### ECER-Symposium “Construction 2.0: Concepts, Challenges and Chances for Research & Development Dialogue in the Learning Layers Project”

### Paper 1: The Role of Accompanying Research and Participative Design in the Learning Layers Project

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### Abstract

The concept ‘accompanying research’ **(***Wissenschaftliche Begleitung, Begleitforschung)*has been used in different German innovation programmes to characterise the co-participative, co-shaping and co-evaluative role of researchers. In the field of vocational education, especially the shaping of work was a central issue for this approach, e.g. new concepts for apprenticeship training in companies were developed (Deitmer et.al. 2004).

In the main examples the role of accompanying research can be characterised in the following ways:

a) In the accompaniment of “Work and Technology” programs the accompanying research was characterised by use of specific evaluation methodologies and impact analyses

b) In the accompaniment of pilot schemes (*Modellversuche*) the approaches varied from *programme evaluation* methodologies and *project-specific studies* (see Deitmer et. al 2004).

In the context of the design processes of the LL project the role of accompanying research is different from the above mentioned models. The dynamic and participative design processes are characterised by reorientations and shifts of emphasis. This poses specific demands for participative workshops, documentation of the findings and reuse of the materials. This paper provides insights into the development of accompanying research approaches alongside participative design processes in the construction sector.

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### 1. Introduction

This paper has the task to give a picture of the evolution of the *accompanying research* approach of the German research team from ITB that has been working in the EU-funded Learning Layers project. The ITB team has been involved in pilot activities to develop and use web resources and mobile (learning) technologies to support workplace learning in construction sector in North Germany. The main application partner has been the intermediate training centre Bau-ABC alongside partner enterprises and sectoral organisations of construction industry or craft trade companies.

**Firstly**, in order to understand the given task, it is essential to look at the background developments in European and national projects to promote use of ICT, e-learning and web resources in working life and workplace learning. The experiences with prior programmes and projects have led to an evolution of funding priorities and project designs from simplistic technology-push approaches to more complex co-design projects with multiple expert organisations and relatively open innovation agendas. **The second main** section provides insights into this background and to the initial starting points of the Learning Layers project.

**Secondly,** it is essential to look at the tradition of accompanying research (Begleitforschung) as special mode of institutionalised action research in German innovation programmes since the late 1970s and early 1980s. Here, it is essential to note the slightly different developments in innovation programmes and pilot projects in working life (e,g, on Work and Technology) and in vocational education and training (single pilot projects or national innovation programmes). From ITB point of view it is essential to reflect on the experiences with networked innovation programmes and the interaction between particular pilots, accompanying projects and joint knowledge development activities). These experiences, parallel developments elsewhere in Europe and their relevance for accompanying research activities in the Learning Layers project are discussed in the **third main section**.

**Thirdly,** it is essential to give insights into the participative design activities of the Learning Layers project in construction sector - in particular the ones launched with Bau-ABC. The evolution of the co-design process via different phases and iterations provides a specific challenge for accompanying research. These process dynamics and the contributions of accompanying researchers are discussed in **the fourth main section**.

**Fourthly,** on the basis of these background explorations it is possible to give insights into the of specific interventions of accompanying research team. Here, the User Survey (on uses of web and mobile technologies) has already implemented at an early phase, whilst a set of evaluation activities is being planned for the subsequent phases. These interventions are discussed **in the fifth main section**.

**Finally,** in the light of the above, the picture of the shaping of the accompanying research approach needs to be reconstructed as a dynamic learning process in which the conceptual and methodological impulses as well as the participative design and transfer activities require flexibility and creativity. These issues are discussed in the concluding remarks of **the sixth main section**.

### 2. Giving shape for research activities and stakeholder engagement in the Learning Layers project

This section discusses the background for shaping of the tasks of the (accompanying) research team of ITB within the LL project activities in the North-German construction sector. Here it is worthwhile to look, how the funding priorities, project formats and research approaches have been developing in programmes that have focused on the use of ICT, web and e-learning in working life and workplace learning. Without going into details it is possible to explore some key questions to see, what shifts of emphasis have occurred and and what lessons have been learned. Below, these will be assumptions of the project team. In the initial phase of the project these have guided the shaping of research activities and the stakeholder engagement in the selected sectors:

1) What was the background for developing the project concept of the Learning Layers and how does it differ from the above mentioned innovation programmes?

2) What are the specific characteristics of the innovation concept promoted by the Learning Layers project and how does it differ from the ones promoted in the previous programmes?

3) What lessons have been learned with recent predecessor projects that have focused on use of multimedia, web resources and mobile technologies in VET?

4) What have been the implications from the above mentioned starting points for shaping the research activities and the stakeholder engagement approach in the Learning Layers project?

#### **2.1. Early projects on ICT, learning technologies and SMEs**

One of the major shifts in European project landscape was provided by the breakthrough of learning technologies to promote remote learning, open distance learning or e-learning by the year 2000. At that time there was a latent assumption that wider use of such technologies and learning arrangements would open new learning pathways and career models for people in working life. In this respect the European Commission launched specific funding for projects on e-learning and on uses of ICT for learning. A particular concern was the limited use of such learning provisions by SMEs. However, the projects that had the aim to promote e-learning provisions did not seem to be successful. As a contrast, the projects that were exploring the uses of ICT to support learning, gave a different picture. They drew attention to more incremental uses of ICT resources to support knowledge acquisition and learning in the context of work.

#### **2.2. Major research projects on web-supported knowledge processes in organisations**

In the next phase major European research funding was allocated to projects that sought to promote (informal) organisational knowledge processes with web tools and specific software solutions. However, these projects were looking primarily at knowledge-intensive work processes and ‘knowledge workers’. Parallel to this, the attention to web technologies was mainly looking at knowledge development and knowledge management from the organisational perspective. Gradually it became clear that they had not addressed the underlying level of occupational work. This has given rise to new priorities that have sought to support occupational sectors that have made less use of web resources. In addition, this called for additional efforts to develop web tools and software architectures.

#### **2.3.Regional projects on multimedia, web and mobile technologies in the field of VET**

A third set of predecessor projects has focused on the use of multimedia, web tools and mobile technologies in the context of work, workplace learning or informal learning. One of these projects has engaged young people in transition from school to work (and looking for vocational learning opportunities) to work with videos to make their capabilities visible (draufhaber.tv). One project has piloted with regional platform for apprentices as means to support their workplace-based learning (expertAzubi). One project has piloted with specific mobile devices designed to be used at construction sites to support communication, knowledge sharing and learning in work contexts (Vila-b). Altogether, these projects concluded that the introduction and use of such technologies cannot be based on the assumption that young ‘digital natives’ would immediately take these as their own tools to be used. In all cases it appeared that there is a need for wider acceptance and perception of clear benefits from the use of the technologies.

#### **2.4. Implications for shaping research activities and stakeholder engagement approach**

Taking into account the developments in earlier projects and lessons learned by the promoters it is apparent that the Learning Layers had to face several new challenges to r*each the targeted user organisations*, to *develop rich and flexible innovation concepts* and to *engage individual users* in such a way that the *innovations can be scaled up* and promoted beyond the initial pilot regions. Here it is worthwhile to emphasise the following points:

* The Learning Layers project needed to change the picture of a ‘technology push’ project that tries to promote pre-defined technologies. Instead, it had to find ways to engage the targeted user organisations (SMEs in construction sector) to mutually interesting and beneficial co-design processes.
* The Learning Layers project needed to abandon the traditional one-way communication between technical developers and users of technologies. Instead, it had to find ways to overcome a situation in which users don’t know the potential of developers, whilst the developers are not aware of the contexts of users’ needs.
* The Learning Layers project needed to change the picture of insular innovations by mobilising the application partners as multiplier organisations. This, however, requires that the innovations are sufficiently consolidated and that the practitioners in construction sector have trained themselves as peer tutors and peer mentors.

Altogether, the Learning Layers chose to work with a relatively open innovation agenda that gave much room of manoeuvre for participative design processes (that were supported by manifold expertise). The processes were expected to clarify the preconditions for introducing innovative solutions and enhancing the users’ capabilities. In such a process the research teams that were supporting the sectoral partners - in this case the ITB team supporting the construction sector partners in North Germany - had a role of accompanying researchers.

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### 3. Revisiting the contribution of accompanying research in prior German innovation programmes

#### **3.1. The background and development of ‘accompanying research’ in Germany**

### The concept ‘accompanying research’ (*Wissenschaftliche Begleitung, Begleitforschung)* has been used in different German innovation programmes to characterise the co-participative, co-shaping and co-evaluative role of researchers. In the programmes of promoting *socio-technical innovations in working life* (*Humanisierung der Arbeit, Arbeit und Technik* and their follow-up programmes from the late 1970s onward) accompanying research projects have had the task to evaluate the impact of the programmes on quality of working life and on social participation of employees. In the field of *vocational education and training* (VET) the use of accompanying research has been a mandatory condition for pilot projects since the early 1980s onward.

### For the research institute ITB the two main contexts for participating in accompanying research have been the Bremen regional innovation programme in Work and Technology (*Landesprogramm Arbeit und Technik* in the late 1980s and early 1990s) *and* the nation-wide innovation programme in (VET) (*Neue Lernkonzepte in der dualen Berufsbildung* from the mid-1990s to 2003). A general overview on the former programme is provided by Rauner & Oehlke and on the latter one by Sloane in the Handbook of TVET Research (Rauner & Maclean 2008). More specific insights into such programmes and into the role of research on the Work and Technology context is given by Deitmer (2004) and on the programme on new learning concepts in VET by Deitmer et al. (2004). A more overarching assessment on the role of such pilot projects in transfer of innovations has been provided by Rauner (2002).

#### **3.2. Role of accompanying research projects in earlier programmes and projects**

In general terms accompanying research has been carried out in a policy context in which pilot projects or innovative initiatives are carried out with an attached research project. Here, it is worthwhile see, how functions like *process consultancy*, *implementation research* and *evaluation research* have been distributed between the programme coordination and individual projects and how this has influenced the research culture:

* Local accompanying research projects **in the earlier innovation programmes in working life** were set up case by case. Some of the projects focused on introducing technical changes in the work environment or new tools. The role of the accompanying researchers was to assess the impact without major involvement in the process. Other projects were introducing new modes of social participation and co-designing of work tasks by the workers. In such projects the role of the researchers included more intensive participation, critical feedback and clarification of the views of different parties.
* Accompanying research projects **in single pilot projects in VET** have been set up as formally independent from the local project promoter (*Versuchsträger*) and from the public funding body. At an earlier stage the reports were clearly separated - the researchers made interim observations and assessments. At later stage the project designs became more complex (involving several parties) and more participative and interactive role of researchers was needed for getting an overview of process development and achievements in different phases or contexts.

#### **3.3. Role of accompanying research in networked programme frameworks**

As a contrast to the above mentioned earlier programmes, the later programmes were characterised by more intensive support from coordination units and by internal networking and joint knowledge development across the projects. Therefore, it is worthwhile to have a closer look at the distribution of responsibilities and modes of cooperation.

* The responsibilities for research-based accompaniment in the Bremen regional programme (*Landesprogramm AuT*) were distributed between different levels and different actors. Altogether, the programme coordination unit (*Projektträger)* was in charge of recruiting, selecting and general monitoring the projects, whilst thematic accompanying research projects were responsible for reporting on domain-specific goal-settings, implementation and impact. However, in this programme, there were intermediate events and evaluation workshops in which different actors contributed to a joint assessment of regional progress. Finally, an overarching synthesis report (Deitmer 2004) was produced on the basis of all these activities.
* The nation-wide innovation programme on new learning concepts (*BLK-Programm NLK*) was also characterised by distribution of responsibilities. Thus, the coordination units (*Programmträger*) were responsible for the general coordination of pilot projects, on organising joint evaluation workshops and on launching thematic synthesis studies across the programme. The pilot projects had their own accompanying research projects. This programme was characterised by interaction between accompaniment of the processes in the pilots and evaluation of processes at the programme level. Altogether, the aim was to promote common understanding on the implementation of the pedagogic innovation concept (*Lernfeldansatz*) across the Federal States and among different parties involved. (For the final documentation, see Deitmer et al. 2004, for the internal dynamics see the archived website <http://www2.itb.uni-bremen.de/projekte/blk/programmtraeger.htm>.)

#### **3.3. Growth of knowledge via accompanying research**

Although there is a relatively long tradition of using accompanying research to support innovation programmes and pilot projects, the status of such research has been overshadowed by tensions and controversies:

* The first issue is related to the **affiliation of the research themes with the project promoters** (Versuchsträger) **and with the innovation programmes**. In spite of the claim of being independent, there have been doubts that the research projects tend to give a positively biased picture on policy implementation (in general) and on the success of the pilots (in particular). However, looking back at some reports of accompanying research projects it is clear that they have been essential sources for specifying internal tensions, conflicts of interest and organisational limits to successful piloting.
* The second issue is related to the l**evel of conceptualisation that can be reached in such projects**. Here, the researchers’ positions have not been unified. Some of them have emphasised the task of ‘responsive evaluation’ and given priority to provide of responsive feedback to stakeholders within the projects (even with the risk of being lowly rated in terms of conceptual and methodological rigour). An opposite position is that of ‘systemic evaluation’ that tries to use systems theory (e.g. the one of Luhmann) as an overarching explanatory and interpretative framework (even with the risk of losing context-specificity). (See on these contrastive positions Dehnbostel 1995 and 1998). Here, it is apparent that these two positions do not reflect the whole variety of accompanying research approaches. Much of the conceptual literature on new pedagogic approaches (*Leittextmethode*), cooperation across learning venues (*Lernortkooperation*) and new curriculum concepts in VET (*Lernfeldansatz*) draws upon the work of pilot projects and accompanying research.
* The third issue on **transferabilty of innovations studied by the projects** is even more complex. Partly the justification of the pilot schemes and of the accompanying research was the expectation to get a sufficient knowledge-basis to promote transfer of innovations. Here, it is worthwhile to note that the expectations have shifted from simple assumptions to more demanding ones. Thus, the early pilot projects were expected to become ‘light towers’ of innovations supported by the publications and dissemination measures of accompanying research. Consequently, other interested organisations were expected to adapt to the publicised good practice. In later programme-related pilots the expectation had shifted towards creation of innovation networks and mutually supporting initiatives. These were expected to provide critical mass of innovators to promote wider outreach and dissemination of innovative practice. Regarding the earlier and the later expectations, the accompanying researchers tended to create more knowledge on the limits to transfer rather than of preconditions for successful transfer (see Rauner 2002, Dehnbostel 2005 and Sloane 2008).

#### **3.4. Accompanying research in a wider group picture**

The sub-sections above have discussed ‘accompanying research’ which can be interpreted as a particular German institutionalisation of ‘action research’ within innovation programmes. Looking at developments in other countries, it is clear that the early action research projects of Thorsrud and Emery with focus on socio-technical innovations and industrial democracy can be seen as predecessors of both German and Scandinavian programmes in working life. In particular the Norwegian and Swedish policies for promoting health and safety legislation and industrial participation with co-participative projects (e.g. HABUT and LOM programmes) have been widely renowned. Here, it is worthwhile to note the different roles given to action research in the Scandinavian and German programmes on working life. In the Scandinavian programmes researchers tried to facilitate democratic dialogue (between employers and employees) emphasising local innovations captured by ‘local theories’. As a contrast, the German programmes sought to promote broader regional or sectoral spread of innovations. Accompanying research was expected to provide a conceptual basis for wider transfer.

In the context of educational research the concept of ‘action research’ has often been linked to movements in which teachers take a double role - as active practitioners and as conceptual interpreters of their own practice. In the context of organisational development ‘action research’ has also been widely used. However, these approaches have tended to highlight particular intervention strategies as means to facilitate innovations and changes (e.g see the work of Engeström and his teams). As has been indicated above (see section 2.4), the Learning Layers chose to work with a relatively open and flexible innovation agenda that relied very much on practitioners’ and developers’ interaction in participative design processes. In this respect the accompanying researchers had to engage themselves as co-participants and facilitators in the process and adjust themselves to changes. At the same time they had to consider, how their interventions and interpretations could give a more transparent picture of the process and support the desired outreach and scaling up of innovations. In this way the researches could build upon the work of accompanying research in networked programmes but had to work with a more open research agenda.

### 4. Accompanying research as support for participative design processes

#### **4.1. Accompanying research as part of the participative design process**

This sub-section gives a picture of the role of accompanying research within participative design processes of the LL project in Bau-ABC. Here the emphasis is given on researchers’ involvement alongside the developers of software solutions and the application partners from the construction sector (apprentices, full-time trainers and company representatives).

**a) The design idea *Sharing Turbine:* Transition to digital learning resources**

As one of its main events of the first year, the LL project organised a Design Conference in Helsinki in March 2013 to discuss the emerging design ideas and to give shape for consortium-wide design teams.

* In this context the application partners from Bau-ABC raised the initiative to digitise the White Folder - the main learning resource of their apprentices.The White Folder had been designed as a learners’ instrument consisting of worksheets with which they prepare, plan, report and assess their projects in the training centre. Since the documentation was paper-based, the White Folder became a bulky document that was difficult to use at workplace.
* In the LL Design Conference in Helsinki a specific working group focused on this issue and created a complex picture of manifold innovations. In this picture the introduction of new learning technologies and software solutions was linked to the underpinning pedagogic concept and to cooperation between different learning venues (companies, training centre and vocational schools). This complexity was also reflected in the decision to name the design initiative as “Sharing Turbine” (see diagram 1 below). The work of this group provided the basis for the first phase of local co-design workshops that were mapping the context and exploring points of intervention (see section 4.2).
* In the local design work it became soon clear that the digitisation had to be started with some selected trades that could serves as pilot areas for rapid prototyping *(= Rapid Turbine*). In this context the working and learning projects in trade - the pipeline builders (*Rohrleitungsbau*) were explored more closely. The design process made efforts link multimedia, Web 2.0 tools and mobile Apps to support these projects.

**b) The second pilot phase *“Learning toolbox”*: Focus on supporting ‘toolbox’**

In a relatively short while the work with the digitisation agenda revealed that the approach would require far more technical support to produce coherent software solutions. This led to a shift of emphasis from the overall digitisation of the document base to the development of ‘toolbox’ to manage mobile apps and web services:

* Whilst the idea of the *Learning toolbox* emerged from the work with the apprentices’ White Folder projects, the possibilities for customisation were designed to enable other uses (e.g. in optimisation of work processes and work-related knowledge sharing).
* Thus, the toolbox was being developed as an integrative framework to be enriched with QR-tags and other means to access web resources. This phase brought into picture new challenges for the hitherto practiced workshops as well as new kinds of workshops for new target groups (see 4.2.).

#### **4.2. Development of the joint workshops in different phases of the design work**

The sub-section above has outlined the development of the participative design work in different phases. Concerning the role of accompanying researchers, it is worthwhile to take note on the different types of workshops that have been used in the successive phases.

**a) Workshops supporting the ‘grounding’ of the design idea *Sharing Turbine***

After the Design conference the accompanying researchers organised workshops in Bau-ABC involving apprentices, full-time trainers (*Lehrwerkmeister*) and management representatives.

* The first workshops were *Conversational workshops* that served had the aim to map design-relevant issues. These workshops were organised separately for apprentices and trainers and they brought into discussion problems, deficits and hints to possible solutions.
* In the next phase apprentices and trainers participated in separate sessions of *Storyboard workshops.* They prepared posters that visualised their characteristic working days (both in the training centre and in companies). These workshops helped to specify critical issues, gaps of communication, needs for knowledge sharing and points of intervention.
* In the transition from the ‘grounding’ phase to more specific pilots the workshops with the trainers were organised more directly as *Co-design meetings* that gave insights into selected pilot areas and project tasks.
* Parallel to the more focused phase in the design work (the *Rapid Turbine* initiative) the project team identified a general need to promote the multimedial skills and literacy of the trainers. This gave rise to specific *Multimedia training workshops.*

**b) Workshops supporting the development, enrichment and use of *Learning toolbox***

When the design work shifted the emphasis to the *Learning toolbox*, this brought into picture new types of workshops and stakeholder talks. It also provided new challenges for the development of multimedia training:

* For the **development** of the *Learning toolbox* it is important to organise short *Demonstration workshops* and *Stakeholder talks* to get insights into possible uses and needs of companies, trainers and apprentices (with focus on different trades). This kind of workshops and talks have been started in the context of the *Brunnenbauertage* fair (May 2014) and alongside the Learning Layers project consortium meeting (June 2014).
* For the **enrichment** of the *Learning toolbox* it is important to link also demonstrations of other tools (e.g. of the Learning Layers project) to the workshops or stakeholder talks. In this way the role of the Learning toolbox as an integrative framework becomes more transparent. This kind of setting of parallel demonstrations was piloted in the Demo Camp alongside the Learning Layers project consortium meeting (June 2014).
* For **reflective use** of the *Learning toolbox* it is important to develop the Multimedia training workshops into more focused sessions that link the toolbox, relevant apps and web tools and a challenging work situation to each other. Moreover, it is has pointed out to be helpful to use of peer learning and peer tutoring in the preparation, implementation and follow-up of the multimedia training sessions. (Currently these issues are discussed as a part of the preparation of more targeted pilot workshops and outreach workshops in collaboration with the application partners.)

#### **4.3. Role of accompanying researchers in the documentation of the processes**

The project dynamics - both in the design processes and in the workshops - has provided specific challenges for the accompanying researchers. The researchers have had to cater for the documentation of the processes - both for the sake of basic activity reporting and for the interpretation and (secondary) analysing of processes:

**a) For basic activity reporting** researchers have used the following tools:

* Logbooks of *Minutes of local design meetings* provide a record of planning activities.
* Logbooks of *Reports on co-design workshops* provide detailed information on interactive events with apprentices, trainers and other representatives of application partners.
* *“Design team stories”* have been used to present the evolution of design processes during a longer period of time.

**b) For interpretative and analytical documentation** researchers have used the following:

* Logbooks of *individual blogs* have been used to highlight or review certain episodes and series of activities.
* *Individual reports* have been used to describe in detail internship-like field visits of researchers in application partner organisations (e.g. the participation of two researchers in clay-building course of an application partner organisation *or* the ‘internship’ of one researcher working one day with an apprentice in Bau-ABC).
* Logbooks of *Exploitation meetings and stakeholder engagement events* provide insights into planning, implementation and reviewing of major exploitation and outreach activities.

The first set of reports - collected in cumulative logbooks or compressed into design team stories - has served the purpose of keeping the track of the developments during the dynamic processes. The second set of of documents has served the purpose of analysing and interpreting certain episodes of project work *or* drawing conclusions for forthcoming activities.

Altogether, the role of accompanying researchers *within* the participative design process has been characterised by documentary interpretation and facilitation of the dialogue between developers and practitioners (apprentices, trainers and management) of Bau-ABC. Thus, researchers have not taken very interventionist roles and the process has been shaped jointly. Neither have the researchers tried to capture the early phases of the process with conceptual interpretation. This is partly motivated by the fact that Bau-ABC is an intermediate training centre and a multiplier-organisation. Via Bau-ABC the project seeks to engage craft trade companies and supplier enterprises to work with the tools, services and applications that the Learning Layers project is developing. In this respect the accompanying researchers have further challenges in preparing the outreach activities, in supporting the engagement of stakeholders from enterprises and in analysing the subsequent processes. Thus, the progress documented so far needs to be linked to the further targets for ‘scaling up innovations’ in the construction sector.

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### 5. Specific interventions and evaluative activities of accompanying researchers

The previous section has discussed the role of accompanying researchers within the participative design process as team members responsible for documentary interpretation. This section outlines a picture of specific interventions - the User Survey (implemented in 2013) and the evaluative activities (that are being prepared for the next phase).

#### **5.1. The User Survey carried out with apprentices**

Parallel to the design activities the accompanying researchers carried out in autumn 2013 u User Survey in collaboration with the applicant partner organisation Bau-ABC. The survey focused on the use of mobile devices by apprentices in the building industry and was. The questionnaire covered the following issues:

* The type of mobile devices used,
* Access to internet,
* The use of mobile devices at different learning venues,
* Usage patterns,
* Knowledge and use of existing work-related apps,
* Preferred formats for information retrieval and communication.

The interim analysis was based on the first 581 respondents drawn from 16 occupations in the building industry and crafts. The respondents’ ages range from 15 to 35. Most are in the first or second year of their apprenticeship, as this was the group easiest to access in early autumn. (Although third year apprentices subsequently completed the survey, there appeared to be no significant difference in the overall picture.)

Of the 581 respondents, a high percentage of 86,7% use a smartphone. The use of previous generations of mobile phones (18,1 %) is clearly becoming outdated. Within this group. 19,4% own a tablet computer, 59,7% a laptop, 54,7% a desktop computer. Six of the respondents (0,5%) do not have any of these devices. The great majority of users (78,3%) are connected to the internet via their private smartphones. Despite this, the use of mobile devices is not encouraged by employers: only 1,9% of employers provide access to the internet and only 27% of employers allow the use of smartphones at the workplace. Yet, the respondents indicated that smartphones are used for acquiring work-related knowledge, through personal communication or from the internet. These activities are to a large extent carried out in the apprentices’ own time. 20% of the apprentices use their smartphones to make work-related photos and videos for documenting their practice.

The questionnaire presented the apprentices a list of different apps that can be used for workplace-based learning. Some of them were popular consumer applications. Others were designed for specific work situations in the building industry (measuring noise etc.), and some provide information on health and safety. The apprentices who knew about the apps, had made little use of them. WhatsApp was the only one with significant usage, maybe because apprentices use it to make short videos of their work and learning tasks at the training centre.

The User Survey was launched as a quick inquiry to get first-hand information on the use of mobile devices in the context of work and workplace learning. Thus, it was not designed to provide a basis for an in-depth research on uses of mobile (learning) technologies. Yet, given these limitations the User Survey has proven to be a useful intervention since it has drawn attention to the following contradictions:

* The questionnaire provided a wide range of apps for construction sector. Yet, the apprentices knew few of them and had not used most of the ones they knew of. Instead, they had made more use of the basic functions of smartphones (messaging, taking photos, recording videos) to support their work and learning.
* Employers, vocational schools and training centres tend restrict the use of smartphones (as distraction from work and learning). Yet, the apprentices indicated that they make use of smartphones to support work and workplace learning. Several apprentices gave their e-mail addresses to be contacted later on this issue. (In a similar way several groups of apprentices expressed their interest in being involved in further piloting with the Learning Toolbox during the Demo Camp workshops (see above 4.2.).

#### **5.2. Evaluative activities designed for the construction sector field activities**

Whilst the User Survey has been implemented at a relatively early phase of the design activities, the accompanying research team has needed more time to prepare the evaluative activities. Here, as a contrast to the earlier mentioned innovation programmes with accompanying research projects, the evaluative activities need to be linked to more open innovation agendas with wider outreach activities.

In such a context the evaluation approach needs to take into account the processes and interactions in the design process and in the outreach activities as well as in the organisations involved. Thus, it is not enough to concentrate on the evaluation of outcomes of design processes and use of the learning gains in immediate pilot contexts. The aim here is to analyse what are the aspects enabling and constraining individual and organisational learning processes in the context of promoting innovations.

From this point of view it is possible to outline a working agenda for developing the evaluative activities taking into account the following aspects:

a) evaluation of participative design and transfer-promoting activities,

b) evaluation of the impact of new tools on the multimedia and web capability of participants,

c) evaluation of the impact on the overall picture of occupational competences.

**a. Evaluation of participative design and transfer-promoting activities**

Concerning *process evaluation*, the Learning Layers project can build upon the participative evaluation approach that was already used in the above mentioned German innovation programmes on Work and Technology and on New Learning Concepts. This approach explored the attainment of innovation goals (at the programme level) and ownership of innovations (project level) with a questionnaire and a participative workshop. This approach has been developed further in several European projects on co-design and co-participation. Concerning the innovation agenda of the Learning Layers project, the main challenge for using such an approach is to capture the co-design processes in initial pilot contexts, the transfer-promoting activities in further organisations *and* the role of multiplier organisations.

**b. Evaluation of the impact of the new tools on the web capability of participants**

Alongsdide the process evaluation, the accompanying research team in construction sector is interested in evaluating the impact of the new new tools (in particular of the Learning Toolbox) that are being piloted. One of the key points here is to bring into concept a wider interpretation of web capability (*Medienkompetenz*) that is not reduced to user-skills (of given tools) and media literacy (on given apps and services). The wider interpretation requires insights into the incorporation of web and new media into work processes in organisational contexts.

**c. Evaluation of the impact on the overall picture of occupational competences**

In addition to the task to evaluate the development of web capabilities (*Medienkompetenze*n) of the participants in the pilot activities, the accompanying research team has a further challenge. Although the Learning Layers project is mainly addressing informal learning as promoter of wen capability, the German pilot activities rely to a great extent on interfaces between formal and informal learning. This refers both to the initial training of apprentices (at construction sites, workshops and schools) and to continuing training (alongside occupational career). In this respect it is appropriate to bring into concept, how the web capability can be incorporated into a holistic model of occupational competences. This provides the basis for evaluation on the acquisition of competences in different phases of occupational career.

### 6. Concluding remarks

The task of this paper has been to outline the role of accompanying research within the Learning Layers project and its pilot activities in the construction sector. The EU-funded projects is a dynamic R&D project that has relied on participative design processes in order to promote the development and use of web resources and mobile technologies to support (informal) learning in construction and healthcare sectors. In this paper the emphasis has been on the evolution of the activities of the ITB research team during the process. In this context reference has been made to the tradition of ‘accompanying research’ as a specific institutionalised mode of action research in German innovation programmes. For ITB this European project has provided specific challenges to develop the approach further.

Below the learning journey of the ITB team with shaping its own research approach is reconstructed as key messages. These reflect the adaptation of conceptual, methodological and practical impulses from prior innovation programmes and *projects as well* as adjustment to new contextual boundary conditions in the project activities within construction sector:

**1. Key message: Initial shaping of the project concept of Learning Layers:**

In the initial phase the key achievement of the consortium was toovercome one-sided technology-push approaches and simplistic assumptions on the adaptability of web tools and software solutions that seemed context-relevant. The interim conclusion for the whole project was to launch participative design processes with relatively open innovation agendas and to allow several iterations. The interim conclusion for the ITB team was to support the interaction of different parties in the parties and to facilitate the search for appropriate solutions.

**2. Key message: Building on prior accompanying research in innovation programmes:** When looking back to prior experiences with accompanying research, the ITB team saw less similarities with the earlier cases with single pilots and local accompaniment. Instead, the emphasis was given on the more *networked* innovation programmes (Work and Technology, New learning Concepts) in which the coordination units supported mutual learning across the projects, *knowledge sharing* and *outreach activities*. The interim conclusion for the ITB team was to look for opportunities to engage professional organisations and networks on the participative design process and to promote targeted outreach activities.

**3. Key message**: **Adjusting the documentary and interpretative contributions to the process dynamics of participative design:**

During the design process (with manifold workshops) the ITB team has been responsible for the real-time documentation of the events and subsequent interpretation of the steps taken. In this way the research team has provided a basis for joint reflection and process-awareness across different parties involved. The interim conclusion for the ITB team is that such material provides a basis for deeper conceptual interpretation of the design and transfer processes.

**4. Key message: Adjusting research interventions to further development of design and transfer processes**

In general, accompanying research is being legitimated as evaluation measure. Yet, in the light of the dynamics of the design process - and taking into account the goals for scaling up innovations - it has been appropriate to delay the evaluation measures. Instead, the first intervention has been the user survey to get facts on uses of smartphones or mobile devices in work and workplace learning. The interim conclusion for the ITB team is that the evaluation activities need to grasp the initial pilot contexts, the potential transfer contexts and the role of multipliers and peer tutoring and/or peer learning.

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### News articles on the Learning Layers project

**Article series: Milestones in co-design and user engagement activities of the LL project**

by Pekka Kämäräinen

<http://learning-layers.eu/recent-progress-with-learning-layers-activities-in-the-construction-sector>

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Article 2: [Co-design process from “Sharing Turbine” to “Learning Toolbox”](http://learning-layers.eu/co-design-process-from-sharing-turbine-to-learning-toolbox/)

Article 3: [LL project goes to Brunnenbauertage with the “Learning Toolbox”](http://learning-layers.eu/ll-project-goes-to-brunnenbauertage-with-the-learning-toolbox/)

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