Structures and Processes in Didactic Design

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ABSTRACT

This paper introduces a user-driven approach to designing new educational formats including new media for learning. Focus will be on didactic design involving the use of information technology as a means of mediating, augmenting or even fundamentally changing teaching and learning practices. The two key points in the article are the introduction of a Quadrant-Model, and the understanding of the user as a construction.

Keywords: Innovation, Designing Learning, Media, Innovation, Quadrant Model, Materiality, User Categories

1. INTRODUCTION

The design and production of new forms of education takes place in many different environments. These include commercial suppliers (learning media), teams in schools and colleges (didactic designs), projects funded by public grants, and more. In most of these environments, norms have been established for how the design process should be handled. The research of the present authors has focused on how to develop new ways and models for designing forms of education in the intersection between systems and actors. The basic premise for this work has been that design processes take place within a context of social, cultural, economic, technological, ideological and emotional factors broadly framed by knowledge institutions (including both research and education), government, enterprises, and end users.

Our research has been carried out under the auspices of the ELYK-project that has addressed the problem of developing and retaining competencies in outlying areas. The premise of this project has been that net-based learning may help provide *in situ* the competences needed for the development and growth of small and medium sized enterprises (SME) in outlying areas. Taking an experimental, user-driven approach to developing competences, the project acknowledges the differences in cultures of learning and work in SMEs and in knowledge institutions.

2. USER-DRIVEN: DIFFERENT APPROACHES

On paper, user driven innovation is a strong concept. Problems crop up, however, when translating potentials into practice: Who are the users? How does one engage them? What is the relation between user involvement and the workflow within the project? Planning for, implementing and integrating didactic designs based on user driven innovation is an extremely complex task where there is still ample room for experiments.

Among the various theories about user driven innovation, at least three basic approaches may be identified: End-user approaches, focusing on the needs of the actual end-user, and different forms of Participating-user approaches involving the user in the actual development process. Lead-user approaches, such as the concept has been developed by von Hippel, are based on the idea is of identifying users who are at the forefront of development and use them as "a need-forecasting laboratory" [1]. Von Hippel presents us with a critique of and an alternative methodology to more traditional market research where the researcher or developer gazes at the unknown market, seeking to unveil its secrets. The methodology still looms large in user-driven innovation, but it may be approached from various traditions ranging from quantitative market research to the kind of anthropological studies that have recently emerged. The anthropological approach, giving voice to the unarticulated end-users, is in fact a rather different methodological approach than that of von Hippel. A third approach derives from participatory design and what is termed User-centered Design (UCD). It is a design approach that emphasizes usability and involves users in the design of efficient as well as usable systems [2].

In Scandinavia, there is a long tradition in this field, sometimes referred to as the "Scandinavian School of Design" [3]. The defining characteristic of this school is an understanding of software development not just as developing an isolated artefact, but also integrating it in a context of changing practice. In doing so, meaningfulness and sense making are emphasized as essential for designing by means of a structured process of involvement and development [4].

The various approaches outlined above may be explained by referring to different disciplinary traditions. In our research context, however, focus has been on how to draw upon these different positions so as to produce a comprehensive model that may enable a type of cross-fertilization from each of the disciplines. This would be a sort of multidisciplinary rather than

cross-disciplinary approach, allowing the different approaches and related methodologies to co-exist and co-create. To enable and understand such a cross-disciplinary approach, being on the one hand structured and on the other hand open for different interpretations, we developed a Quadrant Model.

2.1 Unfolding the Quadrant Model

The Quadrant Model (Figure 1) illustrates four stages in didactic design. The model combines the strengths of the different traditions presented above. The model should be read clockwise starting in the upper left section. The four stages represent a progression in terms of chronology and substance. But the model is not linear. At each stage, iterative processes occur, and iterations may also take place across stages.
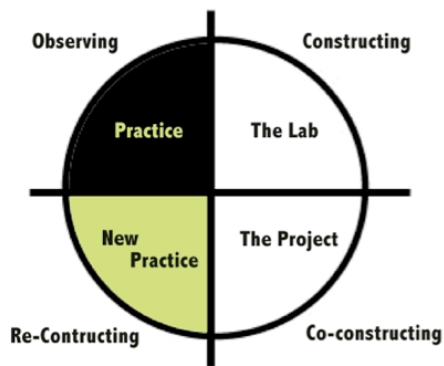

Figure 1: *The Quadrant Model*

Observing. Whether designing for modifying existing practices or devising entirely new ones, it is essential to develop an understanding of current practices. These include the setting, context, goals, and rules applying to the learning situation, the various tools currently in use, and the objectives, attitudes, and general work situation of the users. In an educational context, users may be employees, students, teachers, administrators and it-specialists, and when appropriate also "customers" from organisations and business. At this stage, data collection follows established methods such as ethnographical observation, interviews, and document reading. The users are involved as informants, but not yet as participants. The reasons for this are twofold: Firstly, researchers must gain domain knowledge in order to perform qualified work. Secondly, domain knowledge is used to formulate the first assumptions about how to improve or change practice. These assumptions are used as a point of departure at the next stage so as to overcome one of the paradoxes of user-driven innovation, namely that more often than not when confronted directly, users are not able immediately to come up with innovative and useful improvements to their practices.

Constructing. The Lab (upper right section of the model) is the stage where new artefacts are developed and new ideas are tested. Based on the observations at stage one, preliminary assumptions are presented by the researchers in order to head off discussions, make the users reflect on their own practices, and to draw them into actively participating in the design processes. It is a dynamic and iterative process where drafts for artefacts are created, and where the analysis of the functionalities of the artefacts generates the basis for reconsidering and reformulating the task. The

outcome is not a ready design, but rather a set of ideas or a sketch that will form the basis for actual working prototypes – possibly informed by further observations (stage 1). The lab should be understood as a setting, physical or virtual, where researchers, developers and users interact. At this stage, the researchers go from being observers to becoming developers, as do the users who now assume an active role as equals in the design processes. Also this stage, various kinds of users are involved (students, teachers, administrators, it-specialists, representatives from organisations and business), and their interactions help inform the case from several perspectives and on levels ranging from micro (e.g. artefact functionality) to macro (work place relevance of qualifications). The work form typically consists in one or more workshops where users and researchers collaborate in groups in one or more intensive sessions, followed by plenum presentations and summaries.

Co-constructing. (lower right section of the model) This is the project stage where prototypes are developed, tested, and modified. At this stage, all the various actors participate as co-creators, bringing together the rationalities and competences of each type of participant. A new social pattern is introduced at this stage in that all participants act as partners, and roles, originally defined by job description (including the observer/informant distinction), are now defined by the competences each participant is able to contribute to the shared project. The work form may be a physical workshop, but sessions of testing and evaluating may also be carried out in smaller local groups or in a virtual setting.

Reconstructing. (lower left section of the model) In the final stage, novel artefacts are adopted in practice, and new practices are implemented and integrated at the relevant levels in the learning institution. Organizational integration, always the Achilles' heel in the adoption of inventions and innovative practices, may not be a trivial matter, but it is likely to be facilitated by the fact that every type of user likely to be involved in the new practice has had a hand in developing it. Thus, ideally, the new practice will become a routine in everyday life, and the significance of technology, prominent in the early stages of the development process, will fade. Being a circular model, observations of the (new) existing practices will now provide a point of departure for another cycle of development.

3. CONSTRUCTING THE USER?

From a formal point of view, the user in didactic design is either the learner/student or the lecturer/instructor. Beyond this initial observation, the "user" of a didactic design is not an unambiguous entity, and furthermore should be added that he or she constantly shifts among or combines different roles, it may be helpful to understand the concept of user in terms of processes evolving in time and space and being subject to interests both within and outside the immediate situation. When applying the Quadrant Model, this becomes apparent. In the initial phase, the user is our object of interest. As researchers we observe users, attempting to understand how users perform practice. We ask them about how they experience and reason about numerous factors. The aim is to learn about their every-day challenges.

Understanding current processes solely on the basis of observation or interviews is likely to result in a snapshot of users acting in a particular situation within a particular role. But there is no guarantee that this image reflects all or even the most important aspects of a complex situation. Therefore, engaging the users actively promises to be a constructive approach when designing for new learning environments or new learning media. A first step

is to invite users to actively participate in observing situations. Next, they may become partners in designing and testing designs, and finally, they will be instrumental in integrating novel designs into practice, augmenting, modifying or even radically changing existing practices. In this progression of user involvement from participant to partner, and eventually change agent, each stage is guided by its own set of rationalities and methods, as demonstrated in the Quadrant Model. The model depicts the move from initial observation to active participation seen as a role defined by the methods applied. The changing ontological status of the user means that he (or more often: they) redefines and is himself redefined by the relations.

3.1 Users and Patterns of Power

One immediate reservation would be to ask why one should not simply move ahead in a collaborative process drawing upon the different competences associated with different systems. However, this may be a too simplistic approach that will replicate but not transcend a dominating pattern of power and reciprocal expectations. The process of innovation requires a process and a structure that enables a transcending of this traditional division of labour (and patterns of knowledge and power). – The reflected use of methods is a key to opening up this process. Methods are not simple scripts for action [5]. They are mobilized in our on-going often unarticulated design of processes. They establish a sudden rationality or in the words of Cohn, Sim, and Dourish: "a particular discourse in which action unfolds" [6]. This then determines who is enabled to speak.

The idea is illustrated in the following model (Figure 2). The user can be observed as an object. Involving him or her transforms the user to a subject. Thus the user becomes a construction through the different methods we apply.
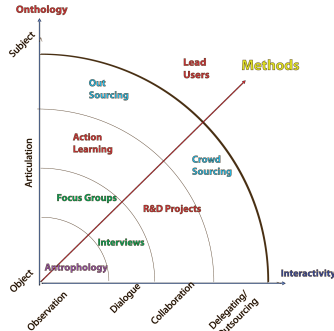

Figure 2: *Constructing the user*

In the Quadrant Model, this transformation is structured and designed. It is an evolving process where the "user" moves from being an informant observed by the researchers/designers, to becoming an associate that the researchers/designers cooperate with, and then to someone they enable be observers, completing a full circle. The growth of articulation and interactivity is intended. And still we should bear in mind that this progression also has pitfalls if the overall intention is to "change".

3.2 Outside – Inside?

The involvement of the user means that his or her role changes from being on the "outside" to being on the "inside". The involvement means that the user is enrolled and becomes part of a community that stabilizes itself and distinguishes itself from what is "outside". The object becomes subject, meaning that he or she becomes an active partner, but it also means that this very subject

is subjected to a specific regime – the community of researchers, developers and practitioners – and no longer is an object that, in the verbal form, objects, but a subject that subjects to this specific domain [7]. The challenge then is how to establish a process and structure that brings people from different domains together, enables them to communicate and create and then leave the temporary community and engage in their daily practises which then again have changed through the development processes.

4. THIRD PLACE AND MATERIALITY

Bringing different actors into the process generates a need for a special kind of place. This could be defined as "the third place" [8]. The notion of third place refers to the overlap that occurs when different domains interact. This place is the setting for continuous negotiations about one another, about sense making, and about roles and rules. Interestingly, when people come together in this way, they are open for new interpretations and challenges. Thus, it is an opening for change and it has potential for innovation [9]. Studies suggest that such multidisciplinary settings offer advantages for innovation processes [10;11].

4.1 Generative Speech

The knowledge management theoretician Scharmer looks into the process of such meetings and reflects on how these processes ideally take place. He talks about the polite initial meetings, where at a face value level we are open for the differences between different domains or disciplines. At this stage, we are talking "nice" in his vocabulary. From there we move into a phrase where we are talking "tough", meaning that we will engage in what Scharmer (2001) calls "rule reveal speech acts"[12], thereby seeking a deeper understanding of the other as well as an opening to a deeper understanding of oneself in particular. This again might open up for "the reflective dialogue" where you try to understand both yourself and the other. Ending up, or rather opening up, for the generative dialogue where in both togetherness and "bringing yourself into the act" one seeks out the emergent reality. To us, this is part of the basic understanding on how innovation takes place. The phrase "Innovation takes place" should be understood quite literally. It is both something happening "it takes" and a spatial occurrence" it takes place." The understanding of the relation between structure and process is probably an important part of the key to innovation.

4.2 A Special Kind of Community

We need to bring in more dimensions: The process of moving from the polite to the generative dialogue is not characterized by linear progression, but rather by a process of constant shifting. Central to supporting the process is the capability to bring actors back to a stage of politeness, if things become too frustrating; and at same time to facilitate progression towards generativity. Furthermore, that the community revolving around the innovation process is a special temporary community. Therefore it is not a community of practice [13]. It is looser, and it is characterized by difference rather than by uniformity. The participants are embedded in different domains. They are breaking away from them while at the same time representing them as they come together, mobilized by an idea. The idea is to develop something new. This newness and the idea, which in the different domains will be interpreted differently, generate the need for another conceptualization.

To describe the practices and the relationships in the practices we can observe in "Third Place", we adopt the concept of

"Communities of Interest". They are what Fisher calls communities of communities [14] where stakeholders from different communities of practice come together. In our experimental work, it has been essential to bring together different actors or stakeholders (in the word of Fisher) from these different domains – to generate new emerging knowledge. Thus, it has also been important that these communities should remain temporal to avoid homogeneity. Therefore we have insisted on both the structural shifting of openness and closeness in the process, and in talking of multi-disciplinarity, using differences, rather than cross-disciplinarity which entails focusing on sameness. Over time in the project, a kind of common lingua has developed where it-developers have adopted phrases from the educational world – talking about didactics and constructive learning, and where educators have started talking about HCI and API. This common language has become a connector and bridge-builder, but the most important part has been the different kinds of externalizations – the materiality of the process.

5. MATERIALITY

When working together in zones bordering on different domains in a special learning context, we need mediating artefacts – boundary objects in Fisher's [14] words that: "allow different knowledge systems to interact by providing a shared reference that is meaningful within both systems".

In a community of practice we would talk about the relationship between reifications or mediating artefacts. Lave and Wenger (1991) claim that we learn by becoming part of a community, and that this becoming is a dual process of reification and participation – reifications stabilizing the process. We do not use reifications as means to tell us what to do, but as ways of understanding [13]. When we move into the more temporal communities of innovation, they are unstable and the reifications change and become different both through our changing interpretation of them and through the actual development of the externalization.

The externalization, i.e. the prototype, undergoes transformations from the initial sketches to the nearly finished prototypes. And they again are interpreted differently in different domains, either as media for teaching/learning (teachers, pupils), or commodities to be sold (producers), or as a means for educational modernization (local policy level or higher policy levels).

The initial process of observation could be labelled a process of reifying practice. In daily practice, we also have reifications – different artefacts that enable practice, which tells what to do, and how to coordinate. In education, we have learning media, which could be differentiated as didactic and structural media. Structural media are artefacts that in use become learning media (classrooms, blackboards, etc.). They are not learning media as such, but become learning media in a specific context such as teaching. Other media, however, have embedded delegated processes of didactics. Thus, there are textbooks or multimedia applications, designed for learning. Such media are reifications of processes, which enable us to generate practice. In that respect, we can talk about reified practices, materiality that is not reflected but a part of what we do, how we coordinate. When observing and describing what is happening, we generate new reifications of that very practice. These descriptions open up for a process of reflection, which means that we move into an area of reflected practice. We may scaffold this process of reflection in different ways: The traditional way is to write a report and then discuss it with the participants in practice. In context of the ELYK-project, we generated different reifications, writing reports, generating

different personas, and making user cases. But most importantly, we worked with prototyping, using different inputs in a laboratory setting to develop prototypes, which eventually could be reintroduced to practice. These activities are associated with the upper right section of the Quadrant Model. We invited teachers and other participant into workshops where we discussed the prototypes. This new materiality (reifications) proved extremely useful in the development process. The input from the initial part was necessary for the development of the prototypes. But the prototypes proved to be reflection tools for the participants. When it was difficult for the participants in practice to articulate or imagine new and different practices, the use of prototypes helped scaffold this sociological fantasy. We also learned that prototypes should be developed in a delicate balance between being "too developed" or "too rough". If they were too developed, the potential users did not wish to criticise, and the developers became too defensive because they had developed ownership of the artefact through their involvement and use of resources. On the other hand, the artefact also has to be sufficiently developed so as to provide for the sense making process. Users should be able to imagine a new practice using this or that device.

There is no simple answer to how much the actual artefact should be developed. But in mobilizing the findings of Buxton [16] we could talk about a development from "a sketch" to a prototype. Buxton describes a continuum where the difference is the difference in purpose. The sketch is opening up; the importance of seeing new things and creating new tentative understandings, whereas the prototype is closing down. The important thing is to understand this as a process of reciprocal iterations where the development generates an increasingly closed prototype. At the end of the day, the developers need a stabilized picture, and thus development is finalized. But moving from an idea on to sketching a new learning media, and then on to some kind of usability testing represents some huge strides, especially when engaging the users in the entire process.

The Quadrant Model serves as a scaffolding of this process. It does not prescribe exactly what to do, but it enables us. This leads to a model of the innovative process that departs from what could be called the *hylomorphic* meaning (transforming matter, hyle, into a predefined form, morphe). In this line of thinking, form is created by an agent with a specific design in mind, and matter is understood as passive and inert [16]. Developing learning media is of course a question of transforming matter into a designed output. The interesting question is whether and to what extent this is a hylomorphic process – do developers impose their design on matter and if so, what is this very matter? We suggest that we have to study the dynamics of a dedicated process where different actors (developers, teachers, pupils and researchers) together move towards a designated outcome. The matter consists of different contexts, not to be viewed as stable structures, but as dynamic evolving relations, that eventually are stabilized by traditions, rules, roles, models, and prototypes.

Designing an innovation is a question of understanding these different contexts, enabling the competences to be mobilized and thereby generating meaningful relations. The idea of scaffolding defines different context markers as means for sense making and thereby enabling articulation, which again enables emerging processes and structures.

We will take this last observation a little further by claiming that the interesting point of observation and reflection probably is the difference between the ontological observation in the different domains – and the difference between the initial sense makings and the later sense makings. We have identified a growing mutual understanding of the different domains and especially a re-

interpretation of one's own domain through insight generated by looking from the outside with the help of "the other".

6. INNOVATION IS A LEARNING PROCESS

Otherness is an essential part of innovation and learning. Popular notions such as "Thinking out of the Box" reflect the demand for understanding from a different point of view. In the same way as education is about understanding yourself and letting society understand you through estrangement. About being enabled to reflect on yourself and thereby enabling communication with others. In that respect, we can only confirm that innovation is a learning process. That we basically know and are capable of more through this process: That we learn – informally, due to the lack of curriculum. We do not know what will be the expected outcome, but we do know that the process suggested is likely to generate outcomes in the form of new products and new methodologies. We are learning in such a process, but it is also a process of being educated. What does it mean to become educated? As stated above, it means that you have opened yourself to the world, and the world to yourself. Ideally, this is what happens in education. By meeting the unfamiliar setting of the school you become aware of the difference between yourself and the rest. This opens up for establishing relations with the other while keeping your integrity, for developing language, understandings and a disciplinary vocabulary that enables you to understand and make you intelligible to the world. The innovation process is both a process of learning to be able to do more, understand more, and it is an educational process transforming the participants through the meeting with otherness.

7. CONCLUSION

In the Quadrant Model, we have combined various traditions within user-driven innovation to take advantage of their different qualities and avoid at least some of the shortcomings. The model is not a normative approach, but rather a kind of script, that can be mobilized in the spatial-temporary design of the innovation process. Discussing and applying the model has proven useful, both as a structuring model and as a part of the scientific reflection process. This has demonstrated its value as a way to scaffold and understand the innovation process. The major insights gained by using the Quadrant Model in the ELYK-project are: (1) The development of a model is a way to bring together different domains and rationalities. (2) That externalisations or materiality or mediating artefacts are instrumental to the alignment processes between different rationalities. (3) The process of development should be seen as dialogical processes. (4) Open and closed processes should be structured to bring forth development, alignment and to avoid sameness. (5) And finally, the process also has generated an understanding of the user not as a stable entity, but as something constructed through different methodological approaches. If designed in a reflected way, the approaches open up for a broader understanding of innovation as innovating practice where the actual artefacts should be considered parts of the process rather than means or outcomes of innovation processes. The prototypes developed throughout our project have contributed to the ongoing dialogue and they have become part of the language of the participants.

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