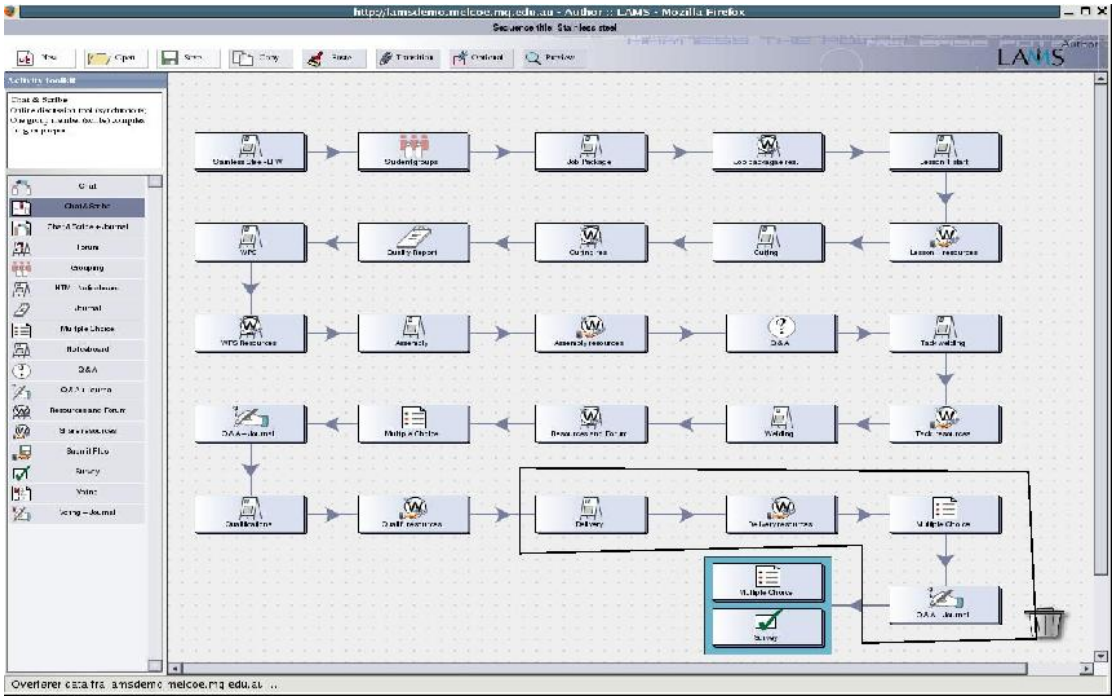


Figure 3. The first LAMS structure covering the production flow.

The structure was established with the intention to have a model for the design sequences of the course
The intention here is to add a standard set of resources that cover the minimum set that is necessary for the course to meet the requirements according the IIW Guideline.
The course will then be released for use as a template.

When the teacher wants to use this template, a copy is made and given a course specific name. Then the teacher add additional resources if that is deemed necessary for the specific course. The teacher may also use his/her version as a personal template as well.

To this structure a new table was created in order to specify the topic and purpose for each activity. The table is used to further structure the ideas and to start the process with preparation of the required content elements.

Activity no	*Name/Topic*	*Purpose*	
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 either create one group or divide this group into smaller units in case these units later shall work with parallel activities and get different roles in the production.

Activity no	*Name/Topic*	*Purpose*	
3	Job Package	Introduction to this course module. The introduction specifies the scope of the module and the expected knowledge that shall be reached after this module.	A standard introduction is used or it is modified by the teacher or created from scratch by the teacher.
4	Job Package Resources	The teacher adds the resources, learning content into this element. A standard set of resources according the requirements of the Guideline will be added.	This is a multi task activity where the students in addition are asked to discuss the topic Job Package. More topics can be added by the teacher.

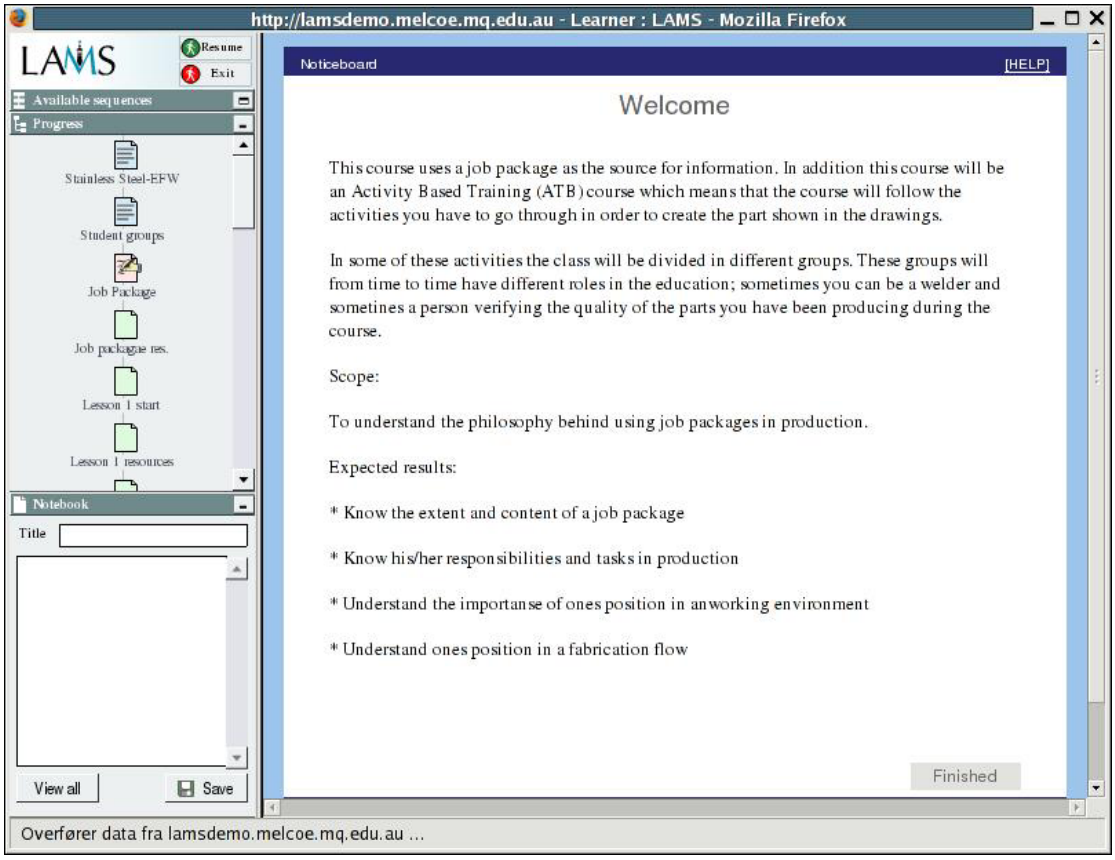


Figure 4. Some welcome screens were designed in a traditional manner where the objectives of the activities are highlighted

Additional work was then carried out to specify the content for each activity and divide this into categories of content. If it was a primary content element , which was mandatory, or a secondary content element, which is nice to have but not strictly needed.
Additionally the content was divided into to elements, content where we could use video as the source or content which depends on a textual presentation

For Module 1.

Reference	*Topic*	*Primary*	*Other*	*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 to achieve a suitable cutting surface	x		T
	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

But this process also highlighted one of the immediate problems that we ran into. Traditional course books are not designed according the production process and just as important, a lot of practical experience from industry production itself had to be written.

One of the core ideas in this project has been to use targeted video in order to focus on special topics. The use of video may be divied into different scenarios according to the purpose for the video and the perception envisaged by the teacher. In the following some of these scenarios have been defined into some logical elements:

Laboratory type This is video that is used to show technical details that can only be produced in special laboratories in order to detail a problem or to show certain behaviours. A typical example may be a visualization of the transfer of metal into the weld pool itself. Such videos are developed in order to identify a special problem which the student are unable to see or verify by themselves

Equipment type This is video that shows an operation of a given equipment or shows how given equipment

is used. Such videos are important when the students need to have knowledge about processes and principles which they do not have access to . Examples could be laser welding equipment or the behaviour of a robot cell.

Industrial examples

This type of video is to demonstrate the practical application and use of a process being taught or similar processes. These videos will serve as an example for typical use which will be relevant for the country where the course is held

Cases

A case will be again examples either as an introduction for a given part of the course or for practical or theoretical tasks to be carried out by the students. Or the case could be a summary for a given part of the curse itself and highlight the important topics.

Actions

An action will be a video that shows a particular behaviour. This could be a positive behaviour, meaning that the result is positive and wanted or that the behaviour is negative and the result is not wanted.

In welding like in many other work situations, people are taught to do things correctly. However very often they are not taught to see the consequences of doing things wrong. It may very well be that some videos should be created in order show why things go wrong and the practical consequence of such actions.

These video sequences were in average 2 minutes long. The topics of these sequences were very highly focused. This means that each video sequence discussed only one topic or showed one example. The use of negative examples has been a success (learning from the mistakes of is always a pleasure).

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. As shown in the following table

1			CLASSROOM MEETING, DAY 1-2-3 TOTAL 12 HOURS INCLUDING COURSE INTRODUCTION---	
2			MODULE 0 - 1	
3			MODULE 2 SHOP 5 HOURS, THEORY 3 HOURS,	
4			MODULE 3 WPS AND MODULE 5, 50%	
5			MODULE 4 PRACTICALAND MODULE 5 THEORY	
6			MODULE 5 TACK WELDING	
7			MODULE 6 WELDING	
8				
9				
10				
11				
12				
13			MODULES 7 AND 8	
14				

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

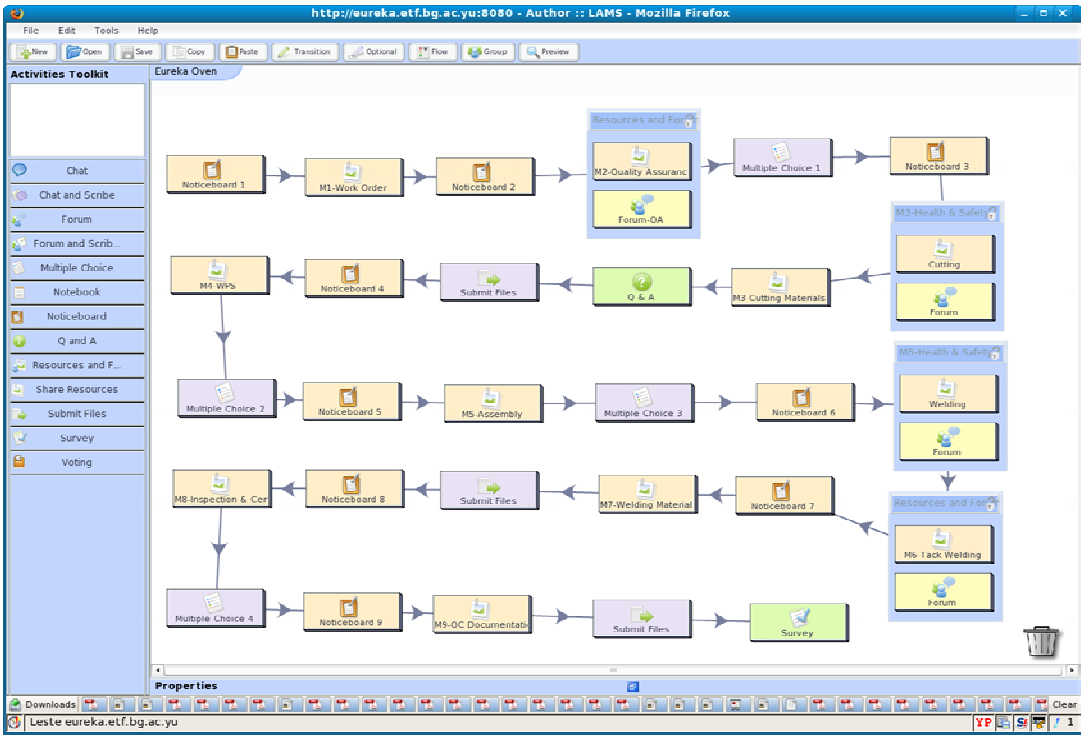
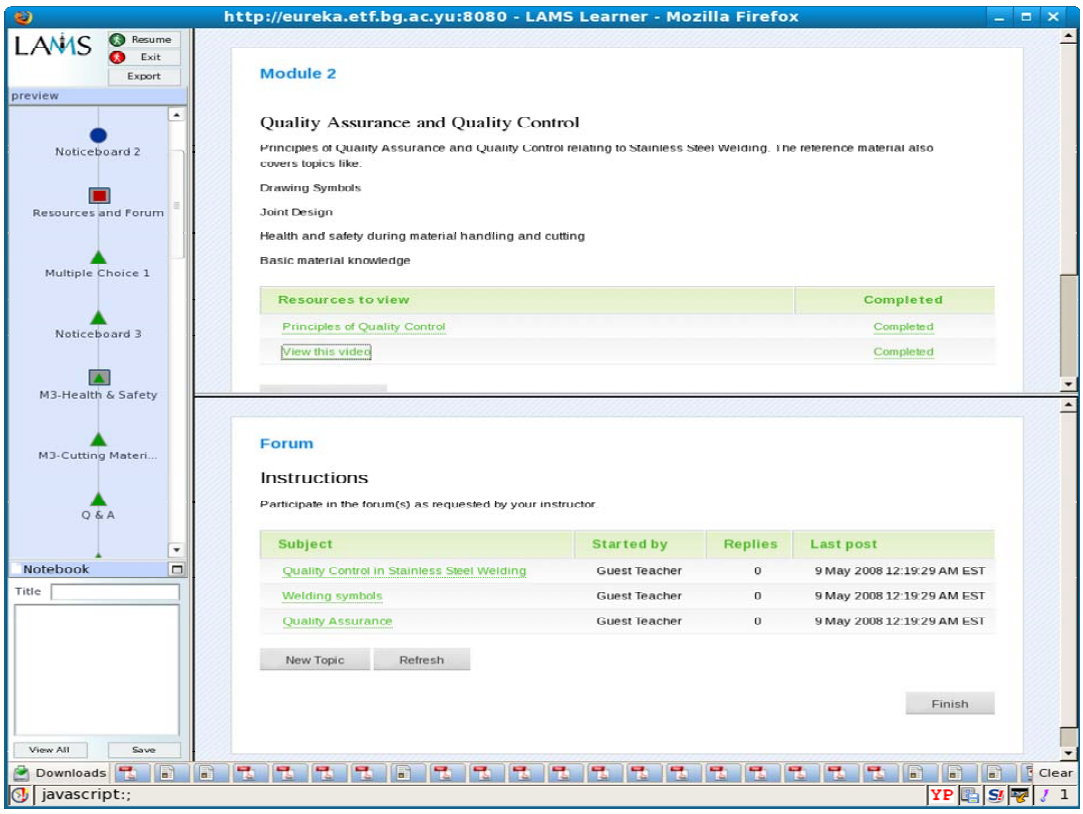


Figure 5. The complete LAMS design when all elements were added for the course.

The required resources were added so that the student could access the documents or also additional video material when needed. The videos were hosted by Smartcom, a leading supplier of video services in Norway, in order to have a powerful streaming backbone.
If required as a part of the process, discussions were initiated on particular topics.



WHAT WERE THE RESULTS ?

The courses were a success.
But LAMS was not used in the course itself, 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 main reasons for not using LAMS at this stage can be summarised as follows:

- The project was in the development phase of the ABT structure and had time constraints in delivering the course itself
- The theoretical part of the course was 35 hours only while the practical part was 50 hours
- The trainer did not have the time to learn LAMS properly

The main reasons for using LAMS in the course design:

- LAMS is a flexible and visual tool that can be used for model creation
- LAMS helps you find a structure in the course design
- Easy to modify and reuse
  Easy to add content and verify that the content is relevant for the task
- Easy to modify and reuse a design

CONCLUSION

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

Further work will be done to apply the LAMS system into practical use in real life implementation. The tools and features seems ideal for educational ideas as utilized in the ABT courses that were carried out.