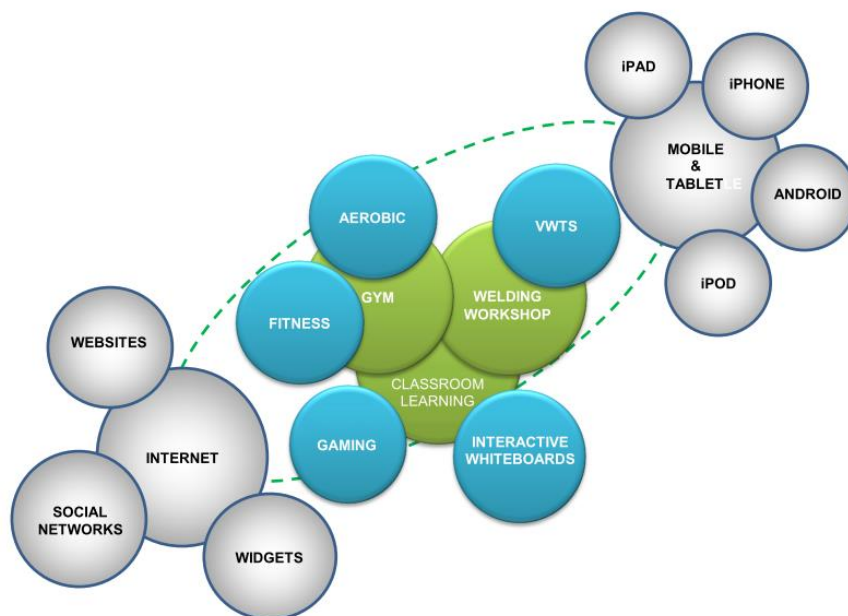


Report



Report on the carried-out pilot programmes

Slavonski Brod – Porto Salvo – Oberhausen – Basel – Wels - Zagreb



1. Introduction

The goal of this pilot programme was to implement the IIW guidelines into the official welder syllabus.

Implementation of the pilot programme had the purpose to assess feasibility of the S- K – S system for lifelong education of welders and the possibility of its implementation at the EWF level and wider.

Estimated duration of the programme was one school year, i.e. from 8 September 2014 to 16 June 2015.

Basic documents used in conceiving of the pilot programme are:

1. Syllabus for the profession welder, Croatian Ministry of Science and Education (hereinafter: the syllabus),
2. IAB-089r4-12 Part 1; IIW Guideline for International Welder Minimum Requirements for the Education, Training, Examination and Qualification (hereinafter: IIW Guidelines)
3. Recommendation of the European Parliament and of the Council of 18 December for lifelong learning (2006/962/EC)

The third document represents recommendations on key competencies for lifelong learning that need to be developed by the end of formal education or training and represent a foundation for further learning as a part of lifelong learning.

The Reference Framework sets out eight key competences:

1. Communication in the mother tongue;
2. Communication in foreign languages;
3. Mathematical competence and basic competences in science and technology;
4. Digital competence;
5. Learning to learn;
6. Social and civic competences;
7. Sense of initiative and entrepreneurship; and
8. Cultural awareness and expression.

Partners who participated in implementation of the pilot programme for students are IOŠ SB and SVS, and in implementation of the pilot programme for professional welders ĐĐ TEP Slavonski Brod and KMK Zagreb.

56 students and 35 professional welders were involved in the pilot programme.

94 students and 20 professional welders took part in the We-learning programme.

56 students and 20 professional welders took part in the Stability programme.

2. Pilot programme S – K – S – INTERACTIVWELD

2.1. Pilot programme for students of IOS

Table 1 Pilot programme syllabus

Subjects	1 st year hrs	2 nd year hrs	Total hrs
I General education			
Croatian language	85	70	155
Information technology	68	-	68
Physical education	51	42	93
Religion/Ethics	34	28	62
Total I:	238	140	378
II Vocational theoretical part			
Foreign language	34	28	62
Entrepreneurship	-	28	28
Mathematics (occupational)	68	28	96
Welding	68+	12+	80
Occupational safety	16		16
Welding - extra hours	86+	184*	
Total II	272	280	552
Total I + II	510	420	930
III Practical part			
Practical education	440**	573**	1013
Practical education - extra hours	64		64
Total I + II + III	1014	993	2007

Legend:

- + Lessons are executed 50% in a classical way, and 50% by we - learning method
- * Lessons are executed on the VWTS
- ** Lessons are executed 40% on the VWTS, 60% in a classical way

	Subjects completely harmonised with the IIW Guidelines
	Subjects harmonised with the S-K-S system
	Subjects according to the Croatian syllabus

The represented pilot programme for students came about after a detailed analysis of previously mentioned basic documents with regard to structure and number of hours for both vocational theoretical and practical part of the pilot programme.

2.1.1. Vocational theoretical part of the pilot programme

Vocational theoretical part of the pilot programme encompasses six subjects. Each of the six subjects was elaborated in a curricular way with stated learning outcomes which are evaluated according to assessment criteria using marks/grades from 1 (non-satisfactory) to 5 (excellent).

Apart from the obligatory teaching matter, subject Foreign language incorporated lessons pertaining to the professional language (language for specific purposes) and for this reason



used the following material *Operation: Arc - Action/Technology/Knowhow* by Fronius (in the 2nd year). The matter that was covered dealt with welding processes (MMA, MIG/MAG, TIG) whereas 1st year students covered the WPS documentation and safety at work.

Teaching matter regarding subject Entrepreneurship also leans on the professional profile and covers material connected to setting up of welding companies.

Subject Occupational mathematics encompassed not just the obligatory, but also subject matter closely connected to age appropriate calculations in welding.

Subject Welding is a synthesis of four different compulsory subjects from the Croatian syllabus (Welding technology I, II; Welding machines and devices I, II; Naval architecture with materials I, II; TIG welding). This subject completely integrated all the compulsory materials and matter from the document "International-Welder-Guideline".

During execution of the subject Welding and taking into consideration professional principles, we observed the possibility and necessity to increase the number of hours anticipated in the document "International-Welder-Guideline".

Subject Safety at work was carried out at the very beginning of the pilot programme and is a compulsory part of the official syllabus. It partially covers the subject matter of safety at work anticipated in the "International-Welder-Guideline".

After they successfully pass the safety at work test, the students can then move on to the practical classes.

Subject Welding - extra hours for the 1st year is directed towards technical drawings, i.e. reading technical drawings and understanding the WPSs.

Teaching matter of the 2nd year is closely connected to the VWTS system.

2.1.2. Practical part of the pilot programme

Practical part of the pilot programme consists of 440 hours for the 1st year and 573 hours for the 2nd year.

Teaching methodology was conceived in such a way that 40% is carried out on a VWTS system, and 60% on real welding machines.

1st year covers MMA welding, 2nd year MIG/MAG welding, whereas TIG welding is covered only on real welding machines when carrying out the practical part outside the school at ĐĐ TEP.

Training curricula for the 1st and 2nd year are identical to those carried out during the 2013/2014 research.

As previously mentioned, SVS also took part in implementation of the pilot programme with 4 participants divided into 2 groups/pairs. Their curricula encompassed 2 trainings:

1. Fillet weld – position PB - one layer
2. Butt weld – position PA - one layer and second layer (multi-layer)

2.1.3. Results of the practical part of the pilot programme - SKILLS

2.1.3.1. Results of the practical part of the pilot programme MIG/MAG welding - IOS

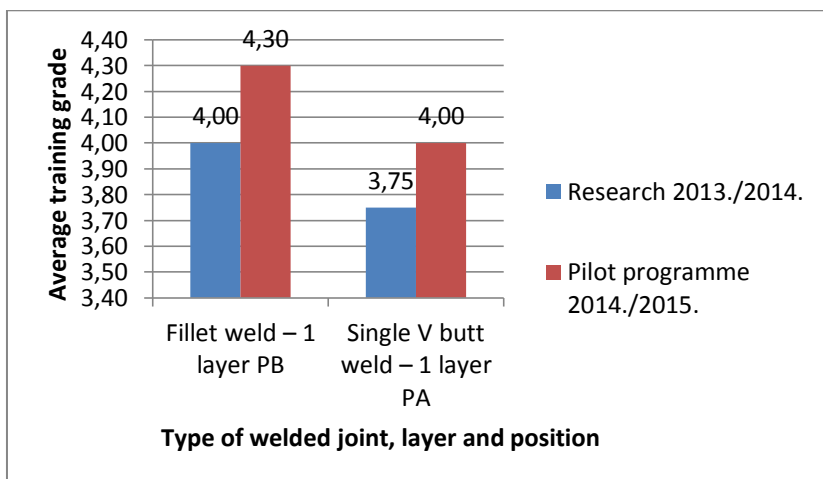


Figure 1 Students’ accomplishment chart after the training on real welding machines following the introduction of the VWTS into the interactive training system (2 nd year of education) – Training 1; Training 5

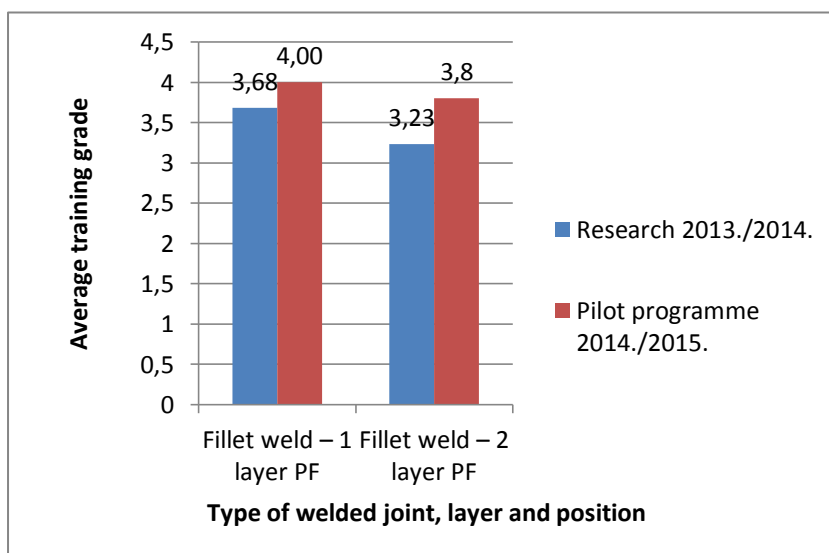


Figure 2 Students’ accomplishment chart after the training on real welding machines following the introduction of the VWTS into the interactive training system (2nd year of education) – Training 2; Training 3

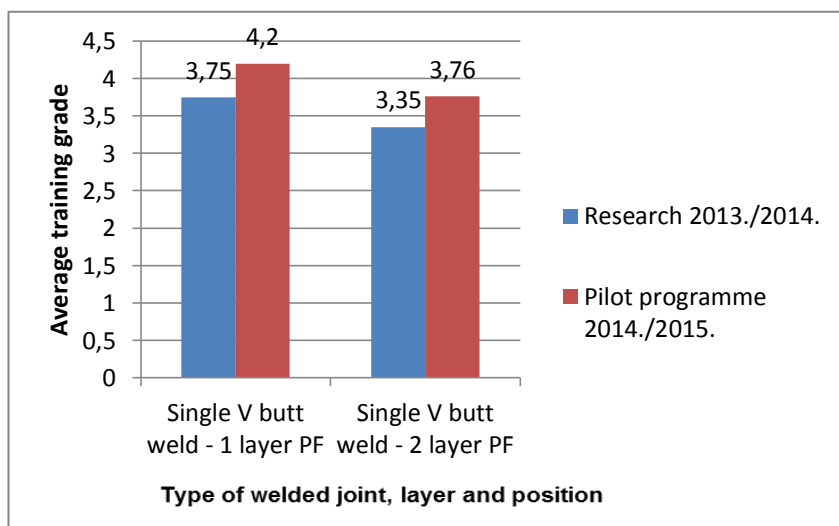


Figure 3 Students' accomplishment chart after the training on real welding machines following the introduction of the VWTS into the interactive training system (2nd year of education) – Training 6; Training 7

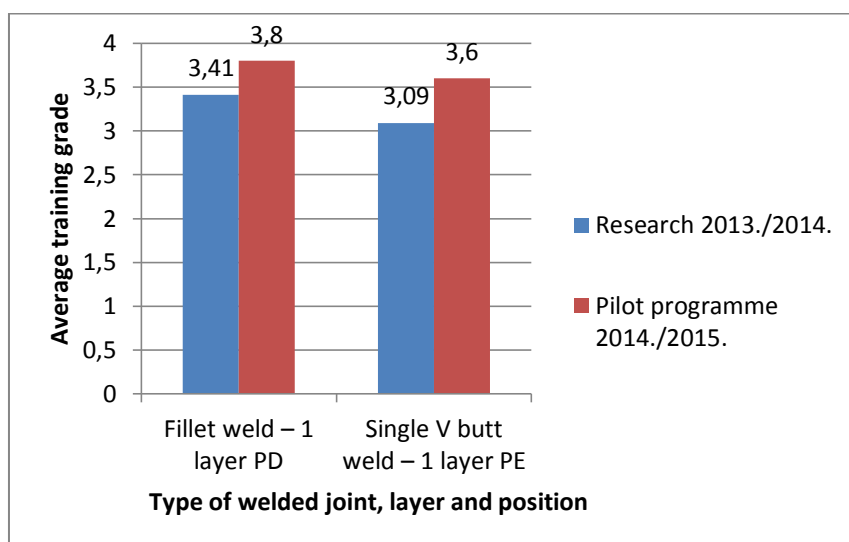


Figure 4 Students' accomplishment chart after the training on real welding machines following the introduction of the VWTS into the interactive training system (2nd year of education) – Training 4; Training 8

2.1.3.2. Results of the practical part of the pilot programme MMA welding - IOS

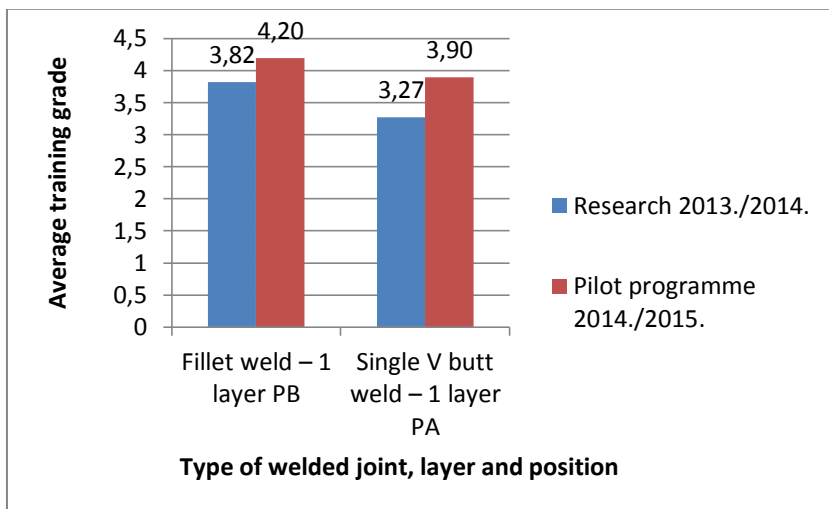


Figure 5 Students' accomplishment chart after the training on real welding machines following the introduction of the VWTS into the interactive training system (1st year of education) – Training 1; Training 5

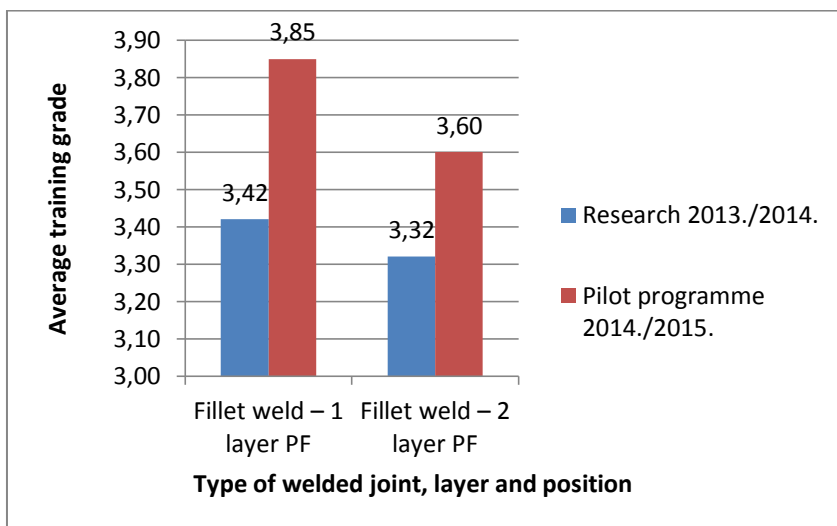


Figure 6 Students' accomplishment chart after the training on real welding machines following the introduction of the VWTS into the interactive training system (1st year of education) – Training 2; Training 3

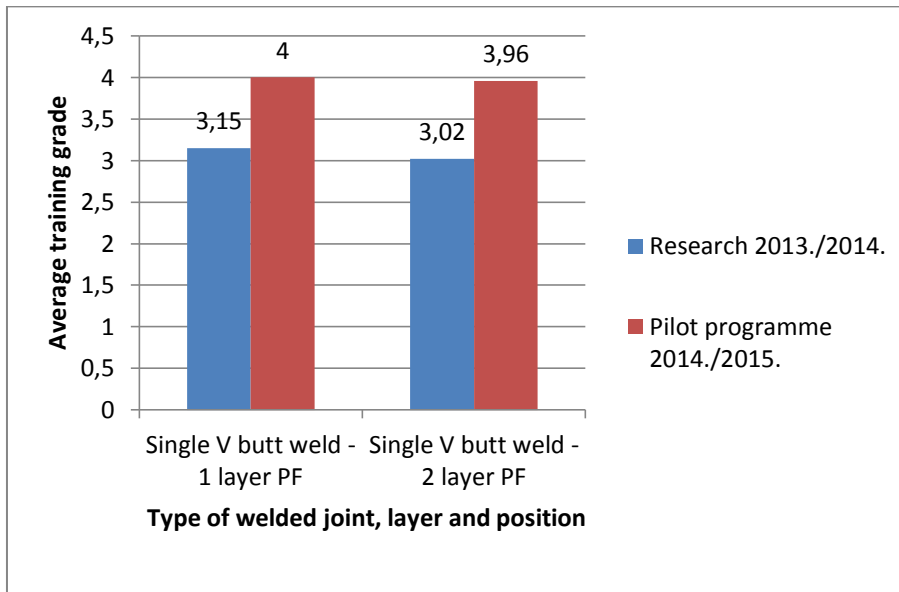


Figure 7 Students' accomplishment chart after the training on real welding machines following the introduction of the VWTS into the interactive training system (1 st year of education) – Training 6; Training 7

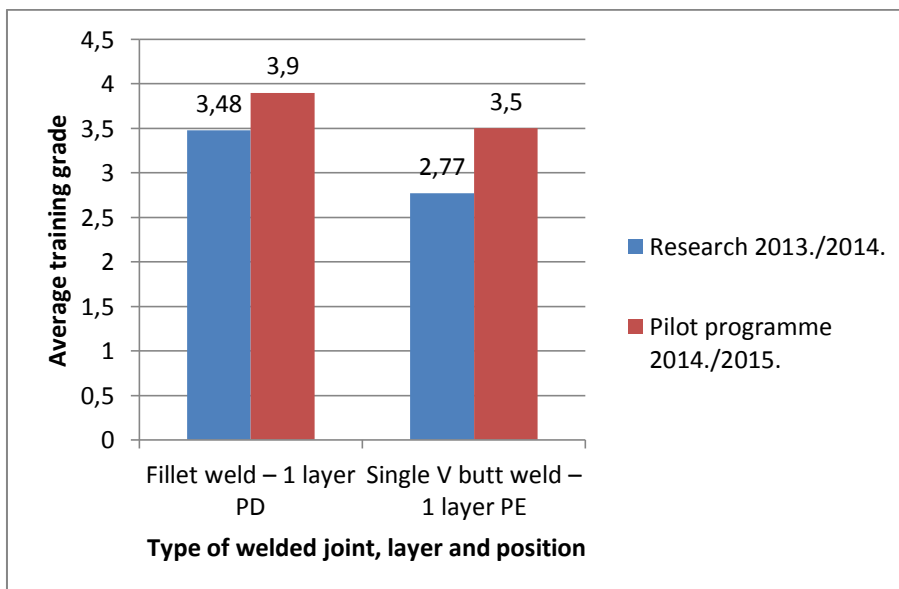


Figure 8 Students' accomplishment chart after the training on real welding machines following the introduction of the VWTS into the interactive training system (1st year of education) – Training 4; Training 8

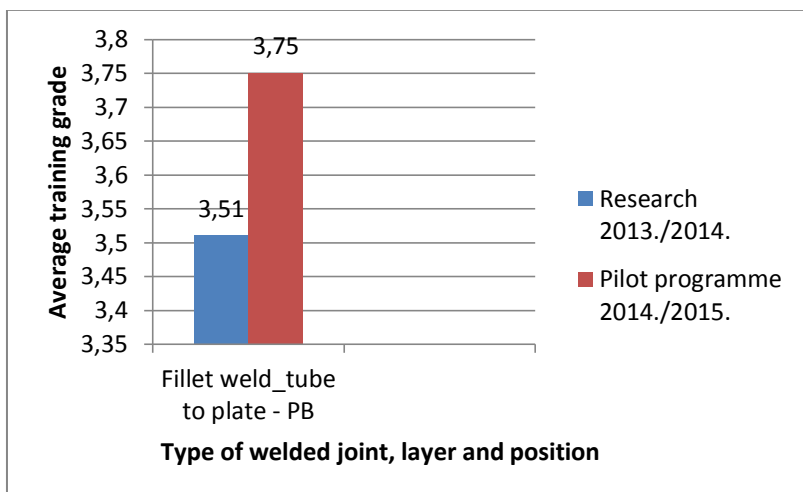


Figure 8 Students' accomplishment chart after the training on real welding machines following the introduction of the VWTS into the interactive training system (1st year of education) – Training 9

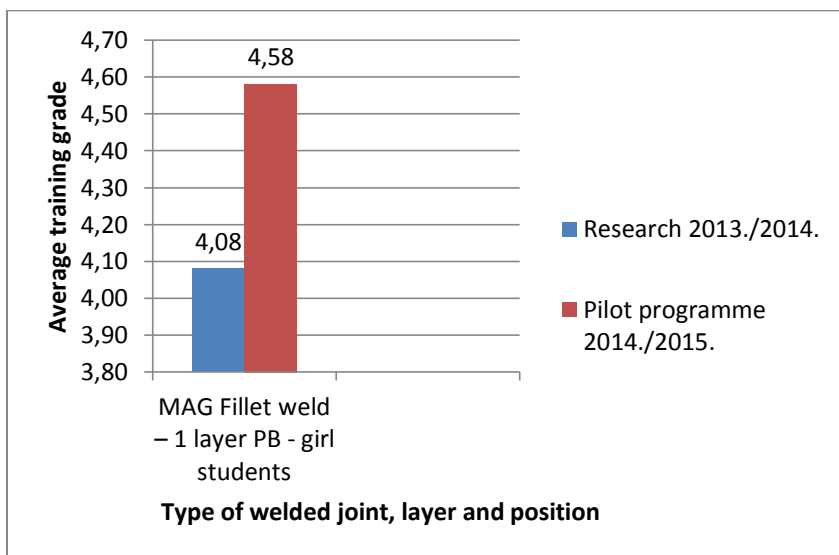


Figure 9 Girl students' accomplishment chart after the training on real welding machines following the introduction of the VWTS into the interactive training system

2.1.3.3. Results of the practical part of the pilot programme MIG/MAG welding – SVS

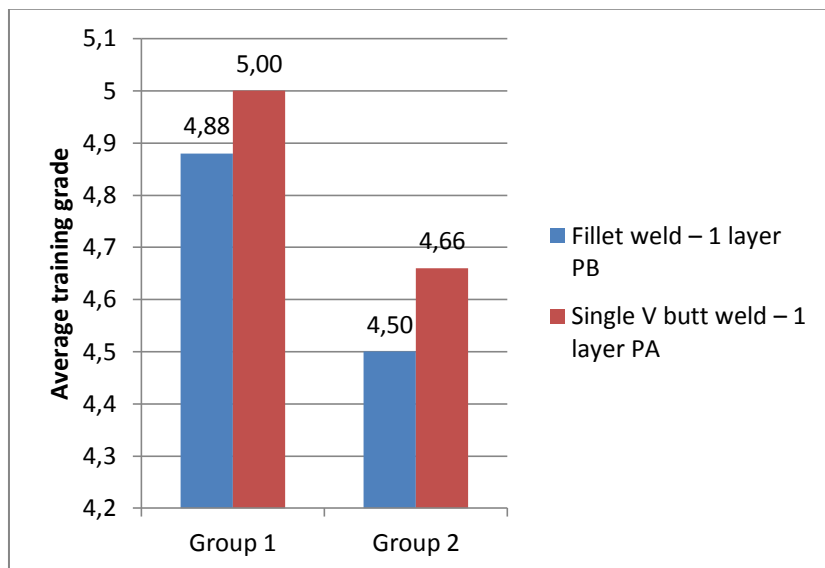


Figure 10 Diagram comparing accomplishment of participants who went through the interactive training (Group 1) and participants who only went through the training on real welding machines (Group 2)

3. Pilot programme for professional welders - SKILLS

Pilot programme S-K-S for professional welders is based on the tailor made principle, according to the demands of the company where the programme is being carried out. Theoretical part ratio is 20% the classical way, and 80% we – learning method. Practical part is 100% on the VWTS system.

Following curricula were designed for ĐĐ TEP according to their needs and pertaining to the correction of welding technique:

- 3. Fillet weld – positions PB, PF – one layer
- 4. Butt weld – positions PA, PF – one layer

3.1. Accomplishment results for professional welders achieved on the VWTS

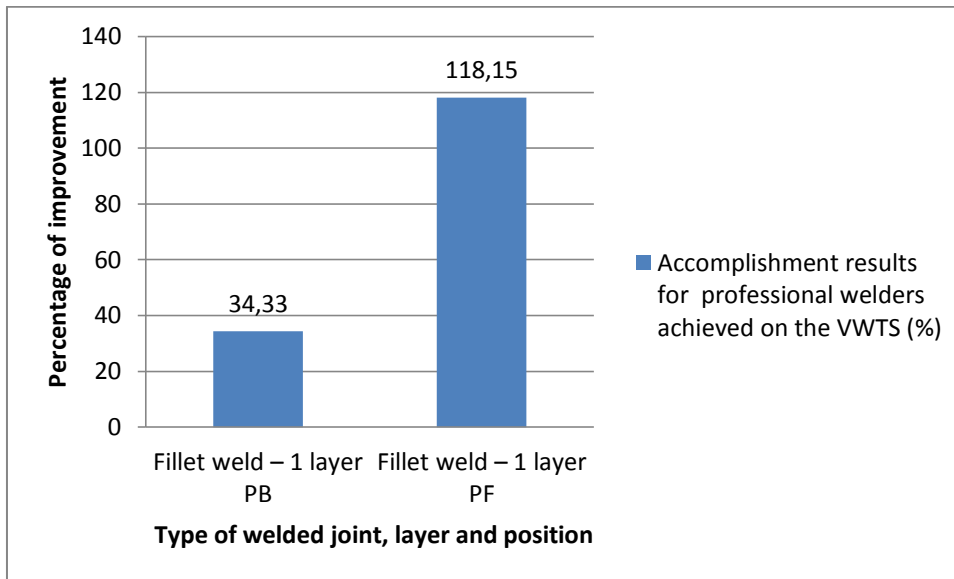


Figure 11. Accomplishment chart after the training of fillet weld

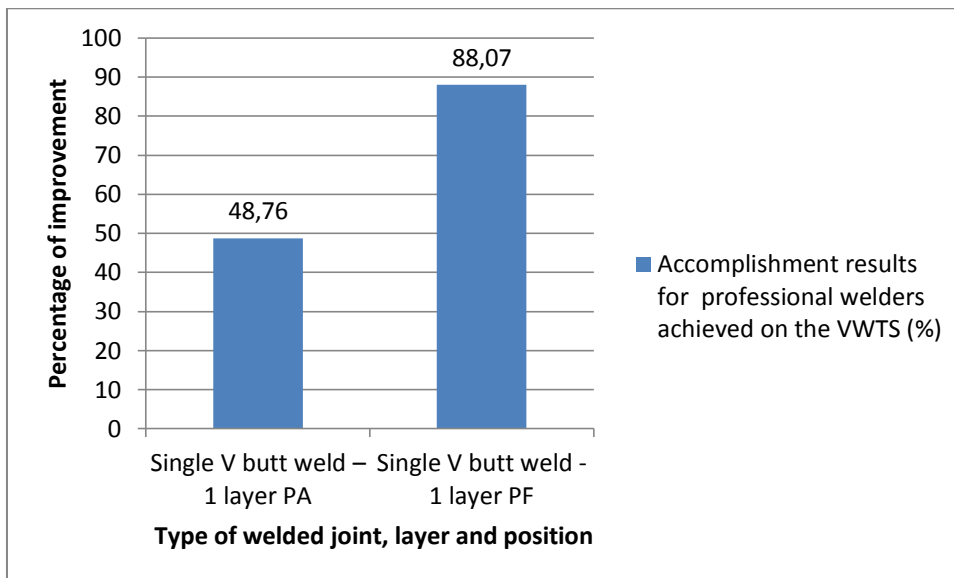


Figure 12. Accomplishment chart after the training of butt weld

4. We-learning method - KNOWLEDGE

We-learning concept completely utilizes the social component of learning. For that reason, the emphasis in teaching is completely put on the communicational aspect and observation of the social process.

Apart from the theoretical classes for welders, this concept was used in teaching 4 other subjects: Technical materials, Technical drawing, Machine elements and Electromechanical engineering for students of following professions: heating and AC fitter, gas fitter, plumber, metalworker, toolmaker, milling-machine operator and draughtsman/woman. The total is 94 students.

Teaching materials are of multimedia type, e.g. clips from You Tube on pipe making were used while teaching fitters Technical materials.

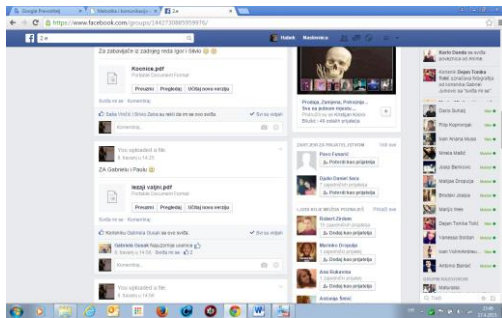


Animations from the following link were used in teaching Machine elements:

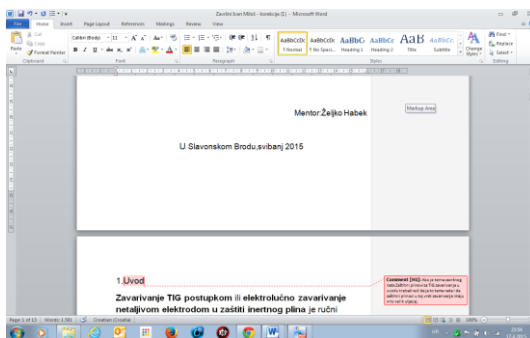
<https://www.youtube.com/watch?v=DAY8TzT8zgM>

Other communicational channels included sending and receiving Facebook messages and e-mailing, where special attention was paid to feedback.

An example of sending the materials through Facebook for students to prepare for classes:



Feedback example:



An example of Electromechanical engineering class, students elaborating the subject matter in pairs/small groups:



5. Stability

The basic goal of this part of the S – K – S system is raising the welder's fitness - physical performance and effectiveness. It is necessary to raise the physical power and health state to a higher level, and in such a way increase the fitness and effectiveness of the work process, but also decrease body entropy and at the same time prolong the working life of welders.

The ultimate training result is to render the welder capable to repeat a precisely determined set of moves multiple times in different specific body positions while having a steady and stable hand.

Programme execution dynamics through steps:

- Work place screening was done
- Health state of each individual was determined
- Initial state of motor and functional abilities was established
- Survey on motor skills and knowledge was conducted
- Training plan and programme was done
- Welders were taught self-control and valorization of training effects
- They were taught stretching, relaxation and self-massage exercises
- They were given individual programmes to work out at home (in nature) on their own

The participants were divided into three groups

- Homogenized according to motor and functional abilities
- Each group works out at a
- Specific intensity and exercise volume

The exercises were chosen in such a way that they have an impact and can ensure progress on:

Locomotive system by increasing

- The strength
- The stamina
- The flexibility

Cognitive-conative system by developing

- The coordination
- The balance
- The feeling and body control in time, space and rhythm

Cardiovascular system

- By developing the lung and hearth capacity
- By increasing the vascularization of the whole body

Mental relaxation and increase in

- Motivation
- Confidence
- Optimism
- Joy

Exercises

Working out is done

- One hour twice a week in the gym with professional guidance and control
An hour exercise consists
Introductory part – stretching and warm up
Main a part - aerobic exercises, especially sports games
Main b part - developing of repetitive strength and stamina
Final part - relaxation, stretching and self-massage
- Once or twice a week on one's own at home
Exercising based on aerobic training
Each individual was tested and given an individual exercise programme

Selfcontrol

When developing the functional abilities, everything is done by measuring the pulse.

- Measure the puls while keeping still – after getting up, three days in a row, then take the middle value
- Trainees work with 60% intensity- it is calculated as follows:
a person is 40, their puls while still is 85.
 - $220 - 40 = 180$
 - $180 - 85 = 95$
 - 60% of the score under 2. Is 57
 - $57 + 85 = 142$



this means that the person has to exercise with the puls of 142.

When developing the repetitive strength, stamina and flexibility one has to pay attention to technique of exercise execution and breathing technique.

Results

There is an evident progress in characteristics and abilities of trainees measured in several ways:

- as a difference between initial and final testing
- as a difference in grades/marks in the subject Physical education for this and previous school year
- as a comparison of results achieved through implementation of the S-K-S system and those who exercised in a traditional „general“ way

With professional welders, no significant progress was observed. The reason is that they did not get involved in exercising on their own the way it was requested.

The pilot programme, just like the conducted research, has confirmed the assumptions of work in kinesiology education:

- Many characteristics and abilities on which the success in welding depends can be altered under the influence of learning and exercising.
- The influence of learning and exercising on development of specific characteristics and abilities is unequal, some abilities can be influenced more, some less.
- Learning and exercising change not only the level of characteristics and abilities, but also their mutual relations.
- At equal volume and intensity of learning and exercising, the participants whose initial level of characteristics and abilities was higher, at the end of transformational process achieve a higher level of change.
- The probability of achieving the desired results by learning and exercising is bigger, when the process started earlier.

The results demonstrate that the exercise program needs to start as early as possible, with the start of welder education the latest. With the change of physiological and chronological age depending on the gender of welders, the results naturally become weaker. However, much better results can be achieved with active implementation of the S-K-S system and the very important support of the employers.





6. Conclusion

The course of the pilot programme demonstrated the success in implementation of the S – K – S system within the targeted framework.

Taking into consideration the stated results from all three constituents of the S – K – S system, it is obvious that only through synergy of all its basic elements, all the key competencies recommended by the European Commission in 2006 have been achieved.

It is clear that some corrections will be necessary upon completion of the programme, and it is already obvious that the hours for the theoretical part for beginners need to be increased both in Croatian syllabus and in the Guidelines IAB-089r4-12 part 1.

Another thing that has been observed is many unreliable materials dealing with welding on the internet, which can be very misleading for inexperienced and less educated welders. One possible solution for this and many other problems would be the on line platform for welders.