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Designing for Learning in Coupled Contexts

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Abstract

Vocational training curricula are often designed as a progression of alternating periods of attending school and working as an apprentice in a company. In the case discussed in this paper, involving the training of electrician apprentices at a Danish vocational school, many of the apprentices (pupils) have difficulties understanding how the two modes of learning, i.e. formal learning by means of instruction and informal learning through apprenticeship, relate to one another and add up to a meaningful whole. This paper is an account of an experiment in designing for net-based vocational learning with the aim of providing a coupling between widely different learning contexts. The design approach is based on a user-focused quadruple helix model of understanding the learning situation. According to this model, knowledge institution, enterprise, and public authorities together and in shifting constellations provide a framework in which all actors assume roles that are multi-dimensional. The actual design process used is based on a recently-developed method for user-driven innovation, the "quadrant model", involving apprentices, teachers, and masters and journeymen from companies as active and equal co-creators of new didactic designs. Having initially acquired domain knowledge by means of observation and interviews with the various user groups, the researchers together with apprentices, teachers, masters and journeymen have developed a series of designs for new practices by means of workshops, prototyping, and testing. The final outcome has been three designs that facilitate communication between apprentice-and-apprentice, school-and-apprentice, and apprentice-and-master/journeyman. From the perspective of the apprentices, the three designs: a) facilitate community building; b) help bring the school into the practice environment; and c) encourage reflection on one's own practice. From the point of view of the school, the designs make it possible to extend formal learning to the workplace, and for masters/journeymen the designs offer an opportunity to supplement dreary routines of documentation with visualisations and reflections on practice. It is suggested that the designs are likely to result in an empowerment of the apprentices, and thus that in a wider perspective successful integration of the designs entail a need for adjusting existing practices in terms of assigning the learners a more active and responsible role as co-contributors to their own education.

Keywords

coupled learning contexts, didactic design, practice-based research, quadruple helix model, quadrant model of innovation, user-driven innovation, work-based networked learning.

Introduction

This paper deals with vocational training of young adults. This kind of training focuses directly on jobs and the labour market. The main characteristic of vocational training is the principle of alternation, where the pupils (apprentices) alternate between periods at school and periods of working in a company. By means of close cooperation between vocational schools and companies, the practice of alternating training is meant to guarantee the quality and relevance of the curriculum by continually ensuring that competence development at school matches the needs of the companies and the labour market (Wilbrandt, 2002).

Prominent among the problems relating to the educational practice of alternating training is the fact that the interplay between learning processes taking place at school and at work typically is perceived as being weak. It is challenged by the different rationalities of the two widely different learning contexts of the vocational training programs (Helms Jørgensen, 2004). Recent research indicates that responsibility for creating coherence in and making sense of vocational training is left to the pupils who, working as apprentices in companies, have to deal with the challenges of establishing continuity and integration in the learning processes (Nielsen, 2009). Thus, it

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is the apprentices in cooperation with schools and companies who have to be provided with tools and structural frameworks that may help support the individual pupil/apprentice in developing professional skills and competencies (Schwencke & Larsen, 2011).

In the case to be discussed in this paper, the training of Danish electrician apprentices, the curriculum consists of five modules of attending school interspersed with five modules of working as an apprentice in a company. The transition from one module to the next is documented in a “practice form” (in Danish: praktikskema) stating what competencies the apprentice had prior to embarking on the module, what competencies have been acquired in the course of the module, and what the objectives are of the next module. Apart from drawing up a contract, formal communication between company and school may be limited to the practice form document. So, in the understanding of many of the apprentices, school and practice are quite different worlds (Gleerup, 2010). “What I was taught in school isn’t worth a damn out here”, is a typical comment indicative of a transfer problem. Dealing with it is not just an organisational issue, but also one of creating a meaningful coupling between two widely different learning contexts (Christensen, 2010).

The project reported on below attempts bridging the gap by means of networked learning. The solution arrived at rests on two premises. Firstly, a networked learning solution should involve all actors in the learning context – that is apprentices, teachers, masters and journeymen in companies. Below, they are referred to as "users" in order to avoid assigning connotative labels to individuals whose role, it will be argued, will always be a construct in a particular setting. However, they are users in an active sense of "participants", as will be argued below. Secondly, that developing new didactic designs should be based on user-driven innovation.

Actors in changing contexts

In terms of actors, the framework for vocational training is comprised of learning institution, enterprise, user, and public authorities (government). On a meta-level their interactions can be modelled as a quadruple helix model. Quadruple helix models have been developed in recent years by adding a user-strand to the triple helix model that has been in wide-spread use in policy planning for innovation (Arnkil et al., 2010). The model that has been developed for the present project is one that emphasizes the user aspect, and in which interactions between strands develop and change according to context (Helms & Heilesen, 2011). The model (Figure 1) distinguishes between "relationships" and "roles". Relationships exist between organisations and they evolve rather slowly on continua from "governing to regulating", from "regulating to enabling", or from "implementing to empowering". Roles are assumed by individuals interacting with organisations, and they are continually shifting according to context.

Interacting with enterprise, the user may be a customer, an employee, or – in the present case – a learner (apprentice). Interacting with the knowledge institution, the user may be a pupil, a teacher, a client, or an informant. Interacting with government, the user may be a client, or a party. Thus, the "user" is a multi-dimensional phenomenon. At any particular moment, the set of relations is fixed. But relations are still multi-dimensional. That is, the learner is an apprentice (user – enterprise), but he is also a pupil (user – knowledge institution), and a client, if for example he or she is receiving a student grant (user – government).

In most cases, determined by context, one particular dimension will be dominant. This is illustrated by the fact, noted above, that the learners tend to see themselves either as apprentices or as pupils. Observers such as researches and didactic designers are prone to do the same – overlooking the fact that the "user" is in fact a construction serving a particular purpose. In order to bridge the gap between the different learning contexts it is necessary to be aware of and to make the users aware of the multi-dimensionality of the user role.

User-driven innovation

Accepting that the user is a construction, then in designing for user needs it makes sense to involve the users who actually experience their different roles rather than basing design on observations from one particular outside perspective of the learning context (that of the researcher).

For decades, in designing IT-systems there has been a tradition of involving the users in cooperative, participatory, or contextual design, and there is even an ISO-standard for it (International Organization for Standardisation, 2010). In recent years, users have become increasingly engaged, not only as consultants, but as co-creators and innovators in so-called user-driven innovation (Hippel, 2005; Nordic Council of Ministers,

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2006). User-driven innovation is a broad field that has developed from several different traditions one of which is user-centered design (Halonen, 2010). The method employed in the current project has been inspired by the user-centered design approach (Helms & Heilesen, 2012).

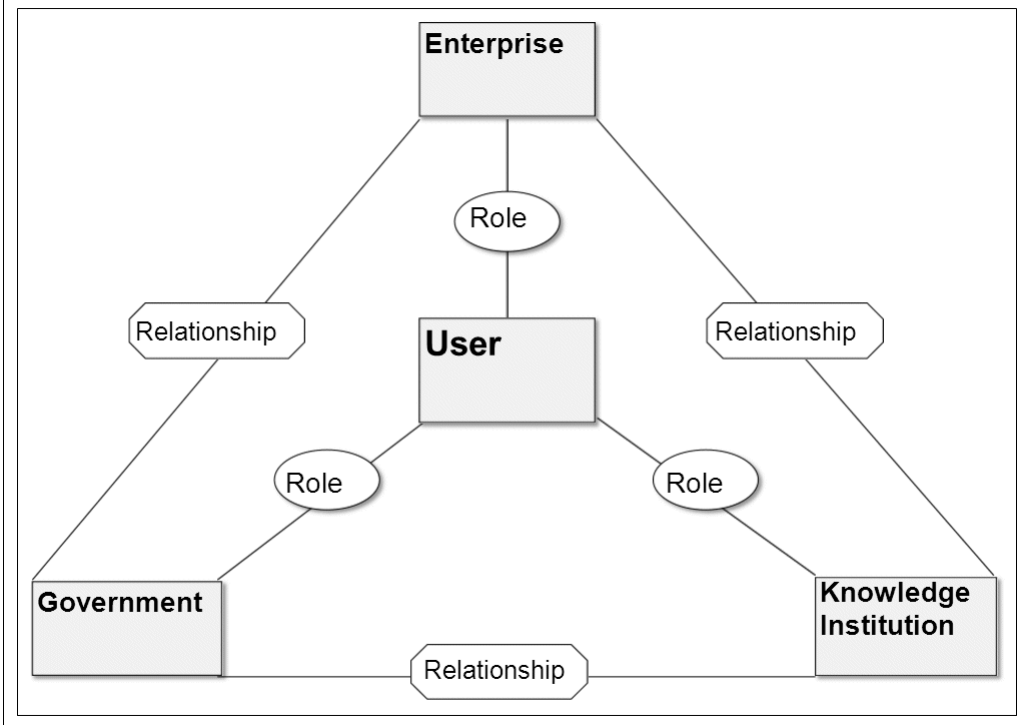

Figure 1: A quadruple helix model

Also in the field of education, methods exist for basing development processes on the experienced reality of the users. A case in point is design-based research (Barab & Squire, 2004; Wang & Hannafin, 2005; Amiel & Reeves, 2008). Still, it is not yet common to let students act as equal partners or innovation drivers in didactic design.

The method adopted for the electrician apprentice case has been developed for the Danish ELYK-project the main objective of which is to develop innovative didactic designs to help develop competencies in small and medium-sized enterprises (Gynther, 2010). The method is visualized in the Quadrant Model (Figure 2).

The Model is circular, and it should be read clockwise starting in the upper left quadrant. The inner circle enumerates four stages in design. The ones on the left (shaded grey) take place in the organisation. The ones on the right take place in the research and development environment. The outer circle provides a label for the main activities associated with each stage. The model suggests a chronological progression, but iterations may occur within and across quadrants.

Observing current Practice (upper left quadrant) is the natural basis for developing designs for new practices or modifying existing ones. Observation is practiced in various forms including document reading, interviewing, and ethnographical observation. All types of actors involved in the practice should be consulted, and observation includes explicit knowledge (curricula, setting, tools) as well as tacit knowledge (attitudes, general circumstances, actual actions). The main objective at this stage is to provide the researchers and developers with domain knowledge. Hence, the users act only as informers. Based on domain knowledge, the researchers arrive at ideas on how to improve or change current practices.

Constructing in the Lab (upper right quadrant) is the initial stage of innovation where the ideas generated in the first phase are used to head off discussions with the users on current practice, on how it may be augmented or changed, and on how artefacts should be designed to support such processes. "Lab" is used to signify any space,

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physical or virtual, where researchers and users meet outside the actual work setting. Reflecting on their own practice the users are invited to participate actively in proposing and challenging designs, or even state tasks in new terms. Outcomes are various sketches and descriptions on the basis of which actual prototypes are developed at the next stage. At this stage, roles begin to converge as researchers and users participate in the design process on equal terms. Researchers as well as users representing all types of actors involved help explore the case from various perspectives and on all levels from simple tool functionality and to relevance in a company or school context.

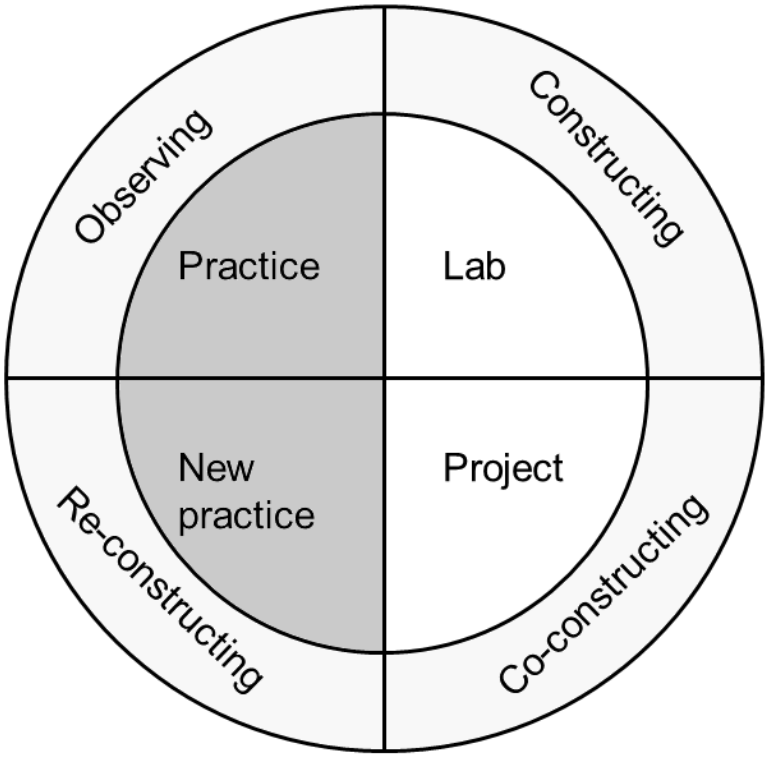

Figure 2: The Quadrant Model

Co-constructing the Project (lower right quadrant) involves designing, building, testing and evaluating prototypes. By "co-constructing" is meant that all users and researchers act as co-creators, and indeed partners, irrespective of job-defined roles, contributing their competencies, experience, and perspective on the task. At this stage, the outcomes are prototypes and designs that can be tested in a real-world situation.

Re-constructing new practice (lower left quadrant), the new designs and artefacts are introduced into, implemented, adjusted, and integrated in the work environment. All users revert to their conventional roles, but they may act as advocates for changing practices, thus facilitating adoption of the innovation. If successful, the new practice will become routine and eventually may form the point of departure for a new cycle of innovation processes.

Developing a didactic design

Empirical work

Initially, current practice was observed in a study involving interviews and ethnographical observation (Gleerup, 2010). Next, construction in the lab was carried out in the form of two workshops. In the first workshop, a class of apprentices, some of their teachers, and representatives from local companies that accept apprentices participated in two sessions of group work, first within and next across their job-defined roles. Finally, the outcome of the group work was visualized in posters, presented and discussed. Input from the first workshop was systematized by the researchers into categories defined by: a) relevance to education; b) user perspective(s)

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(apprentices, school, and company); c) ranking made by the workshop participants; and d) requirement for involving technology. Based on this analysis, eight subjects were identified as potentially interesting, and a set of rudimentary prototypes were designed so as to help visualize the design ideas. In the second workshop, involving only pupils, the seven designs involving this type of user were discussed at length, leading to a clarification of needs and goals, and to the reduction of the number of designs to three.

The co-construction phase was headed off by producing a new set of prototypes to be tested and further developed in a real context. Co-construction was initiated at a workshop at school involving a class of apprentices and their teachers, representatives from companies becoming involved, as the pupils entered a period of practice. Given the physical framework of 18 apprentices testing designs in about as many companies, the space for co-creation primarily had to be a virtual one, consisting of dialogues and reports in virtual space, using text, images and video. However, some visits to companies were also carried out.

Netbased practices and needs

E-learning at the vocational school is based on Sharepoint 2007™. The system functions as an intranet with newsletter and directory, and as a learning management system with time tables, class pictures, practical information, assignments and teaching materials. Communication is from school to apprentice, and it is reserved for registered faculty, administrators, and students. As noted in the introduction, the curriculum consists of alternating periods of school and apprenticeship, the link between the two being the "practice form" that no one seems to appreciate greatly. While working in companies away from school, the Sharepoint intranet has little to offer the apprentices, and contact with school seems to dwindle. Socially and professionally, the apprentices tend to be isolated from their classmates, barring informal private contacts. It was noted, however, that apprentices like to share their successes in terms of images of jobs well done. Outside school, extensive relevant information is available for electricians and apprentices at the website of the Danish union of electricians (Dansk El-forbund, http://www.def.dk/).

The design ideas accepted by the apprentices relate to the conditions already described, involving facilitating of communication between:

- School and apprentice. The apprentices wish to remain in contact with school, and they need affirmation that they are still receiving education.
- Apprentice and apprentice. The apprentices wish to share experiences in a context not interfered with by either school or the companies their work for. The bright side to this is the sharing of successes. But there is also a desire to communicate critically about work conditions, notably violations of safety measures that allegedly are not infrequent.
- Apprentice and master. The need for this type of communication can be inferred from statements about the "practice form". As discussed below, it may also involve communication with the school.

The prototypes

The prototypes developed have both a practical and a cultural dimension. As software they help perform certain tasks better or in new ways. By they are also vehicles for developing and changing the more general practices of interaction between the various actors.

As to the practical dimension, the task specific and general learning environment needs and requirements were analysed by means of Bates & Poole's (2003) SECTIONS-model, focusing on organisational, technological, pedagogical and communicative factors. On this basis, the project decided to develop prototypes on the Podio online-platform for computer supported collaborative work. Podio (established 2009, company.podio.com) is extremely versatile in terms of uses, and it provides simple and fast tools for developing apps. Podio runs on computers as well as on tablets and mobile devices, and therefore it can be accessed easily from the work place.

Within a Podio "organisation" framework for the vocational school, a "space" was created for each of the design ideas to be tested. Access to these spaces can be regulated so that only relevant users can access them. Each space has an "activity stream" that helps provide awareness of other users and that also allows for a simple dialogue in the form of comments.

- The apprentice – apprentice space is the most restrictive, giving the apprentices a private space for sharing experiences in words, images and videos. Its main app allows for an asynchronous threaded discussion in

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text, images and videos. A filter mechanism provides facilities for sorting postings in various ways, including by tags so that the apprentices can develop their own categories of concepts. The space is meant to help maintain social and professional contacts between apprentices during the long periods of working in companies when they are not likely to meet often.

- The school – apprentice space is a dialogical system with two apps by means of which every week the school issues an assignment to be completed and submitted online in a forum or by e-mail. Only teachers and apprentices can access the space. This space is meant to help maintain ties between school and apprentice during practice periods, to train theoretical competencies, and also, importantly, to help the apprentices maintain an identity as members of an educational community
- The apprentice – master space is open to all users within the "organization" framework. Its main app is a mini-portfolio based on the practice form. Having selected a practice period, the apprentice selects an entry from the list of objectives (skills) for the practice period. This skill may be documented in text, photos, and video. The space helps document the skills acquired by the apprentices, and by adding narrative and visualisations to the items listed in the practice form, it makes it relevant to the daily life of the students, drawing on their enthusiasm for sharing their achievements.

Changing practices

Working on new didactic designs by means of user-driven innovation is a challenging and rewarding process for all actors involved, making them reflect on their own practices and providing them with a chance to test possible futures in education within their particular field. Integrating the innovations into the organisation ("re-constructing" in the terminology of the Quadrant Model, Figure 2), however, is another matter. The user-driven approach guarantees that within the organisation there will be actors with a profound understanding of the innovations acting as ambassadors for change. But they are unlikely to succeed unless the new designs are understood not only as solutions to concrete problems, but also as triggers for a broader discussion of pedagogy and the organisation of work.

In the case of the electrician apprentices, where the modularisation of the curriculum has favoured an understanding of school and apprenticeship as being separate worlds, the didactic designs are meant to bridge the gap. Thus from the perspective of the apprentices, the designs facilitate community building; bringing the school into the practice environment; and encouraging reflection on one's own practice. The electrician masters/journeymen and the teachers, all partners in the design process, however, also need to reflect on how the coupling of contexts affects relationships. In a sense, the apprentices are empowered both by input from school that may be tested and reflected upon in a work setting; and by being able to document skills and practice-based learning in such a way that it can serve as examples to be drawn upon in classroom teaching. Thus, in a wider perspective, successful bridging depends on allowing the apprentices more actively and responsibly to contribute to their own education.

Project outcomes

At the time of writing, the report on the case of training electrician apprentices at a vocational school in an outlying area of Denmark has yet to be completed (Mogensen, Gleerup & Heilesen, 2012). Still, it is possible to draw some general conclusions.

Firstly, the apprentices recognize that there are potentials in strengthening the interplay between learning taking place in companies and at school. The portfolio in particular is a useful tool in that it helps bring out the connection between and the progression in the learning requirements of the two different contexts. The apprentices express an interest in having a platform like the Podio prototype introduced as a learning tool at the workplace. There, it will be able to support the interaction between apprentice and more senior colleagues who may also be able to make use of the knowledge offered to the apprentice through the net based tool. Furthermore, it has been established that the apprentices while working in companies away from school generally do not miss close contact with their classmates. Instead they orientate themselves towards the social and learning environment constituted by the workplace and its employees.

Secondly, it has been demonstrated that by developing tools and structures for networked learning, it is possible to support the learning processes of apprentices working in companies. An online learning platform offers the apprentices opportunities for searching for and communicating informal and formal knowledge. This knowledge becomes rooted in and integrated into the actual practice of learning, whether at school or at the workplace.

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Thirdly, the ELYK-project approach to user-driven innovation has been shown to have the potential for uniting all actors involved in vocational training in a common effort to develop the quality of the educational program by means of an increased insight into and communication of actual problems encountered in learning in alternating, but coupled contexts.

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