Co-construction of Knowledge in Work-Integrated E-learning Courses in Joint Industry-University Collaboration

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• Industrial work-integrated learning, I-WIL
• Flexibel automation
• Welding techniques
• Machining and Additive manufacturing, AM
• Thermal Spray
The study departure from...

- The increased digitalization, automation and robotization fostering work transformations and new skills
- The manufacturing industry need continuous expert knowledge
- The possibilities with flexible e-learning education

The **ProdEx** project
(Expert in Production Technology)

**Industry-University Collaboration**
Positioning

• New industry-university collaborative forms
• New e-learning design
• Knowledge construction towards new expertise
Mutual knowledge construction university - industry

RQ How are practitioners’ experiences and research teachers’ knowledge co-constructed and integrated in case-based methodologies?
Co-construction of knowledge

• Is open-ended between actors

• Is the joint creation of a form, interpretation, activity, identity, skill, emotion, or other culturally meaningful realities (Jacoby and Ochs, 1995)

• Contextualizes sharing, and giving from two or more perspectives

• Involves a social space in and between individuals and through use of technological artifacts

• Hence, scholastic learning should adopt specific features of workplace learning and workplace development of expertise (Tynjälä, 2008)
Research context - the ProdEx project

Projects
- ProdEx I (2 years) 2014-2015
- MERIT (2 years) 2014-2016
- ProdEx II (4 years) 2016-2020

Course implementation


AU I*  Ma I*  AU I  AU I  AU I  AU I  AU I
Neg I*  Neg I  Ma I  Ma I  Ma I  Ma II  Ma II
FEM I  Neg I  FEM I  MS I  FEM I  CAD I
AU II  MS I  AU I  AU I  MS I
Ma II  AU I  AU I
FEM II  AU I  Neg I
Matl I  FEM I  CAD I

Not included
Designing standardized ProdEx courses

**Time and place**
- 2.5 ECTS (European Credits)
- 5-6 weeks duration
- Maximum 2-3 physical lectures at PTC
- 1-2 web-conferences

**Learning Platform**
- Learning material, schedule, instructions, communication

**Learning content – a blended mix**
- Labs, video, written instructions
- Written, and manual tasks
- No written examina

**Validation of work experiences**
Three case methodologies

Case 1 - Virtual digital cases
Practice PLC programming virtually.

Case 2 - On-line collaborative negotiations
Practice real life negotiation collaboratively and on-line in web-conferencing, based on participants own experiences.

Case 3 – Real workplace cases
Practicing turning and milling through a real case collected at the home company.
Case 1: Virtual digital cases

- A virtual and digital lab
- Aim to strengthening learning of PLC programming
- Designed by Camtasia
- Includes PLC logics and tasks by practicing and learning various solutions
Case 2: On-line collaborative negotiations

**Harvard Case** - Practice of online web-conferencing through collaborative negotiations based on textbook examples of a real case.

**Video Production** – Practice real life negotiation cases based on participants own experiences. Producing a collaborative video.
Case 3: Real workplace cases

Instructions: oral and some written
Task: to perform tests on turning and milling with different parameters
Prerequisites: access to a manufacturing plant with a turning and milling machine. The participants had to interrupt the daily manufacturing processes
Case 3: Turning and milling/cutting tools

**Fasförslitning SCMT 09T308-PM 4325**

- Nr of parts

![Graph showing fasförslitning for different parts with images of worn tools.](image-url)
Data collection in 12 focus groups

<table>
<thead>
<tr>
<th>Knowledge Subjects (Themes)</th>
<th>Course Sessions</th>
<th>Sessions</th>
<th>Participants</th>
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<tr>
<td>Automation</td>
<td>Industrial Automation (4) Machine Security in Robotics (1)</td>
<td>5</td>
<td>44</td>
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<td>Business</td>
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<td><strong>Summary</strong></td>
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Analysis – three categories

✓ Problems
✓ Active Learning
✓ Work-Integrated Learning
Findings - Case 1

Problems
Without former practical PLC knowledge – lack of basic knowledge

Active learning
Operator: “We've historically worked with this kind of programming so I think it's perfect. This is useful teaching material, and it's also cheaper. With time you build more models. So that you can advance…”

Work-integrated learning
In-depth knowledge of PLC programming

Virtual and digital labs stimulate high technology learning
Findings - Case 2

Problems
Initially low former practice of negotiations in web-conferencing – i.e. more used to face-to-face communications:

• Audio video problems, lack of a physical room, firewalls at companies

Active learning
Operator: “During a business negotiation, one needs to be calm, to not always claim to be right, rather to show appreciation of other perspectives than your own.”

Work-integrated learning
Human knowing and experience based knowledge was intertwined with new negotiation skills knowledge through the Harvard case.

Online web-conferencing stimulate high interactive collaboration
Findings - Case 3

Problems
Consultant: “We did not have time to find equipment to perform the lab. However, if the labs had been here at PTC I think it would have been easier.”

Active learning
Operator: “… the benefit was to take an example from the own factory.”

Work-integrated learning (WIL)
Operator: “Think we learned a good part from the demos that other participants solved. I for sure want to go into the next course, Tribology (step II). My manager wants me to continue.”

Practical cases stimulate WIL and expansive transformations
Co-construction of knowledge

Case methodologies

- Theory-based instructions
- Experience-based practices

Actors

- Practitioners (Workplace experiences)
- Research Teachers (Research-based experiences)

Work-Integrated Learning
General findings

Case 1: Virtual digital cases stimulate high technology learning but low collaboration with peers.

Case 2: On-line collaborative negotiations both stimulate web-conferencing and high interactivity.

Case 3: Real workplace cases do not stimulate e-learning (low use), but stimulate high work-integrated learning and knowledge expansion.
Conclusions

✓ Workplace versus research-based knowledge were intertwined in the cases

✓ This intertwining stimulated co-construction and work-integrated learning towards workplace transformations
Thank you!
Questions?

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