Universität Bremen

INSTITUTE TECHNOLOGY AND EDUCATION ITB INSTITUT TECHNIK UND BILDUNG

'Begleitforschung' as contributor to digitisation in vocational education and training (VET) for construction sector – Linking 'work process knowledge' to 'Industry 4.0'

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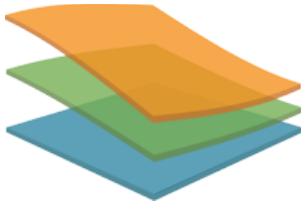
The research questions

The paper discusses the Learning Layers‘ Construction pilot and newer research on similar innovation agendas with focus on the following questions:

- What role has ‘**accompanying research’** played vis-à-vis *innovations in practice* and *knowledge development on them*?
- In what ways has the theme **‘work process knowledge’** been influential in the Construction pilot and its follow-up?
- How can the work of Learning Layers’ Construction pilot be related to **older and newer innovation agendas**?
- How can the theme **‘Industry 4.0’** be related to construction work, related training and to technology-enhanced learning?



Background of the EU-funded RTD project “Learning Layers“ (EU FP7)

Context: European programmes for ICT, Web 2.0 and learning (in work organisations)

- Early push of e-learning technologies vs. limited succes with SMEs
- Major projects with larger companies, „knowledge work“ and knowledge management technologies
- New efforts to promote web technologies to support learning in SME clusters

Learning Layers

17+3 partners

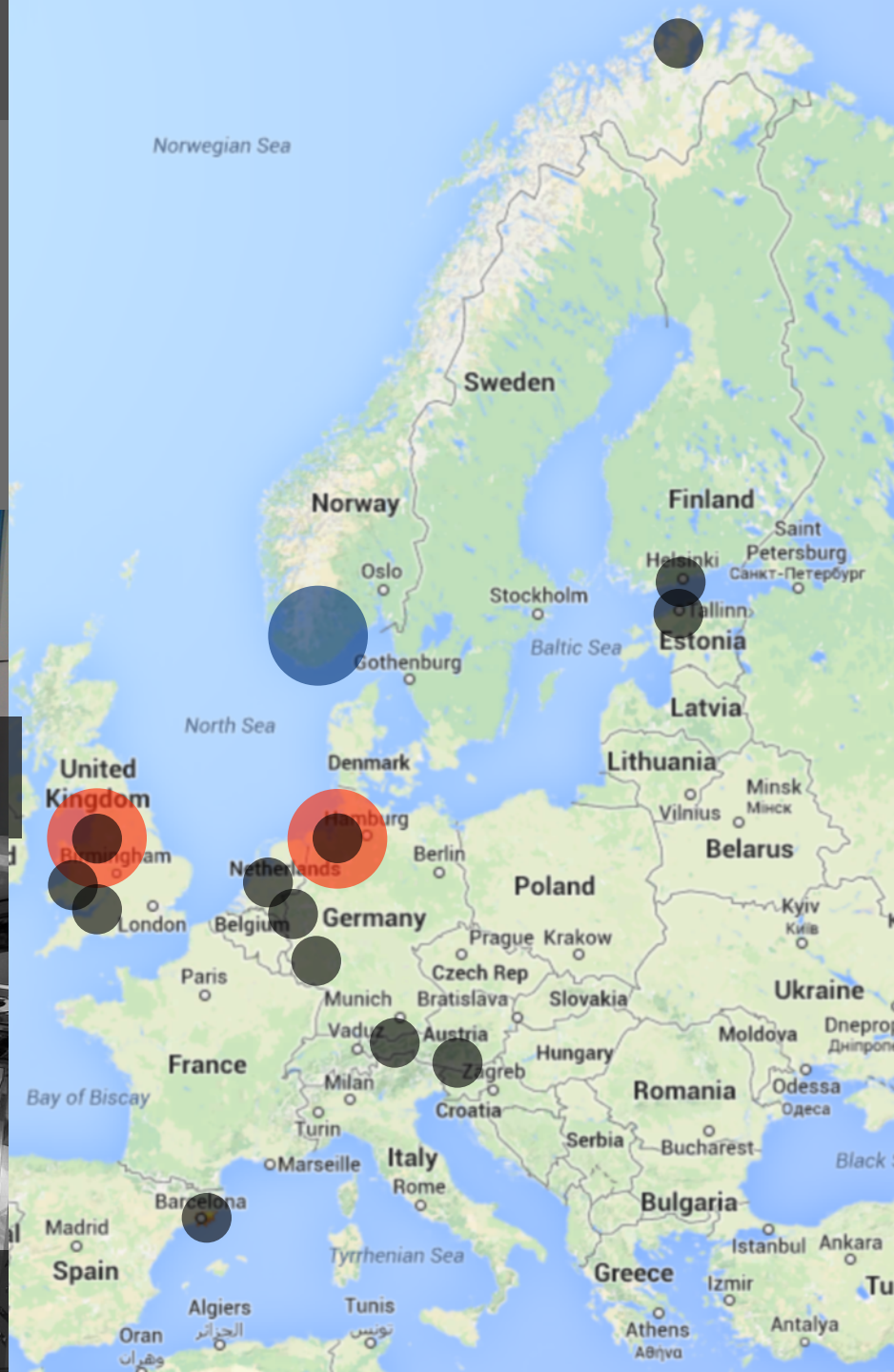
2+1 pilot regions and sectors

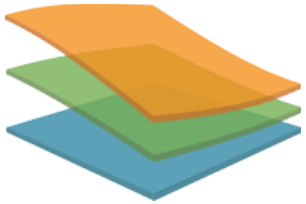
€13 MM, 30% for innovation

4 years (2012 – 2016)

Informal learning at workplace/
Use of digital media & Web 2.0

Learning at multiple levels





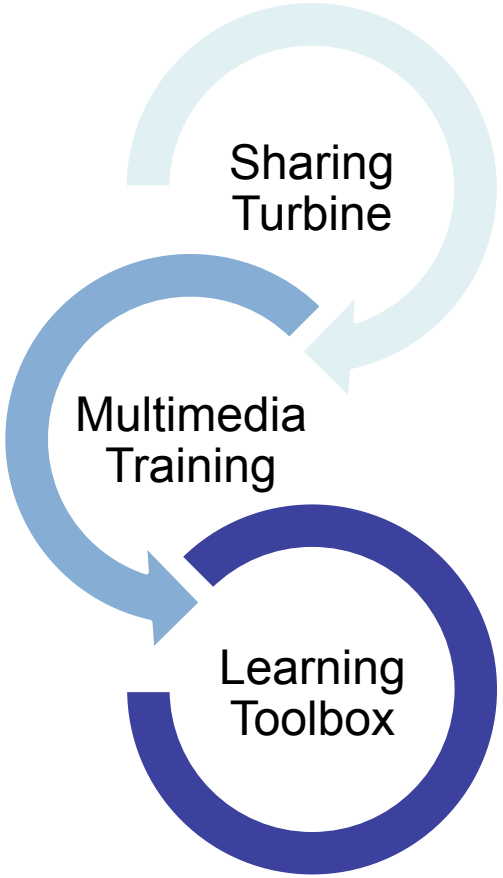
Outline of the Learning Layers' Construction pilot ...

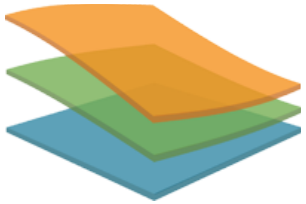
Context: Regional pilot activities with relatively open innovation agenda

- **Initial design idea** raised by *intermediate* training centre Bau-ABC (construction sector)
- **Participative design activities** involving developers, trainers, apprentices and researchers
- **Accompanying research** adjusting itself to iterative process and shifts of emphasis

… adjusting the tasks of accompanying research during the iterative processes

- Initial stakeholder interviews
- Co-design workshops => Change of design idea
- Training schemes
- Support for piloting with LL tools => Learning Toolbox
- Outreach activities
- Continuing dialogue
- Documentation and reporting



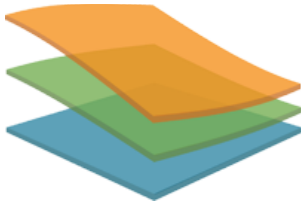


Conceptual support for project activities in the Construction pilot

Context: Learning Layers “Theory Camp” in RWTH Aachen (March 2014) – preparation, workshops and follow-up

- Revisiting the legacy of earlier approaches to accompanying research (*AuT-Begleitforschung*; *Modellversuchsforschung*);
- Revisiting the legacy of *Work Process Knowledge network*, EU FP 4, Targeted socio-economic research (1998 - 2002);
- Revisiting conceptual approaches to *action-oriented learning* (*Handlungsorientiertes Lernen*) and *self-organised learning;*

=> Commentary notes, working papers, contributions to final deliverables (Methodology documents; Scenarios and models)



Revisiting the legacy of the Work Process Knowledge network

Origins and achievements of the WPK network:

- **Case studies:** '*discovery' of learning potentials* of skilled workers, teams and cross-organisational cooperation in change processes (Boreham, Fischer & Samurçay 2002).

- *The key concept* **'work process knowledge'** - *collective, boundary-crossing and cross-organisational knowledge processes* and *patterns of collaboration* that emerged in work processes (Fischer & Boreham 2004).

- **The findings** were *brought together* and interpreted in a period that favoured *basic research* on innovations in working life. It was followed by more utilitarian research agendas and finding periods.

Making use of Learning Toolbox in vocational training and learning

Active piloting: *Getting ready to use Learning Toolbox (LTB) in selected apprentices' projects; Shaping integrative projects; Setting different pedagogic accents with Learning Toolbox*

Making use of Learning Toolbox (LTB) in workplace learning and new training initiatives

Three major strands of Learning Layers follow-up:

- **Company-specific pilot projects** with studies on different work processes (*Betriebsbezogene Analysetage*) and subsequent participative co-design workshops (Firma H.)
- **Joint curriculum design** by guest lecturers of CVT schemes and use of LTB as the learner-interface for accessing contents
- Joint development of **core curriculum** and core contents **for training** in **health and safety** *(Arbeitssicherheit und Gesundheitsschutz)* across different occupational fields

Learning Toolbox (LTB) vs. older and newer innovation agendas

How to locate the work with LTB vis-à-vis older and newer innovation agendas (see Ahrens & Gessler 2017):

a) *Humanisation of Work/ Arbeit & Technik* – remedial or counter-steering initiatives alongside the 'mainstream'

b) *Learning organisations/ Lernkultur Kompetenzentwicklung* – putting the main emphasis on organisational potentials

c) *Industry 4.0* - Emerging innovation agendas based on networked production processes and tool configurations

Reflections on 'Industry 4.0' from the point of view of social and educational research

Insights into R&D contributions to **'Industry 4.0'** from the *perspective of socio-technical design/ learning at work*:

a) **Hirsch-Kreinsen:** Techno-centric vs. socio-technic scenarios => polarisation vs. upgrading of competences (*scene-setting*);

b) **Stich, Gudergan & Senderek**: Shaping of networked production systems as chance to create new spaces for technology-enhanced learning (*project ELIAS*);

c) **Ahrens & Gessler:** Shaping work-related learning opportunities for learning-restrictive work contexts.

‘Construction 4.0’, ‘BIM’ and implications for construction work and education/training

Open questions, tensions and implications for construction work *and* learning potentials at work:

a) **‘Construction 4.0’:** Building Information Modelling (BIM) vs. Production intelligence of skilled workers?

b) **Training** for *‘lean construction competences’* or for *‘mastery of complex construction projects’*?

c) **Technology-enhanced learning** as means to support *‘lean vocational learning’* or *‘enhancement of work process knowledge’*?

The research claims

The paper has argued that the Learning Layers' Construction pilot is a special case vis-à-vis older and newer innovation agendas in the light of the following claims:

- '**Accompanying research'** has been strongly in search for *innovations in practice* to promote *knowledge development*.
- The theme **'work process knowledge'** has been central for the co-design, for the use cases and for the follow-up pilots.
- The Learning Layers' **Construction pilot as a project** has been a recent mixture of older and newer innovation agendas.
- The theme **'Construction 4.0**' is characterised by tensions re. design principles, training and technology-enhanced learning.

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