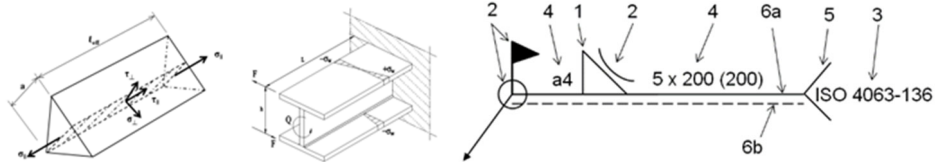


Deliverables for iQVet, WP1**Developing a blended learning framework supporting work-based learning****D1.1 – A new plan for implementation of blended learning in combination with work-based learning.**

Weld on Sweden (WoS) plans to develop further and pilot a short-term hybrid work-based course in Design of welded structures with Welding for designers (SK2-WfD).

The target groups are working engineers, employed by construction and manufacturing industry as mechanical designers, welding engineers or calculators with very limited time for participating in any other activities than their daily business.

The total length of the course is 4 days, which is carried out for two 2-day gatherings with one or a couple of weeks between the meetings.

The course is based on a simple website platform for distribution of course material and e-mails for communication with participants which makes it suitable for smaller groups up to 25 participants.

The course content is based on Eurocodes and fulfils the requirements from International Institute of Welding. The course material includes a handbook and digital (PDF) teaching material (OH).

Demands on the modern mechanical designers are increasing and the fields of knowledge they must cover are many. The designers must decide what conditions a product must be able to meet, which material to be used and how the welding process can affect the structures in the form of welding residual stresses or deformations caused by weld shrinkage. They also need to consider the possibilities and limitations of the production unit as well as the manufacturing costs.

The SK2-WfD course gives participants basic and state of the art knowledge about modern methods to estimate the strength of welded joints and the behaviour of welded structures during different conditions and loads.

The course covers also basic of welding technology targeted to mechanical designers and deals with e.g., common welding methods, steel materials and their weldability, welding classes, and welding designations on drawings.



Co-funded by the
Erasmus+ Programme
of the European Union

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The lecturers include several design tips and discussions about favourable and less favourable design solutions.

During past 16 years, WoS has conducted many SK2-WfD courses based on traditional face-to-face teaching with teachers and course participants physically present in classroom.

Since the Covid pandemic, the SK2-WfD course has implemented as a hybrid course that enabled participants to choose whether they want to join the course physically in the classroom or take part in it remotely. The teacher(s) and a few participants could be present in the classroom, while others could follow the lessons online via Teams.

The existing SK2-WfD course is still a hybrid course, but nowadays most participants choose to join it by coming to the classroom.

Online participants have the same opportunity to join common discussions during the lessons and ask questions, often about their own design problems from their jobs, as the physically present participants.

To adapt the SK2-WfD course as a work-based short-term training using a mixed learning method, the teaching material need to be supplemented with new developed videos covering different subjects in the course content.

The preliminary estimation of needed supplementary material are recorded videos for presentation of topics of the course and introduction to the basic of mathematics and strength of materials.

A challenging and difficult activity will be to try to develop recorded videos that can, to some extent, cover the teachers' silent knowledge.

In addition, it is important to implement a simple questionnaire for estimation of participants' prior knowledge. The questionnaire can be sent by e-mail to participants. After receiving answers, WoS can recommend them suitable teaching material for preparation before the course start.

Successful implementation of this mixed work-based learning course requires also to take part of participants questions before the course and if suited share them with other students or use them as part of the course material for group work or problem solving during the lessons. The course participants will receive information about this possibility in the course description and through notifications when the WoS sends them an e-mail in connection with confirmation of registration and in connection with sending out the questionnaire for estimating the participants' prior knowledge.

D1.2 – Hands on demonstrations for a small group of teachers that will be testing and applying blended learning methods and tools in the course. This will be followed with piloting period and implementation in each country.

During a hybrid SK2-WfD course in June 2022 in Gothenburg and while using only the traditional course material, a scenario for implementation of a work-based blended learning were presented and discussed with the VET teachers.

The planning and administration of the course will be handled centrally by WoS.

The course is based on a simple website platform for distribution of course material. The course material is placed on the course website and made available to the teachers (also for students) through the distribution of authorization.

The teachers do not need to be able to manage the platform apart from being able to log into course website and download the course material.

Since the teachers could already use the platform, the hands-on demonstration was replaced by meetings with 2 teachers for think tank around possible ways to implement

mixed learning method, needs of supplementary course material and possibilities of using online tools for development of new teaching material.

The plan for adaption of the course to mixed work-based learning was also presented and discussed with another VET teacher.

The discussions with the teachers highlighted the need for supplementary course material in the form of recorded short videos that can explain the various topics in the course in an easy-to-understand way. The script for these videos can contain both an introduction to the subject and possibly also include tips and advice on good and bad design solutions.

All three of these teachers, who have extensive experience from both industry and academia, support the adaption of the course to a mixed work-based training course.

The teachers will also participate during National pilot testing in the WP2 providing WoS with video scenarios and contribute with their own recorded videos for different topics of the course.

To preserve and transfer teachers' silent knowledge and to supplement the course material, the new online tools should be used to record videos during the teachers' lectures and use them to create short supplementary digital learning materials.

These videos will be used also for other training courses.

D1.3 – Piloting at VET supply level

During hybrid course, SK4, in October 3-5, 2022, in Gothenburg while using only the traditional course material, the needs of the new contents in course material was presented and discussed with both the teacher and students.

The result of these discussion showed the need of some more videos that can explain the basic of mathematics, forces, and strength of materials. The target group for these videos are students who lack the prior knowledge or need to update it before the course. By watching these videos before the course, participants can be prepared and follow the lessons effectively during the physical meetings.

The topics that should be covered by videos intended as preparing course material are:

1. Basics of mathematics for engineers
2. Basics of strength of materials
 - Equilibrium of forces,
 - Equilibrium of moments,
 - Action and reaction forces,
 - Free body diagram,
 - Shear and moment diagrams, and
 - Force components.

The short videos needed to cover the whole course itself are according to the following list.

1. Common welding methods. Explanation of technique, field of application, material and filler materials, advantages, and limitations of use for following welding methods.
 - Manual Metal Arc Welding (MMA),
 - Metal Arc Welding with Inert Gas (MIG) and with Active Gas (MAG),

- Tungsten Inert Gas Welding (TIG) and
 - Submerged Arc Welding (UP).
2. Welding classes and inspection methods for welding explaining the methods and the fields of application for
 - Welding designations on drawing,
 - Welded joints design,
 - Visual Testing (VT),
 - Ultrasonic Testing (UT),
 - Liquid Penetrant Testing (PT),
 - Magnetic Powder Testing (MT),
 - Eddy Current Testing (ET),
 - Tensile Testing,
 - Hardness Testing,
 - Bend Testing, and
 - Charpy Impact Test.
 3. Design of static loaded structures
 - Basic design strategies for welded products.
 - Basic aspects on welded structures regarding material strength.
 - Tips and suggestions for functional welded products
 4. Design of fatigue loaded welded structures
 - The phenomenon Material Fatigue in welded structures.
 - Design against fatigue.
 - Tips and suggestions.

The result of this meeting and from colleague guidance in June 2022 is the base for developing course material and the first set of guidelines for usage of new tools and method for work-based training according D1.4.

D1.4 – First set with baseline guidelines and scenarios for usage of tools/methods.

The course content is theoretical and within this iQVet-project it will be combined with several new developed videos and recorded presentation material. The new combined course material will be tested during the period for WP2 - National pilot testing.

The result from this planning stage will be applied as the first set of how-to guidelines for teachers and students.

Plan for pilot course

Applying this mixed work-based learning method give the possibility to the students, who often have limited time for any other activities than their daily business, to be prepared when the course starts and much more class time can be spent for active learning experiences by discussions, problem solving and group activities.

The length of the course and the time for its implementation are essential parameters. The courses must provide space for the participants to absorb the amount of information conveyed by the teachers. Therefore, this 4-day course is divided into two meetings with one or a couple of weeks between the meetings.

To pilot the course as a mixed work-based learning method requires that the course material is supplemented with new

1. videos and recorded presentation material for basic topics, as mathematics and strength of materials, that the students may need to take part of to be prepared for before the face-to-face gatherings.
2. videos covering/explaining the topics/subjects of the course that will be used by teachers as part of course material during the lessons.
3. videos that can in some intent digitalize teachers' silent knowledge - Tips, advice, how-to and tricks about the design and manufacturing of welded structures.

The subjects of above needed videos are presented in the D1.3 and at point 9 in the following framework for guidelines.

A first framework for guidelines

Administration of the course and communication with everyone involved is managed centrally by VET.

1. The VET school publishes the course on the website, invite their network by emails and posts on LinkedIn.
2. Registration for the course can be done via the course's website or by email to VET.
3. VET send a confirmation of registration and attach questionnaire for estimation of the participants' prior knowledge.
4. The student reply by email and attach completed questionnaire.
5. VET school make the digital content of the course material (PDF, videos, Excel) available for participants through the distribution of authorization to the course website.
6. Considering the participants' prior knowledge, VET school provides recommendations for preparation before the start of the course. The amount of material distributed to students may vary individually depending on their prior knowledge and include videos, text or Excel documents, tutorial, and problems/questions. The recommended material will be available on the course website.
7. Participants have possibility to send their own design questions to VET and VET teacher before the course.
8. Teacher reviews the questions and decide whether the answer is found in the teaching material. It can otherwise be prepared as an exercise for individuals or groups or raised as a discussion question during the course.
9. The course material includes Design Handbook for welded steel products, copies of lecturer's presentation material in PDF – including examples and problems, quizzes, self-studies problem, homework tasks, recorded videos and course evaluation template.

Recorded videos should cover introduction and possibly also tips and advice on good and bad design solutions to majority of the topics of the course content according to below.

- MMA, MIG / MAG, TIG and Submerged Arc Welding. Materials and filler materials for welding. Welding designations. Welding classes. Inspection methods for welding.
- Basics regarding strength of materials. Welded joint design. Structural design, static loads.
- Basic design strategies for welded products. Residual stresses and weld deformations. Brittle fracture. Lamellar tearing. Design against static loads. Instability of slender structures. The phenomenon Material Fatigue in welded structures. Design against fatigue.

In addition, some recorded videos should cover the teachers' tips and advice (silent knowledge) about design and manufacturing of welded structures.

10. The Design Handbook for welded steel products will be distributed on the first gathering. It will deliver to the distance participants by post before the course.
11. At the course start the participants are prepared and their questions has taken to the course program as exercise(s) or background for discussion.
12. During the gatherings the teachers combine their own lecturer's material with reviewing the recorded videos. Every topic includes some quizzes.
13. After completing the course, the participants and VET teachers evaluate the course and submit their views to the VET school.
14. The VET school makes a compilation of received course evaluations and discusses the result with the teachers to use the input/feedback to elaborate/refine the guidelines for blended learning framework for teachers.