

## Towards a Design Research Framework for Designing Support for Informal Work-Based Learning

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**Abstract.** This workshop aims to bring together different experiences of various design approaches for active and early scaling up of the appropriation of tools and practices. There exists, many Design Research approaches for developing TEL, but synthesising these approaches into a systematic framework is rare, even more so for scaling the use of TEL to support informal work-based learning. We briefly describe the work of four cases: Integrative Learning Design Framework (ILDF), the Design Process for scaling agility, Co-design approach, and Agile approach. In the workshop we drive for the framework that enables aggressive scaling. The design approaches are described with the goal to point the similarities and challenges for forming a synthesised framework.

**Keywords:** Design Research, Research-based design, Informal Learning, Work-Based Learning

### 1 Background, problems and questions

In the workshop we will describe that the various Design Research approaches for developing Technology Enhanced Learning or TEL (e.g. ILDF, Design Process, Co-design and Agile approach), that are used in the Learning Layers project (<http://learning-layers.eu/>). Learning Layers is a large-scale research project co-funded by the European Commission's 7th Framework Programme. Layers will develop a set of modular flexible technological layers for supporting work-place practices in SMEs that unlock peer production and scaffold learning in networks of SMEs into two sectors: health care and building and construction. There is a growing need to scale the use of TEL to support informal work-based learning. Therefore, the context of Learning Layers project, with its emphasis on scaling is relevant and good grounds to test and develop new scaffolding and learning practices in work as well as find the potential of tools to integrate the learning, work and context (used physical artefacts). The tools and artefacts used provided by the new technologies have affordances, which are in constant flux driven by a powerful interplay between technological innovation and emerging enacted cultural practices. Significantly, they

transcend the everyday life-worlds of users and permeate the workplace and its practices. Design Research has been often introduced as a modern approach suitable to address complex problems in educational practice for which no clear guidelines or solutions are available [1]. The approaches of: Integrative Learning Design Framework (ILDF) and Shared Conceptual Models for Agility in Interdisciplinary Research have been tested in previous projects for scaling and maturing of knowledge (e.g. MATURE project <http://mature-ip.eu/>, ended March 2012). These aspects are important to take into account because they enable the focus to remain on aims other than tools and practice design. Especially scaling has proved to be problematic in various EU-projects (e.g. KP-LAB project, <http://www.kp-lab.org/>). Scaling is often related to uncovered drivers and obstacles for adoption, which have to be found out. Knowing these aids the acceptance of innovation and related processes early on in the design research cycle, which again will aid opportunities for new modes of learning to scale beyond the local context. The other two approaches: Co-design and agile process are intended to get the most out of the design process. The first is focused more on ways of integrating all stakeholders into the process to deepen engagement and ownership of the stakeholders. Agile methods ([2, 3 and 4]) aim at being efficient in design and development whilst still keeping the stakeholders involved. These two approaches work hand in hand, with the emphasis on rapid iteration between establishing requirements, designing alternatives, and building and evaluating prototypes. Through the early and regular involvement of users, these approaches enable simultaneous exploration of how users and the establishment of technical and pedagogical requirements work, but if the approaches fall into the technology-first approach they lose the end-users/stakeholders voice. Gulliksen et al. [5] have identified that holistic design is a key principle in designing for work and learning (learning in work). It explicitly considers the work context, physical and social environment. The broader and deeper insights into the users holistically has been highlighted in the UK, on issues surrounding the National Health Service's ongoing National Programme for Information Technology (see [6]). This holistic aspect is the one where the Integrative Learning Design Framework (ILDF) and the Design Process for scaling agility can complement the other two selected approaches. Agile methods are mostly concerned with end-user requirements, and often make the simplistic assumptions that: (a) suitable users are available to interact with the development team and (b) the user requirements are congruent with broader organisational requirements. Thus, the focus on interaction with individual users does not address the need for broader socio-technical awareness in systems. These focus differences point out further needs for the more holistic approaches, which ensure that the scaling, physical and social environment, feelings and practices are taken into account. These should be integrated with the Agile methods and co-design approaches. [2]

## 2 Design approaches

**The Integrative Learning Design Framework (ILDF)** has the general intent of generating research-based insights about informal or formal teaching, learning and/or

training situations as well as applied solutions that provide and inform practical understanding and applicability to real-world design projects. The ILDF is a design-based research model that incorporates design process efficiencies from multiple disciplines such as instructional design, object oriented software development, product development, and diffusion of innovations research. It aims to provide the opportunities to leverage the design process as a vehicle for analysing, codifying and documenting what is learned when the designed artefact is enacted in the context of the design process. The progressive yield from *iterative and connected* research and *design cycles* is often lost because it is not always *carefully documented* [7]. It is expected that the design process for creating e.g., mobile **social learning** (content and interactions) will offer several new opportunities to generate best practices and guidelines for both *co-design and design research*. The claim of this approach is that following the ILDF model will inherently result in documenting designs. The approach consists of four phases (Informed Exploration, Enactment, Local Evaluation and Broad Evaluation) and aims to solve the problem often encountered in traditional research of not capturing the research-based knowledge and important factors relating to **learning context, culture, and technology within the design process**.

The aim of the **Shared Conceptual Models for Agility in Interdisciplinary Research** is to support and enhance the **collective knowledge development** (“knowledge maturing”) in organisations from various perspectives. To be able to do this, an agile project management approach is adopted to *integrate parallel design teams, empirical activities (ethnographic fieldwork, interviews, case studies) as well as evaluation and theory building*. It has been found that Design Research fits very well with agile methods for design of software systems, but agile methods encounter challenges when they are scaled towards interdisciplinary research in larger teams. Broad projects such as EU-projects (e.g. The MATURE project, <http://mature-ip.eu/>, ended March 2012), have shown that such contexts of many parallel interdependent activities necessitate trade-offs between (i) relevance and usefulness to practice, (ii) research advances, and (iii) technological innovation. By taking the assumption of Design Research seriously that the design process itself is a *learning and problematisation* process that interweaves the deepening of understanding of a broader concept and the design of tools, the projects are able to *adopt a design process that is iterative, spiral-shaped approach where in each cycle we have the same recurring generic activities* (prioritisation, investigation, design, evaluation). This iterative process corresponds to sprints in the scrum methodology, but *needs to take into account the fact that there are parallel activities* that have different timelines and mutual dependencies. The core mechanism to achieve coherence between theoretical, empirical, and design and implementation activities, and to foster negotiation processes between conflicting interests, has shown to be *a strong shared conceptual model* as a mediating artefact that *continuously evolves*. All activities are informed by the model, and all *activities feedback their results into the model* [8].

**The co-design taken as participatory design** has been developed during a decade of international research and development projects. In *research-based design*, the artefact, which can include tools, are considered to be outcomes. The researcher

is the facilitator that guides the way to the outcomes. Certain phases can be distinguished in the process, although, one of the most important aspects is that many activities are going on in *parallel*, and often in the *iterative cycles* (to the previous process the strongest difference being that co-design here underlines the activity of end-users especially in the creative practices of designing the “tool”) [9]; indeed one may be required to go back to previous cycles. The process also claims to allow different strands of design that are in different phases to go forward within the same project. This is important to note because one of the advantages is that even though there are strands that are on different phases these can potentially *still feed knowledge into each other due to the iterative nature of the cycles*. The tolerance for parallel design threads allows to change and take into account information and end-users through-out the process. The main phases that can be distinguished are: Contextual inquiry, Participatory design, Product design and Software prototype as hypothesis phase. In co-design, artefacts, tools, and services are used as a means of providing boundary and shared objects (mediated artefacts) to communicate between different participants during design activities.

In **professional agile development in tool design** the aim is to produce a prototype which could be tested in a large scale *evaluation process*, and following *feedback, produce further iterations* of the app which could be appropriate for a broad base of work-based users, for example: military during deployment, NGO personnel and aid workers, and those working in emergency relief<sup>1</sup>. Although an extended period of prototyping is enabled, there are issues over the process of involving so many stakeholders dispersed over many countries. Difficulties emerge surrounding direct access to the intended user group. In effect, the research process is carried out with the expert input of the main user groups with little contribution from others. It is becoming increasingly clear, as users themselves become more “expert”, that to design without their input will not result in a successful product. Making use of all the research data gathered, the core project team develops the initial proposition, and design, via an iterative process, early prototypes of how the mobile learning app might look and function. This is complex process and it is difficult to identify single sources of content, or single functional requirements that would suit all users. The ability to move quickly through rapid iterations in small teams is a key attribute of the agile design process. [10]

### 3. Towards a synthesised framework

The above approaches have similarities in their processes and aims. It could be said that differences are in the emphases of the approaches. The similarities that all approaches stress as important are: Iterative design cycles, The process itself is a learning and problematisation space; various activities go on in parallel and allow these to feed into each other and All stakeholders (end-users included) come along into the design process.

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<sup>1</sup> MoLE Project’s (Mobile Learning Environment) <http://www.mole-project.net/research>

The challenges and differences that appear in these four processes are: Level of involvement of the stakeholder; Iteration scale varies from narrow to broad; Position of produced artefacts (the boundary and mediating or shared artefacts) varies; Meaning and position of research in the processes varies (research-based/design research) and how broadly the context and scaling is taken into account.

We have gathered potential starting points for synthesised framework. These points are the following ones: there is a need for creating and agreeing on the conceptual model that provides the direction and aims for the design, development and research; There is a need to find out ‘core principles’ of the design and research – these could be based on the shared conceptual model; Deeper connection iterations based on the feedback of end-users – aim is to have continuous evaluation; The stakeholders need support in their Professional Learning Networks [11] to build ownership for sustained continuous work.

In the workshop after the description of the four approaches and, the above points work as starting part for the discussion and generating of experiences and previous ‘best practices’. After which, a joint effort to integrate these into framework is attempted. All required material are brought along to the workshop.

## References

1. McKenney, S. and Reeves, T. C. (2012). *Conducting Educational Design Research*. New York: Routledge.
2. da Silva, T. S., Martin, A., Maurer, F., & Silveira, M. (2011). User-Centered Design and Agile Methods: A systematic review. 2011 AGILE Conference IEEE. Retrieved from: <http://ieeexplore.ieee.org/lpdocs/epic03/wrapper.htm?arnumber=6005488>
3. Abrahamsson, P., Salo, O., Ronkainen, J., Warsta, J., (2002). *Agile Software Development Methods: Review and Analysis* (No. VTT 478). VTT Technical Research Centre of Finland, Oulu, Finland.
4. Boehm, B., Turner, R., 2004. *Balancing Agility and Discipline: A Guide for the Perplexed*. Addison-Wesley, Boston, MA.
5. Gulliksen, J., Göransson, B., Boivie, I., Blomkvist, S., Persson, J., Cajander, Å., (2003). Key principles for user-centred system design. *Behaviour & Information Technology* 22 (6), 397–409.
6. Brennan, S., (2007). The biggest computer programme in the world ever! How’s it going? *Journal of Information Technology* 22 (3), 202–211. Checkland, P., 1981. *Systems Thinking, Systems Practice*. Wiley, Chichester, UK.
7. Bannan-Ritland, B. (2009). The Integrative Learning Design Framework: An Illustrated Example from the Domain of Instructional Technology. In T. Plomp & N. Nieveen (Eds.), *An Introduction to Educational Design Research*. Enschede, Netherlands; SLO Netherlands Institute for Curriculum Development.
8. Schmidt, A. and Kunzmann, C. (eds.) (2012). *Knowledge Maturing – Creating Learning Rich Workplaces for Agile Organizations*. Project Report, 2012. <http://knowledge-maturing.com/files/whitepaper.pdf>.
9. Leinonen, T. (2010). *Designing Learning Tools: Methodological Insights*. Ph.D. Aalto University School of Art and Design. Jyväskylä: Bookwell.
10. Colley, J., Bradley, C., Stead, G. and Wakelin, J. (2012). Global MedAid: Evolution of an m-Learning App for International Work-based Learners. Presented at *mLearn 2012, Helsinki, and published in the conference booklet*.
11. Cook J. and Pachler N. (2012). Online people tagging: Social (mobile) Network(ing) Services and Work-Based Learning. *British Journal of Educational Technology*, vol 43 No 5, 711–725.