



**Welcome to the presentation**

**Simulation supported welding with SOLDAMATIC –  
New teaching and learning concepts in education**

**Technology that excites!**





***About WeldPlus:***

***WeldPlus offers the welding industry innovative welding products and customer orientated service***

***Involved in the sale of welding simulation systems since 2009***

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Project management “Soldamatic”

Vice president within the DVS working group

“Virtual Welding” 2.8

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## Presentation contents

- Current situation
- Expectations and goals of simulated training
- Practice-projects/experiences with Soldamatic
- What have welding trainers systems offered up to now?
- Practical requirements
- Soldamatic – the integrated education concept!



## Current situation

### Basic and further education of welders in Germany

Welders belong to the most requested tradegroup worldwide, BUT:

- Dual educational system, insufficient integration of theorie and practice
- Welder no longer exists as its own trade group
- Welder has become a secondary trade group
- Welding is considered to be: unattractive, hard work, badly paid, dirty, dangerous, only for those who have no other possibilities on the job market!....
- Training welders is very expensive
- Welder as a trade group has a very negative image

**How are we going to modernize the training of welders and introduce MORE quality at the same time?**



Bundesarchiv, Bild 183-10730-0025  
Foto: Thiem, Wolfgang | 30. Juli 1972



## Current situation

### Demographic change

- Proportion of socially obligated employed welder over the age of 50 years 46% (January 2013)
- Impending knowledge loss, especially in the field of welding teachers

### Shortage of skilled labor

Welder belong to the most requested trade group worldwide, but:

- Disinterest of the youth "antiquated" training
- The youth have no contact with welding during their normal school education
- Expensive training
- No job description as a welder



## Current situation

### Industrial problem areas

#### Health management

- Welders and cutters suffer an above average number of sick days
- Long term motoric strain (ergonomically bad posture)
- Long-term impairment to fumes, heat, etc.
- Majority of practicing professional welder do not practice the trade up to pension age
- Strong darkend blinds are used as protection, here instructors are not able to accurately view the ergonomics and movement of each student.
- The work is judged on the results (weldbead and time).
- Pressure to perform, rigorous review of the entire process and outcome

#### Communication

- Language barriers, 19% of welders are non native speakers (Januar 2013)
- Due to shortage of skilled workers, welders with limited language skills are often used
- Communication problems



## Current situation

### Problems connected to the welding teacher

- No choice in the selection of the trainees
- Motivation (forced attendance)
- Language problems
- Broad range of target groups and objectives (Job-Center, company, apprenticeship career change etc.)
- Offset start appointments
- Therefore it is rarely possible to carry out real group training
- Individual training also becomes a rarity
- Impossible time schedules
- Pressure to increase performance
- The impartation of theory becomes an after thought
- .....

**...and then a simulator?????????**



### What do we want to achieve?



- Drastic reduction in training costs (material/time?)
- Minimizing safety risks in training
- Health management
- The introduction of the most modern training tools and educational concepts
- Environmentally friendly training
- Drastic increase in the quality of the basic and further education of welders
- More effective manpower recruiting
- Lifting the image of the trade group



Chainsaw simulator



Forklift simulator



Crane simulator



Flight simulator

**Simulation to become a standard process in the training of welders!**





## Projects of WeldPlus and partners (examples) 2011 – 2016

Arcelor Mittal Bermen:  
**Economic study-  
conventional/ virtuel  
welding**  
2011 - 2012

Arcelor Mittal Bermen:  
Involvement of the BG  
to the subject  
"Health prevention  
"using welding  
simulators,  
10/2013 – 04/2014

FH Schweinfurth:  
**Thesis on the  
integration of  
simulation in the  
training of welding  
engineers**  
02/2014

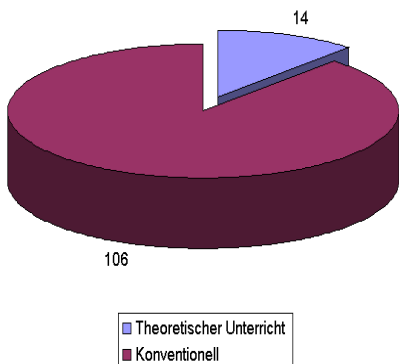
MESA: Project for  
integrating new media  
in the training of  
welders, integration of  
simulation in the  
training requirements of  
specific industries,  
development of  
integrated contents and  
curricula in cooperation  
with  
DVS Media/CESOL

Integration of  
individual  
workpieces  
2015  
New  
developments  
robotics  
.....

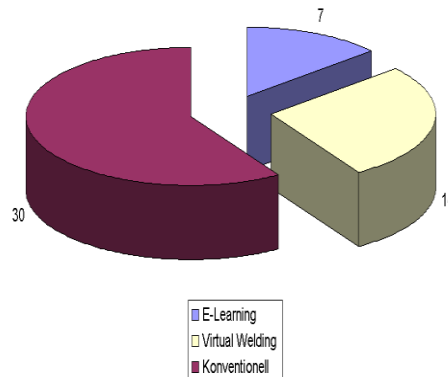
## Projects of WeldPlus and partners 2011 – 2016

Economic advantages, industrial example:

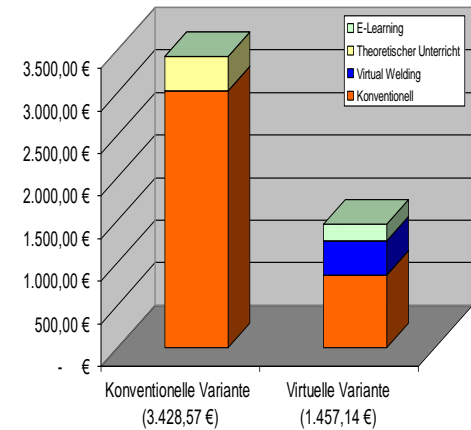
Units of standard training  
(DVS)  
MMA



Complete rescheduleing:  
combi-model (K/V/E)



Schweißausbildung - Übersicht der Kosten pro Mitarbeiter  
- Vergleich konventionelle und virtuelle Ausbildung -





# Independent study CESOL, Spanish welding institute

## COMPARATIVE STUDY:

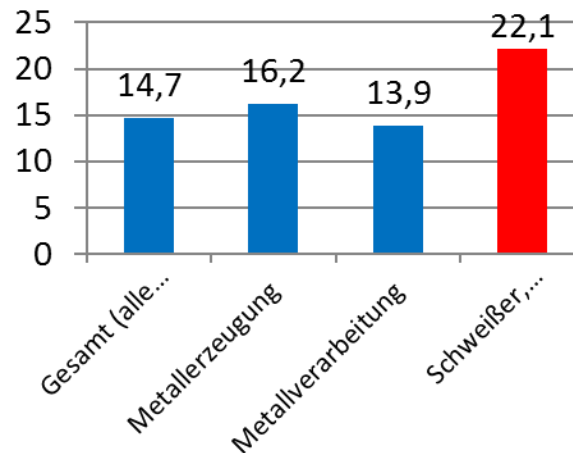
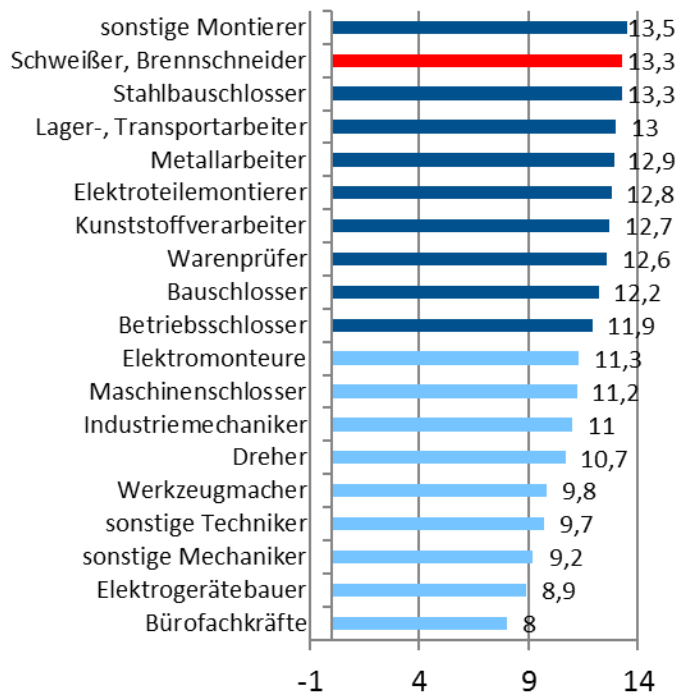
### INTERNATIONAL FILLER WELDER COURSE - MAG (GMAW) - CARBON STEEL

	TRADITIONAL METHOD	SOLDAMATIC MIXED WITH TRADITIONAL FORMAT	SAVINGS IMPROVEMENTS	SOLDAMATIC AUGMENTED TRAINING	SAVINGS IMPROVEMENTS
<b>COURSE INFORMATION:</b>					
Total number of trainees	8	8		7	
TOTAL TRAINING TIME REDUCTION	-51%	-51%		16,67%	
REAL WORKSHOP TIME REDUCTION	0%	9%		56%	
PERCENTAGE OF TRAINEES QUALIFIED FOR IW	37,50%	50%		57,14%	34%
Percentage of trainees approved for PH (5F) or PD (4F) position fillet tube-plate/total number of trainees	0%	0%		42,86%	
<b>WORKSHOP/SIMULATION COMPARISON:</b>					
Practice time regarding total workshop time, including preparation of coupons and joints, brushing, etc.	66%	70%		74%	
Arc time regarding practice time, excluding preparation of coupons and joints, brushing, etc.	40%	62%		89%	
ARC TIME REGARDING TOTAL WORKSHOP/SIMULATION	26%	43%		66%	
<b>CONCEPTS:</b>					
Classroom material cost	200,00 €	0 €	100%	0 €	100%
Welding instructor cost	6.660,00 €	6.660,00 €	0%	5.550,00 €	17%
<b>TOTAL COST OF CONSUMABLES</b>	4.437,07 €	2.366,94 €	47%	1.413,01 €	68%
TOTAL WORKSHOP TOOLS COST	331,58 €	250,81 €	24%	212,55 €	36%
<b>TOTAL COSTS</b>	<b>12.063,65 €</b>	<b>9.495,25 €</b>		<b>7.349,56 €</b>	

## Projects of WeldPlus and partners 2011 – 2016

### Occupational health management initial situation

Days off work in the metal industry by occupation in 2010 (per AOK Member)



The largest proportion of the sick-days in metal production and metal processing are attributable to musculoskeletal disorders with 22.1%.!!!!

## Projects of WeldPlus and partners

2011 – 2016

### Occupational health management

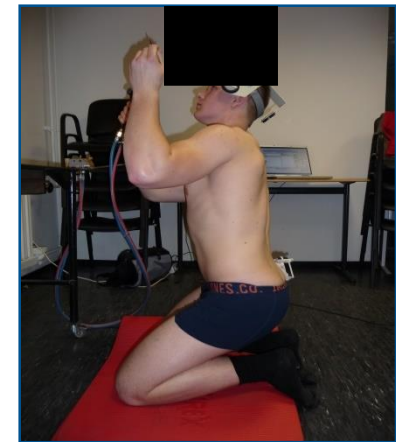
- Detecting the posture during welding in three different positions, tests Arcelor Mittal Bremen and BG accident ambulance Bremen, Prof. S. Dalichau, March 2014
- 9 male experienced welders (  $38,4 \pm 11,7$  years old; arm dominance: right)
- 8 male trainees (6 weeks welder training; arm dominance: right)



1) sitting



2) bent over floor level



3) kneeling head level

**Important: the specific body position was not specified and was selected individually by the subjects**



## Projects of WeldPlus and partners 2011 – 2016

Occupational health management

### Recommended action

- Prof. S. Dalichau, Institut f. Applied and prevention. Performance Diagnostics, Bremen (extract)
- Integration of simulation-based welding systems trainers in the training
- Weight reduction / the employment of ergonomically adapted welding torches
- Integration of training on ergonomics and health in the training
- Introduction of active regulations to improve the occupational health of welders (individual training , mini-pauses etc.)





## Integration in the DVS-training syllabus

Changing of standards:

a) 1108-1

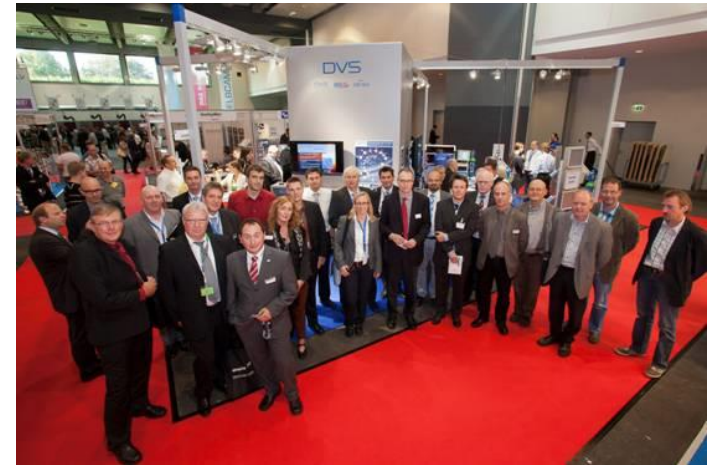
What the system must deliver

How training centres must be equipt

b) 1154

The compulsory integration of simulated training into the training of teachers and welding foremen

**But: reluctance of educational institutions and welding teachers, since they have no practical application experience in the use of simulated training and missing holistic approach to the teaching of theorie and practice, a complete lack of teaching and learning concepts, ...**





## How do conventional simulators work?

- **Focus:** practical training with simulation in addition to the training in the cabin
- **Result:** lower costs, more time on the arc, individual coaching, allowing a quicker practicing motor skills, faster practical learning
- **Focus so far:** efficiency and practical training!

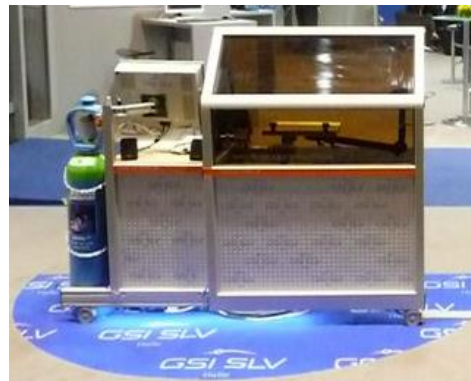




## Welder training systems



GRENZEN VERSCHIEBEN





## Practical demands from industry

Combination of practice and theory in a holistic, personal, educational and practical concept:

**SOLDAMATIC, not just a simulator but:**

**the integrated solution for welding  
education and further training!**

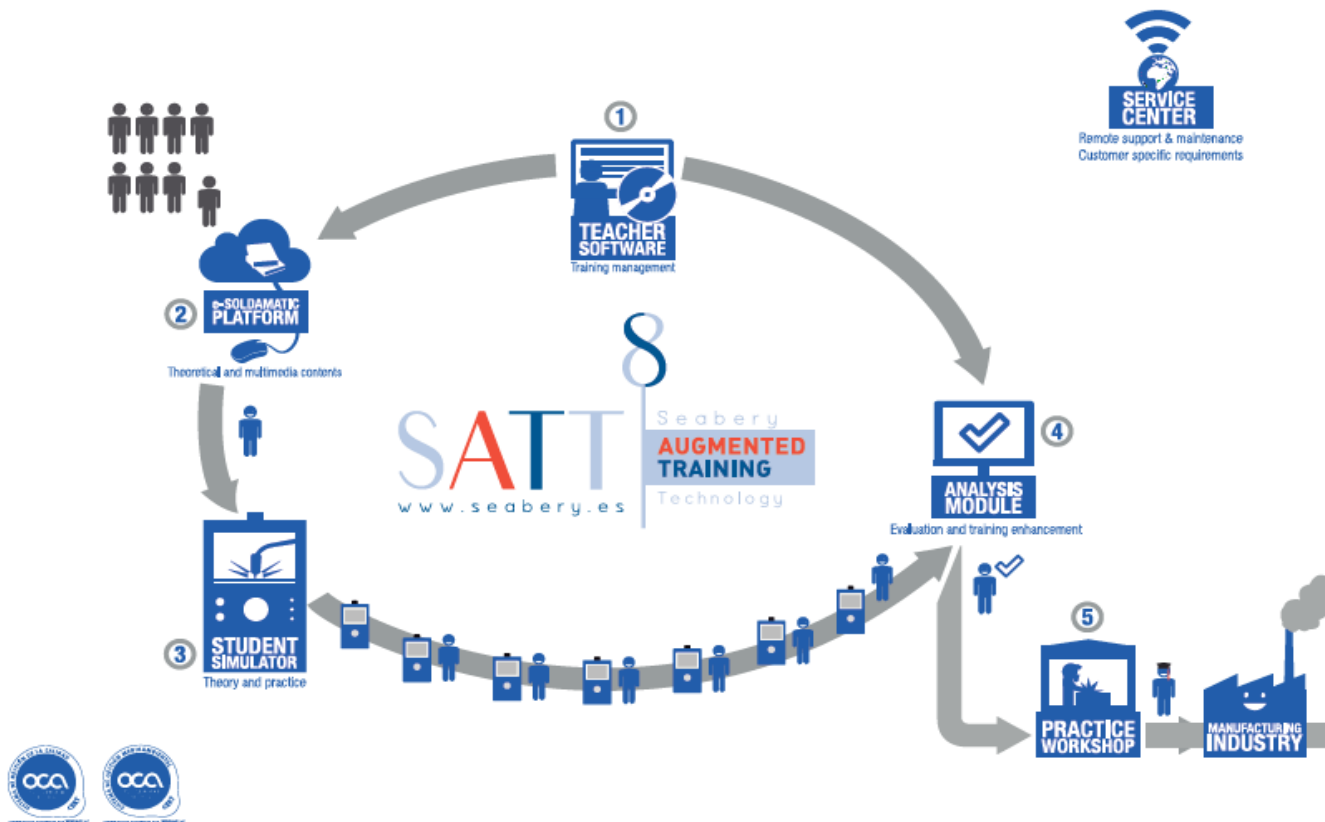


# Integrated educational concept!



## Soldamatic AR

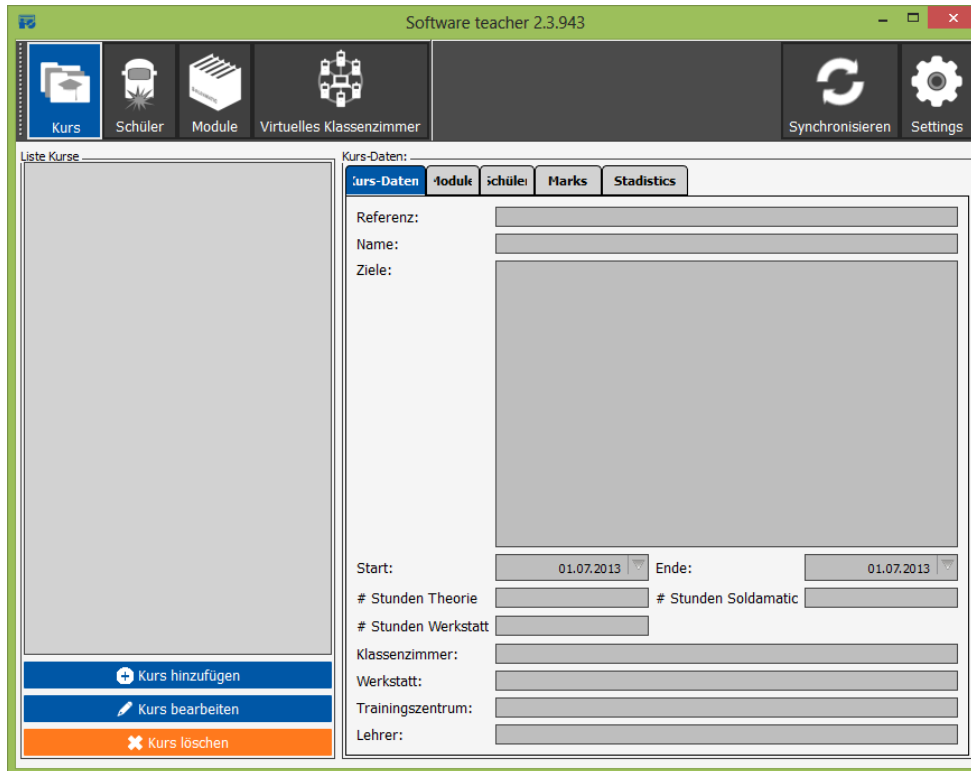
Download our AR App for Android or iOS devices.  
Print this page and use it as a marker.





## Teacher software

- selfprogramming of individual learning material
- theoretical foundations
- confirmation testing
- individual evaluation of tests (Multiple Choice)
- practical predefined welding tasks (IIW)
- all WPS`s can be individually modified (teacher only)
- The ability to check the progress of each individual in realtime:
- Crosslinking of the teacher with all students
- Learning level check at any time (theory / test / practice) incl. evaluation





# E-Learning

Lehrblatt DVS-IM-Lehrang Internationaler Schweißer Modul SM Metall-Schutzgaschweißen Bauweise und Wartung von MSG-Schweißanlagen		
<b>Störungen an der MSG-Schweißanlage – Ursachen und Folgen</b>		
<b>Drathlektrodenprobe</b>	zu schwach gebrannt zu stark gebrannt	Drathlektrode springt von der Spule; Drahtvorschub gestört Überlastung des Drahtfördermotors, Durchdringen der Drahtförderrolle; Drahtvorschub ungleichmäßig, unruhiger Lichtbogen, Festfrieren der Drahtlektrode im Brennkontaktrohr
<b>Drahtförderrollenprofil</b>	Nut zu groß gewählt oder zu groß durch Verschleiß Nut zu klein	Durchdringen der Drahtförderrolle; Drahtvorschub ungleichmäßig Drathlektrode wird verformt; Drahtvorschub behindert
<b>Drahtförderrollen-Anpresskraft</b>	Anpresskraft zu gering Anpresskraft zu groß	Durchdringen der Drahtförderrolle; Drahtvorschub ungleichmäßig Drathlektrode wird verformt; erhöhter Verschleiß des Brennkontaktrohrs
<b>Drahtvorführlöse</b>	keine Abstand zur Drahtförderrolle zu groß oder Bohrung zu groß	Ausknicken der Drahtlektrode; Drahtvorschub gestört Erhöhte Reibung; Drahtvorschub behindert

DVS-IM-Lehrang Internationaler Schweißer Modul SM Metall-Schutzgaschweißen Bauweise und Wartung von MSG-Schweißanlagen	
<b>Testfragen</b>	Testblatt SM 1.12
<ol style="list-style-type: none"> <li>Wovon wird die Drahtförderrolle angetrieben? A) nach der Länge des Schutzgaskegels B) nach dem Drahtabmessungsdurchmesser C) nach der Vorleistung der Drahtlektrode D) nach der Düsendrücke</li> <li>Was ist die Folge, wenn das Brennkontaktrohr einen zu großen Bohrungsdurchmesser aufweist? A) Drahtvorschub wird übermäßig B) Drahtlektrode knickt innerhalb des Brennkontaktrohrs C) Brennlängengang in die Drahtlektrode wird verbessert D) Brennlängengang in die Drahtlektrode wird verschlechtert</li> <li>Warum sollte nicht mit stark verunreinigter Gasdüse gearbeitet werden? A) keine Schweißgas strömt aus B) Schutzgasstrom wird verunreinigt C) Brennlängengang im Kontaktrohr wird unterstützt D) Lichtbogen wird seitlich abgelenkt</li> <li>Bis zu welcher maximalen Drahtförderlänge ist die Kompaktanlage einsetzbar? A) 2,5 m B) 5 m C) 10 m D) 15 m</li> <li>Welche Wartungsarbeiten darf nur eine Elektrofachkraft durchführen? A) Schweißanlage vom Netz trennen B) Umwälzen auf andere Teilspannungen C) Schraub- und Klemmschritte nachziehen D) Schweißgasanlage mit frischem Druckluft ausbauen</li> <li>Bei welcher MSG-Schweißanlage befindet sich das Drahtvorschubsystem weder im Brenner noch in der Schweißanlage? A) Kompaktanlage B) Universalanlage C) Klemmanlage D) Push-Pull-Anlage</li> <li>Welche Aussage zur MSG-Schweißanlage ist richtig? A) Höhe der Schweißspannung wird entsprechend der Schweißaufgabe eingestellt B) Höhe der Schweißspannung wird über den Drahtvorschub eingestellt C) Schweißstrom ist in der Regel Wechselstrom D) Minuspol liegt in der Regel an der Drahtlektrode</li> <li>Welche Aussage zur MSG-Schweißanlage ist richtig? A) Höhe der Schweißspannung wird über den Drahtvorschub eingestellt B) Schweißstrom ist in der Regel Wechselstrom C) Schweißstrom ist in der Regel Gleichstrom D) Minuspol liegt in der Regel an der Drahtlektrode</li> <li>Welche Aufgabe hat der Gleichrichter in einer MSG-Schweißanlage? A) erhöht den Leistung B) verringert die Netzspannung auf die Schweißspannung C) wandelt Wechselstrom um in Gleichstrom D) gibt Stromerzeugung in Schweißstromkreis</li> <li>Wie wird der Schweißbrenner beansprucht? A) nur mechanisch B) nur thermisch C) er wird mechanisch und thermisch nur gering beansprucht D) er wird mechanisch und thermisch hoch beansprucht</li> </ol>	

- Theory exchange own documents PDF / image / movie or
- Theory-exchange standard reading for example online portal DVS Media
- Small steps and individual exchange theory
- Learning level check at any time (Theory / test) incl. evaluation multiple choice



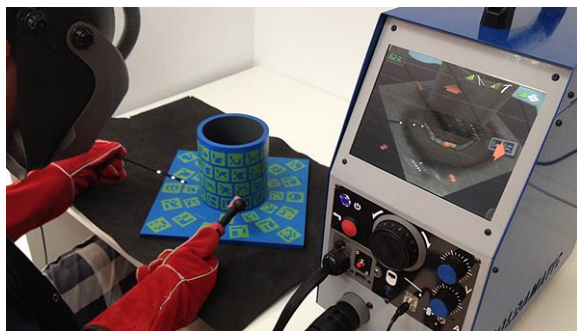
## Individual training simulator



- MIG/MAG
  - MMA
  - TIG
  - flux cored wire
  - changeable WPS
  - all positions (vertical, overhead, downhand etc.)
  - multilayer
  - pipe program
  - changeable amps, volt, gasflow during welding
  - realistic sound
  - the realization of realistic positional work due to AR-technology
  - only the workpiece is animated, realistic background!
  - realistic graphics with realistic weld pool
  - realistic workpiece, real torches
  - helmet without difficult 3D glasses
  - ability to check the progress of each students activities in realtime:
  - networking of the teacher with all students
  - learning statistics check at any time  
(Theory / test / practice) incl. evaluation
- training individually, in groups, in the classroom, in workshop ....



## Individual coaching



➤ individual training of each motoric:

- arc length
- travel speed
- travel angle
- torch angle
- distance to workpiece
- porosity
- spatter
- undercuts, etching, root (coming soon)

- .....

- different training levels (beginner, Intermediate, expert)
- teachers set in advance individual tasks and assessment criteria



## Individual analysis



- comprehensive analysis of every weld bead
- the control of practice time and welding time
- Objektive evaluation of:
  - Arc length
  - Travel speed
  - Travel angle
  - Torch angle
  - Distance to workpiece
  - Porosity
  - Spratter
  - .....
- Documentation through graphics, film and printout
- e.g. for clients (job centers, companies, company training., staff development, etc.)





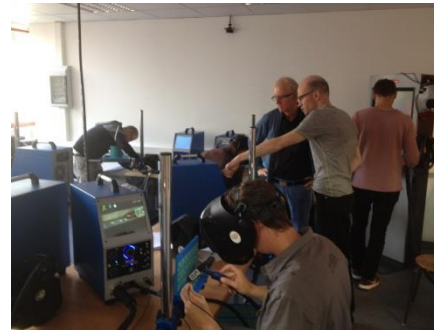
## Training in the cabin



- Students are trained theory
- Students passed state tests theory-learning
- Students have carried out individual practical tests
- Hand skills have been practiced
- Transfer of the acquired knowledge in the cabin
- Pre-trained students
- Reaches all goals faster
- Increase of training quality



## How do we support teachers in the implementation of welding simulation?



- User training
- Individual Train-the-Trainer-concept
- Individual counseling and support in the development of tailor-made teaching concepts (target groups, methods, didactic and methodical integration)



## Integrated training concept advantages

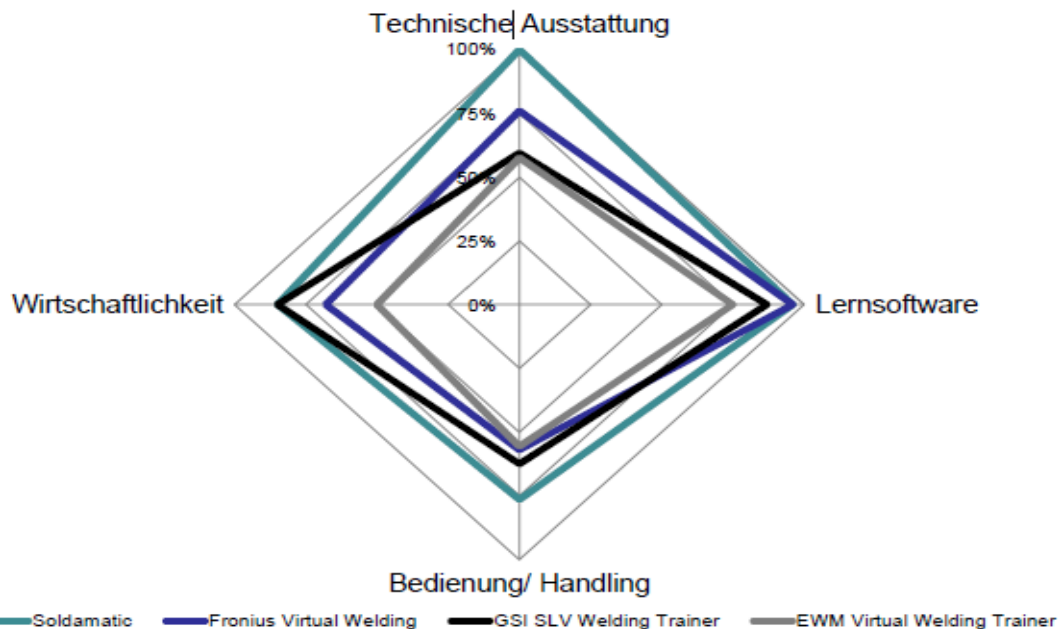
- Availability of IIW / DVS-aligned lessons or
- Integration of own teaching materials (PDF, MOVIE, IMAGE)
- Controlled and individualized practice of theory, simulated practice training, training in the cabin
- Learning progress checks in theory and practice at any point of training possible

Effective and quality-enhanced training!



# Comperative study (SLV Nord/Daimler): Soldamatic head in all fields!

Entscheidungsfindung



21.10.2014

Hanna Streit

12





## Seminar examples:



Welding Solution Center,  
Huissen (NL)



Daimler Digital Days 2016



Teachers recertification  
course, Certilas, (NL)



Job info-day FORD



Train-the-Trainer  
Workshop, GSI Rhein-Ruhr



Technology workshop,  
DAIMLER Stuttgart



Trade exhibition TISM  
Bree, (B)



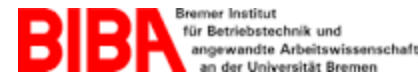
## Some of our industrial customers (examples):



Mercedes-Benz



JOHN DEERE





## Some of our customers educational sectors (examples):





## New development, SOLDAMATIC 2.4:



Development for VW:

- Integration of individual workpieces



Video kurz.MOV

### SOLDAMATIC 2.4

- Inox
- Aluminium
- individual Curricula (IIW/DVS Media)
- .....





## MESA-Project

### Media use in welder training

#### Our goals:

- ✓ Getting the attention of highschoools, reaching youth ealier through its employment in normal lesson plans, development of appropriate curricula
- ✓ Development of industry-specific concepts for industrial and educational partners
- ✓ Development of industry-specific processes, workpieces etc.
- ✓ Development of curricula for need-based training, e.g. ergonomics training etc.



# MESA-project 2015-2017: “Medieneinsatz in der Schweißerausbildung”

Our partner:



Supported and financed by:

Bundesministerium  
für Bildung  
und Forschung



Bremer Institut für Produktion und Logistik GmbH

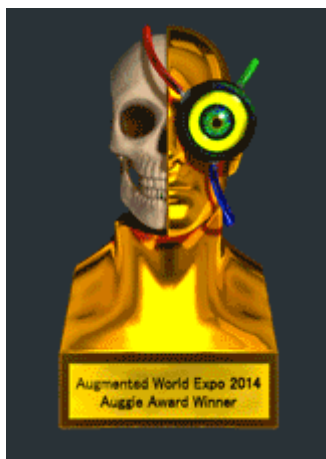




## Prizes and honours won in 2014

**Auggie Award for Best Enterprise Solution**

**Winner: Welding Training by [Seabery](#)**



## Worlddidac Award Winners 2014



**Die Gewinner des 16. Worlddidac Award sind bekannt**

Seit 30 Jahren prämiert die Worlddidac Foundation die innovativsten und qualitative hochstehenden Bildungsprodukte der Gegenwart. Nach der 5-tägigen Evaluationswoche im Berner Technologiepark stehen nun die Gewinner des 16. Worlddidac Awards fest.

Letzte Woche evaluierte eine kompetente Lehrjury aus der Schweiz und eine internationale Expertjury unter der Leitung von Prof. Dr. Peter Gloor fast 50 Bildungsprodukte aus aller Welt. Im breiten Spektrum an beurteilten Bildungsinnovationen fanden sich beispielsweise auch ein Roboter der Schüler bei längerfristigen Krankheiten im Schulzimmer vertritt, neue Sprachlernangebote im Bereich E-Learning und sogar eine Neuschöpfung aus Sierra Leone und China.

Die vielfältigen Bildungslösungen wurden einem sehr strengen, umfassenden, transparenten und zeitintensiven Evaluationsprozess unterzogen. Während sich die Lehrjury auf die praktische Anwendbarkeit der Lehrmittel fokussierte, stützte die Expertjury ihr Urteil auf einen Kriterienraster und die Präsentationen der verschiedenen Firmen direkt vor Ort im Berner Technologiepark. 28 Bildungsprodukte erreichten die notwendige Punktzahl, um die prestigeträchtige Auszeichnung entgegennehmen zu können.

Neben den 28 ausgezeichneten Bildungslösungen verliehen die Jurymitglieder auch einen speziellen Award für das Produkt mit dem innovativsten Ansatz. Der von Swisscom gesponserte Swisscom Innovation Award geht in diesem Jahr an die virtuelle Trainingsmöglichkeit von Schweissarbeiten, der Augmented Training Technology von [Seabery Soluciones](#) aus Spanien.

Für Beat Jost, Mitglied des Stiftungsrates der Worlddidac Foundation, war die Evaluationswoche ein voller Erfolg. Er freute sich ganz besonders an der hohen Qualität der Produkte: «Dieses Jahr hatten wir aussergewöhnlich viele hochwertige Produkte, dementsprechend hoch ist der Prozentsatz der Gewinner.»

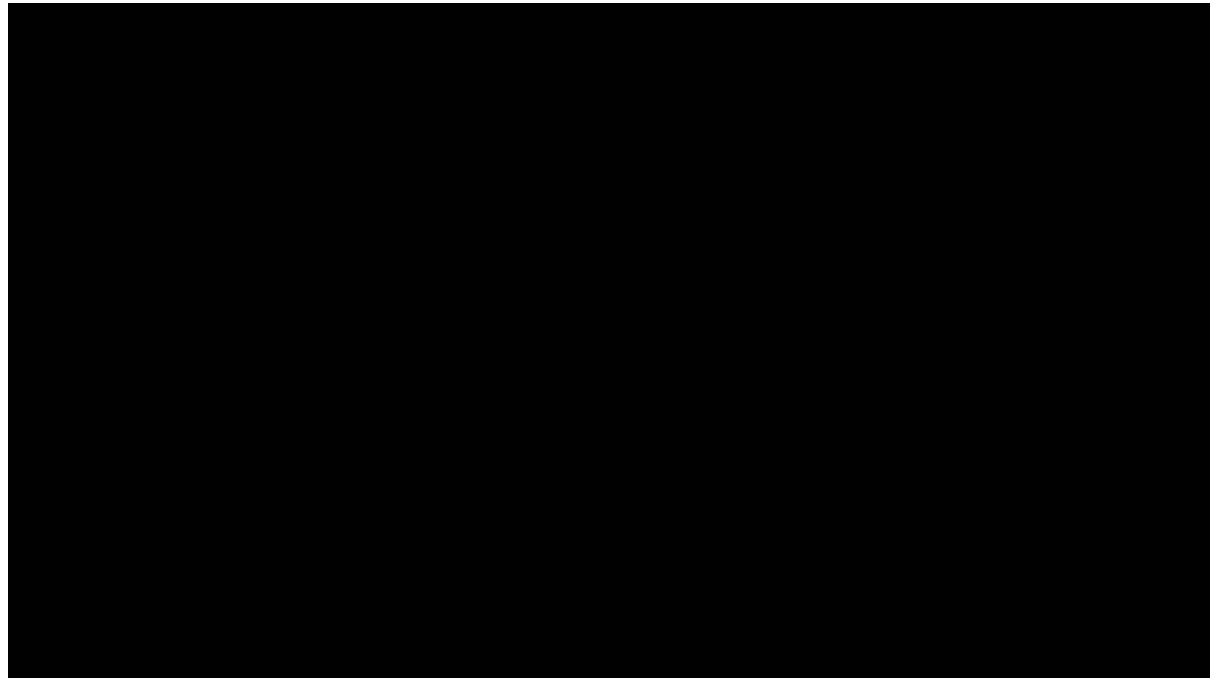
Auch Prof. Dr. Peter Gloor, Professor am MIT in Boston, zog als Vorsteher der Jury ein positives Fazit der intensiven Woche: «Die Woche war sehr interessant. Für mich ist es ein Privileg zusammen mit anerkannten Bildungsexperten die neusten und teilweise brillanten Innovationen in der Bildungsindustrie evaluieren zu dürfen.»

Die Awards werden den Gewinnern in einer feierlichen Zeremonie am Vorabend der Bildungsmesse Worlddidac Basel/Didacta Schweiz Basel am 28. Oktober 2014 in Basel überreicht.

Die Liste mit allen Gewinner des 16. Worlddidac Awards: <http://bit.ly/1hLNgv6>  
Video von der Evaluationswoche: <http://youtu.be/hHiaRzsPX4>



***Soldamatic in the  
training-center of  
Volkswagen in Emden***





## Our future!



***Questions?***

***Invitation to  
prove the system,***

***Thank you for your  
attention!***

**[www.soldamatic.de](http://www.soldamatic.de)**