

Improving Adhesive Bonding Skills: A Pilot Study Across Five European Countries in the scope of KNOWBOND Project

C-XVI - Polymer Joining and Adhesive Technology - paper 133

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Paper with Abstract No. 133

Summary

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- Motivation for the pilot study
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- KNOWBOND objectives, activities and products
- Empowering specific skills development in five countries (methodology)
- Results /outreach
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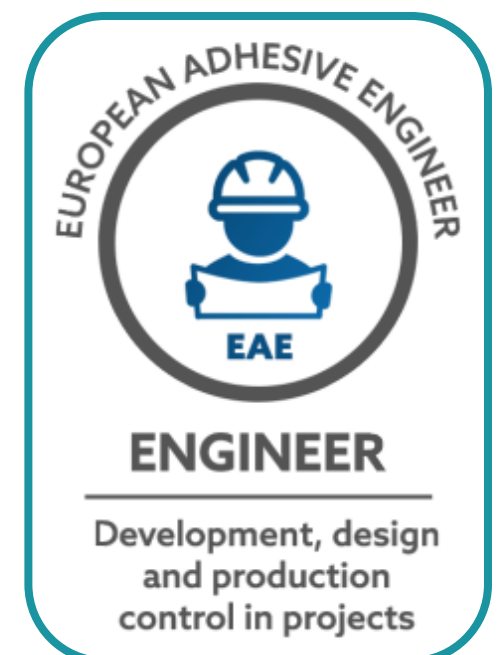
Background on Adhesive Bonding Qualifications & Skills Development



HARMONISED
TRAINING GUIDELINES

HARMONISED
ASSESSMENT

QUALITY ASSURANCE
SYSTEM



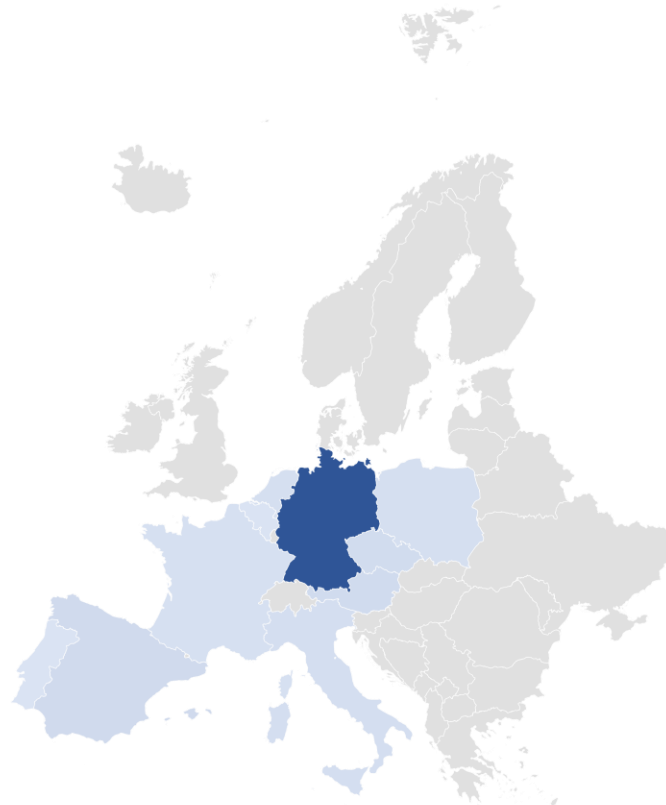
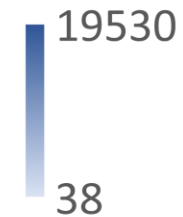
Around **25 500** diplomas issued by 2022

Adhesive Bonding Qualifications

Background on Adhesive Bonding Qualifications & Skills Development

10 AWARDING COUNTRIES FOR ADHESIVE BONDING DIPLOMAS

TOTAL ADHESIVE BONDING
DIPLOMAS



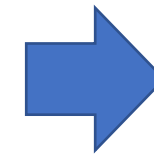
Motivation for the pilot study



For more than 25 years, there has been an internationally recognized qualification system for professions and activities in the field of adhesive bonding technology



However, there is no possibility for individuals to develop and certify knowledge and skills related with specific professional activities as they are being required within their workplace



Flexibility

Specialization

Quality

EU Recognition

KNOWBOND project overview



Aim: Delivering an updated Adhesive Bonding qualification, digital learning tools and quality assurance recommendation for a high-quality provisioning of VET training in Europe.

Duration: 24 months (December 2021 to November 2023)

Partnership: 7 partners (ATBs for Adhesive Bonding)

KNOWBOND objectives



KNOWBOND project addresses the necessity to **increase the ability and promptness** of Vocational Education and Training providers to shift towards **digital and more flexible technologies** for a systematic approach regarding the initial and continuous education of adhesive bonding professionals.

KNOWBOND will review an European industry -lead profile widely recognized as International Qualifications - **the European Adhesive Bonding (EAB)** - in alignment with the Industry requirements in order to enable **the certification of individual skills related with specific professional activities**

KNOWBOND activities and products > Updated EAB curricula



Flexible Training Pathways for Specific Adhesive Bonding Applications

- Window bonding
- Plastic bonding
- Glass bonding
- Metal bonding



Specific European Adhesive Bonding Training –
SEABT

24 teaching hours (48 of workload)⁸

KNOWBOND activities and products > Updated EAB curricula



- **CU1 - Introduction to Adhesive Bonding** →
- CU2 - Specific surface treatment methods
- CU3 - Specific adhesives and sealants
- Optional CU4 - Specific adhesive bonding topics

Fundamentals of adhesion and adhesives

Surface treatment (basics)

The main families of adhesives and sealants (basics)

Design and construction of adhesive joints

Quality assurance /Quality management

Durability of adhesively bonded joints

Benefits and limitation of adhesive bonding technology

Health and safety

KNOWBOND activities and products > Updated EAB curricula



- CU1 - Introduction to Adhesive Bonding
- **CU2 - Specific surface treatment methods**
- CU3 - Specific adhesives and sealants
- Optional CU4 - Specific adhesive bonding topics

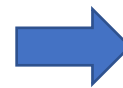


Specific cleaning methods
Mechanical treatment
Physical treatment
Chemical treatment
Primer



KNOWBOND activities and products > Updated EAB curricula

- CU1 - Introduction to Adhesive Bonding
- CU2 - Specific surface treatment methods
- **CU3 - Specific adhesives and sealants**
- Optional CU4 - Specific adhesive bonding topics



1K Epoxies	MMA/2K Acrylics
2K Epoxies	Radiation curing adhesives
1K Polyurethanes	Hotmelts
2K Polyurethanes	Solvent based adhesives
1K Silicones	Water based adhesives
1K Silane Modified Polymer adhesives (SMP)	Pressure sensitive adhesives (PSA)
Cyanoacrylates	
Anaerobically curing adhesives	

KNOWBOND activities and products > Updated EAB curricula



- CU1 - Introduction to Adhesive Bonding
- CU2 - Specific surface treatment methods
- CU3 - Specific adhesives and sealants
- **Optional CU4 - Specific adhesive bonding topics**



Topics to be defined in agreement with
the costumer

KNOWBOND activities and products > Learning tools



Moodle (LMS)

01 - Classificação dos adesivos de acordo com o processo de solidificação

Vejamos o que acontece quimicamente nas diferentes reações.

Poliadição Policondensação Polimerização

A poliadição é uma reação de dois monómeros diferentes. Nenhuma molécula é perdida neste processo.

Monómero #1 Monómero #2 Copolímero #1 e #2

MENU Clique em cada botão para saber mais sobre cada

Contents

01 - Classificação dos adesivos de acordo com o processo de solidificação

Como é que os adesivos são classificados?

Os adesivos podem ser classificados de diferentes formas, embora não exista uma classificação universalmente reconhecida. As classificações podem variar de acordo com diferentes pontos de vista, tais como:

- Origem: Adesivos naturais e sintéticos
- Função: estrutural e não estrutural
- Modo de aplicação
- Composição química
- Estrutura (termoendurecível, termoplástica e elastomérica)

MENU Clique na pergunta para ver a resposta.

Pop-up information

03 - Princípios de adesão

Verificação de conhecimentos

Qual é a energia de superfície de um material?

- ☐ O grau de força de atracção ou repulsão que uma superfície material exerce sobre outro material
- ☒ A soma de todas as forças intermoleculares que se encontram na superfície de um material
- ☐ O grau de molhagem de um material por um adesivo

Está correcto!

A energia de superfície de um material é a soma de todas as forças intermoleculares presentes na superfície de um material.

MENU Selecciona a resposta correcta.

Knowledge check

KNOWBOND activities and products > Learning tools



Game

TÉCNICO DE ADESIVOS - Jogo

Lembra-se da ordem destas etapas?
Arraste cada peça para a área correta. Lembre-se que as peças de Durabilidade e Design e Construção já estão na área certa.

Muito bem!
A sua resposta está correta.

Clique em seguinte para avançar.

Durabilidade

Design e Construção

KNOWBOND

Sequencing

TÉCNICO DE ADESIVOS - Jogo

Os adesivos são tipicamente

- ☒ Polímeros
- ☐ Madeira
- ☐ Metais
- ☐ Cerâmicos

Muito bem!
A sua resposta está correta.

Clique em baixo para voltar ao quadro.

Voltar ao quadro

Fundamentals

KNOWBOND

Quiz

TÉCNICO DE ADESIVOS - Jogo

Consegues definir estas situações como boas ou más? Arrasta cada uma delas para a área correta.

BOM	MAU

Quality Control

Submeter

A oficina tinha temperatura e humidade controladas

Limpei a superfície do substrato metálico com jato de areia e acetona

O meu cartucho está quase vazio, por isso apliquei uma camada fina de adesivo para poupar adesivo

Misturei o adesivo de dois componentes manualmente com uma espátula

Fechei a junta adesiva num movimento rápido sem garantir o alinhamento dos substratos

Segui as informações disponíveis nas instruções de trabalho e utilizei a temperatura adequada durante o período de tempo necessário.

KNOWBOND

Drag & Drop

KNOWBOND activities and products > Learning tools



Case studies

These case studies should be **discussed in the classroom face to face**, reading and discussing what each condition means in real practice, what it implies and what is the best way to approach the situation.

Case study 1

- We have run out of nitrile gloves
- The adhesive is within its expiry date
- I Sandblasted and cleaned the surface of the metallic substrate with acetone
- I used a moisture-curing adhesive within the skinning time
- I applied the adhesive as a triangular bead according to the working instructions
- I used spacer to ensure the minimum layer thickness
- I followed the information available in the working instructions and used the appropriate temperature for the required period of time.



Case study 3

- I don't have the safety data sheet available
- The workshop was temperature and humidity-controlled
- I observed the wettability of the plastic substrate after surface treatment, the contact angle was high
- Adhesive was removed from the refrigerator (4°C) and used immediately
- I applied a closed-circle bead
- I guaranteed alignment of substrates
- I used weights to ensure the joint closed, and let it cure at room temperature.



Case study 5

- I know how to analyse the pictograms on the adhesive container and what they mean
- There has been a heat system failure in storage room in the last winter days
- The solvent that is usually described in the working instructions ran out, so I used acetone instead
- I used a gun to mix the two-component adhesive
- My cartridge is almost empty, so I applied a thin layer of adhesive to save adhesive
- I closed the adhesive joint in one swift movement without ensuring the alignment of the substrates
- I did not use pressure to harden the adhesive joint



Case study 2

- The workshop has a good ventilation system
- The metal has an oxide layer
- I sandblasted the surface of the metallic substrate and only cleaned the surface afterwards
- The resin/hardener ratio was wrong of a two-component adhesive
- I applied two parallel beads of adhesive
- I Closed the adhesive joint in one movement from top to bottom
- I am short on time, so I increased 50°C to the advised hardening temperature.



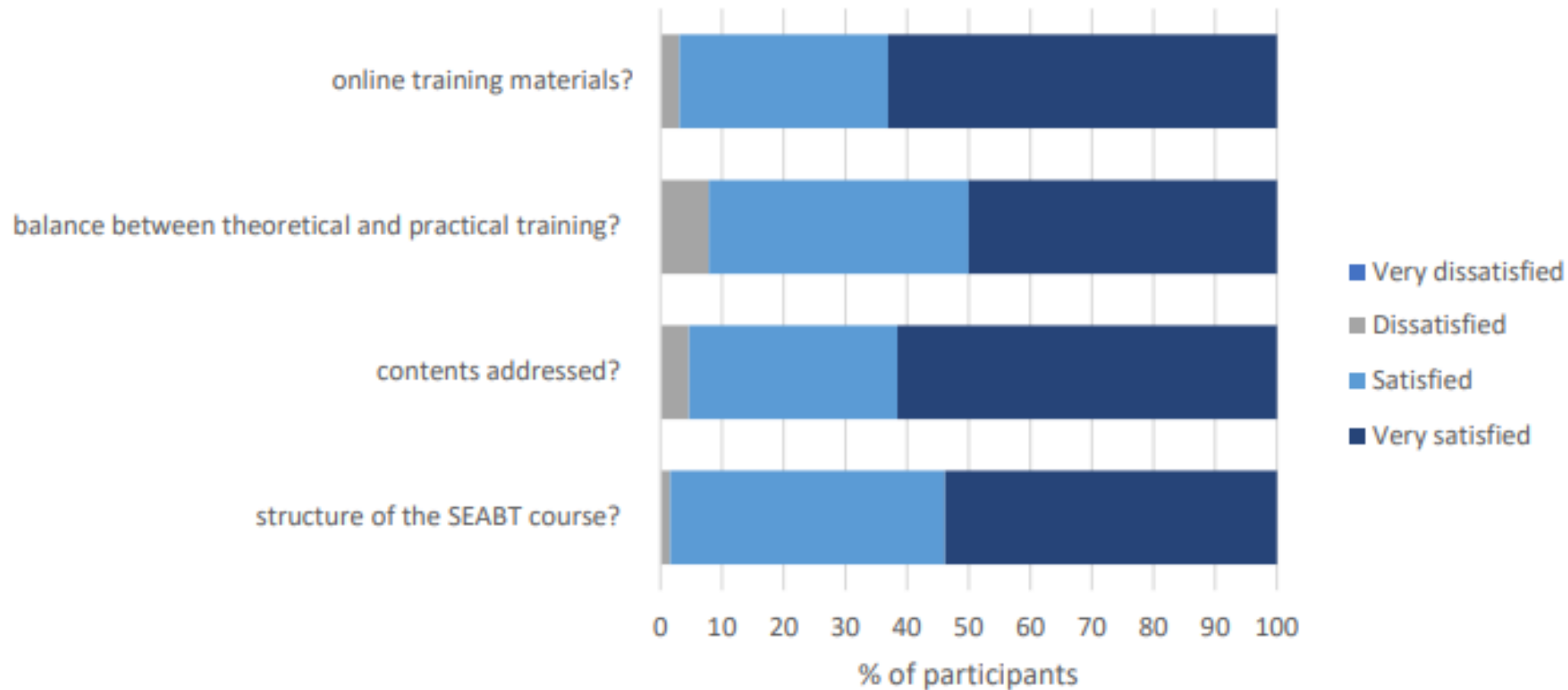
Empowering specific skills development in five countries (methodology)



TESTING OF SEABT PROGRAMME AND DIGITAL TOOLS			
Country	Profile	No participants	No feedback
Germany	Professionals from automotive industry	23	11
Austria	Workers from various industries	15	15
Slovenia	Workers from various industries	15	8
Spain	Repair/maintenance sectors of the railway industry	24	15
Portugal	Workers in various industries and students (VET/HE)	30	21
Total		107	70

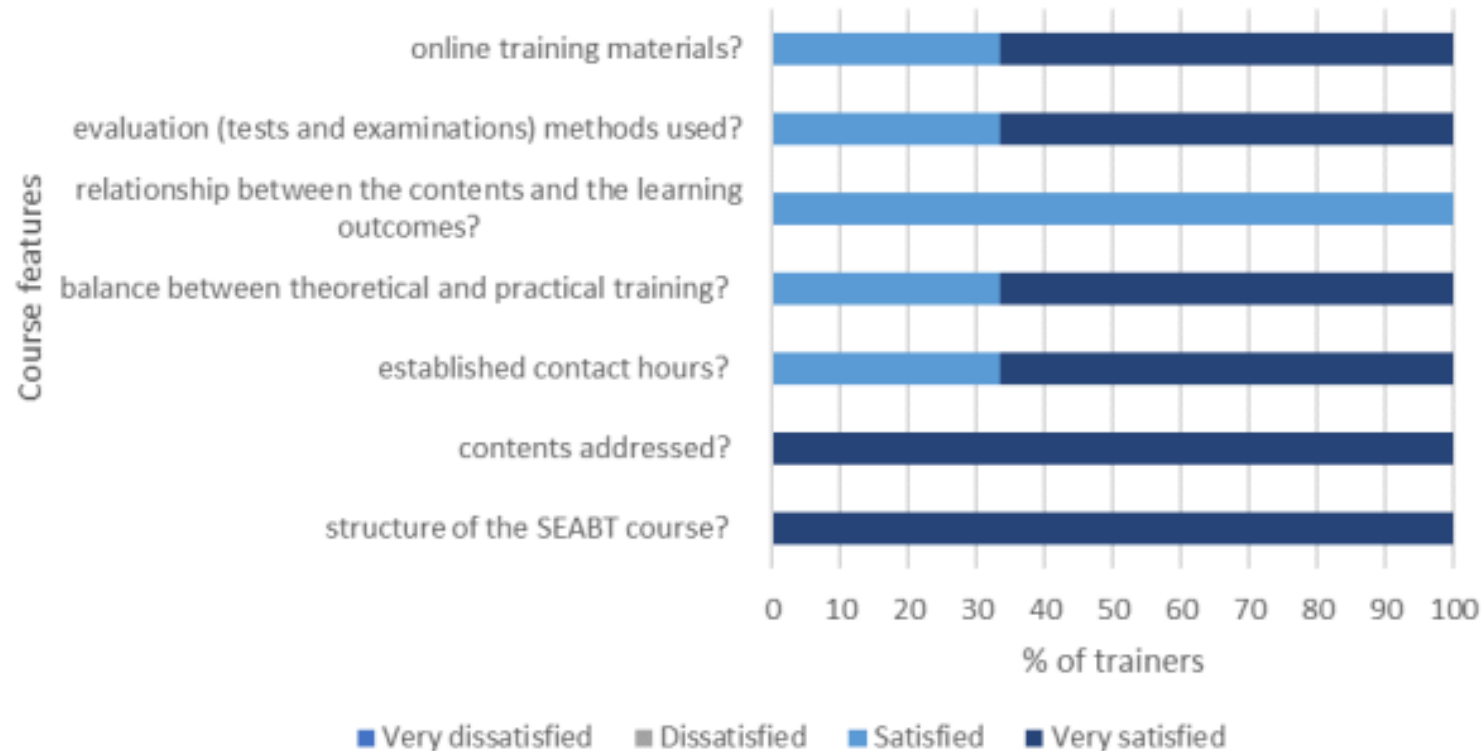
Results outreach

Overall satisfaction with SEABT course



Results outreach

Trainers level of satisfaction with the implementation of the SEABT content



Conclusion

The KNOWBOND Project was conducted in five European Community countries to improve skills in adhesive bonding.

- ✓ The study found that the project had a **significant impact on developing specific knowledge and skills** tailored for Window and Plastic Bonding activities
- ✓ The innovative pedagogical approaches used in the project **addressed previously unmet needs** within the existing training programme, enabling professionals to enhance their competence and proficiency in adhesive bonding
- ✓ The SEABT programme and digital tools used during the course were found to be **adequate and innovative** among the trainers and trainees.
- ✓ This study concluded that the KNOWBOND project's core impact relied on developing specific knowledge and skills for Window and Plastic Bonding activities, which empowered professionals to continually grow in their roles, advancing expertise in the field of adhesive bonding technology



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