Department of Information and Service Economy

Enhancing ICT Supported Distributed Learning through Action Design Research

Lauri Saarinen

Aalto University

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Abstract

Development of information and communication technology (ICT) enables novel ways for interaction in addition to diminishing boundaries of time and place in teaching and learning. In a distributed learning approach online technologies are blended with campus-based in person activities. In higher education, keeping up with the change creates interests and concerns, which the organization has to attend to in order to employ learning technologies productively in line with its strategic goals.

The purpose of this study is to present and analyze the researcher's efforts of making ICT enhanced distributed learning understandable and commensurable to different stakeholders within Helsinki School of Economics. During the research an artifact was built. The artifact is an intervention tool, which may be used on several levels of planning and consultation. The artifact's core consists of a course website template and a minimalist instructional design process attached to it. The core is surrounded by features of organizational management, quality improvement, in addition to internal and external constraints of the organization.

The research question in this study is "How to orchestrate ICT enhanced distributed learning?" The artifact building and organizational intervention were evaluated with data analysis, questionnaires, interviews and reflection.

The chosen research methodology, action design research, results in emergent design principles from an artifact centered organizational intervention. Four design principles – contextualization, concordance, collaboration, and commitment – emerged during the building of the artifact. They are intended to be used along with the artifact within another similar organizational development context.

During the design process (1996-2010), which included the research process, the volumes of online activities within the organization increased. The change did not include many qualitative changes; especially online interaction has not visibly increased. We employ online services mainly to deliver learning material. Therefore, we do not benefit from the online services' inbuilt characteristics of flexible information sharing, connectedness, and collaboration.

Current use of online activities in teaching and learning reflects existing culture and practices. ICT can be a catalyst to cultural change to show new ways of interaction within an organization. If any change is to be expected, it is likely to be gradual and may take considerable time. Nevertheless, new generations always reconstruct their learning environment.

I always prefer to believe the best of everybody, it saves so much trouble.
- Rudyard Kipling

Keywords design research, action design research, distributed learning, e-learning, instructional design, orchestration, artifact, minimalism

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Vihti, June 21, 2012

Lauri Saarinen

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1 Introduction and Outline

This research is a study on the implementation, diffusion, acceptance and usage of information and communication technology (ICT) enhanced teaching and learning within the Helsinki School of Economics[1] (HSE). The research problem is in finding ways to enhance the development, usage and diffusion of online course environments. For this purpose, an artifact was built, which includes instructional design (ID) processes to support the activity. This research shows how the artifact, a simple framework, may be used extensively as an ID tool in various situations and for different purposes. During the period that the artifact was developed, the processes around it evolved at the same time. It was connected to issues concerning organizational management, quality improvement and to internal and external constraints. Flexibility and emergence were the main modes in the design process.

The **purpose** of this study is to describe and analyze the researcher's efforts to demystify, deglorify and decomplicate ICT usage in teaching and learning – to make it understandable and commensurable for different stakeholders within a higher education organization. Therefore, the research is praxis-based.

My **research topic** is **instructional design** in **distributed learning**. Distributed learning is based on the idea that the responsibilities for learning are distributed between actors and that learning activities are distributed using technology (Dede 1996). The research aims in this context to define the instructional design processes, which are intended to lower the threshold for less advanced users adopting online learning and providing simultaneously a flexible and efficient way to use online services for advanced users demanding tailored solutions as part of the learning environment. Therefore, the **research question** is "How to orchestrate ICT enhanced distributed learning"; in other words, how can a design artifact serve as a focal point in this effort?

This thesis includes analysis of two partially parallel processes. The practical design process was started in 1996 with a design-project for the web-template on five courses. The artifact building and scientific research start-

[1] From 2010 onwards Aalto School of Economics

[2] After the national funding ended in 2006, some universities decided to decentralize or even close down their support units; others continued with internal and

ed around the year 2005 after design research was chosen as the research approach.

Minimalism, as a **design and learning theory**, has been used as a basis in designing and applying the artifact. My **research thesis** in this work is the basic principle of minimalism: “Less is more”.

The **focus** in the research is in supporting teaching and learning with planning, designing and coordinating the working environment. The researcher’s work has essentially been collaboration with teachers and other support units’ personnel. The collaboration has consisted of seminars, instructional workshops and development projects, but especially person-to-person teacher consultation on a daily basis. The working method includes taking the teachers previous knowledge as a starting point in developing the online services. The teachers and the researcher have worked as peers from different fields of expertise.

My work is evaluated with questionnaires, interviews and reflection. The instantiations (course sites) of the artifact have been evaluated by researchers. Other evaluative methods include teacher interviews and both student and personnel questionnaires. The practical work has been evaluated as a part of the university level annual performance negotiations of the support unit.

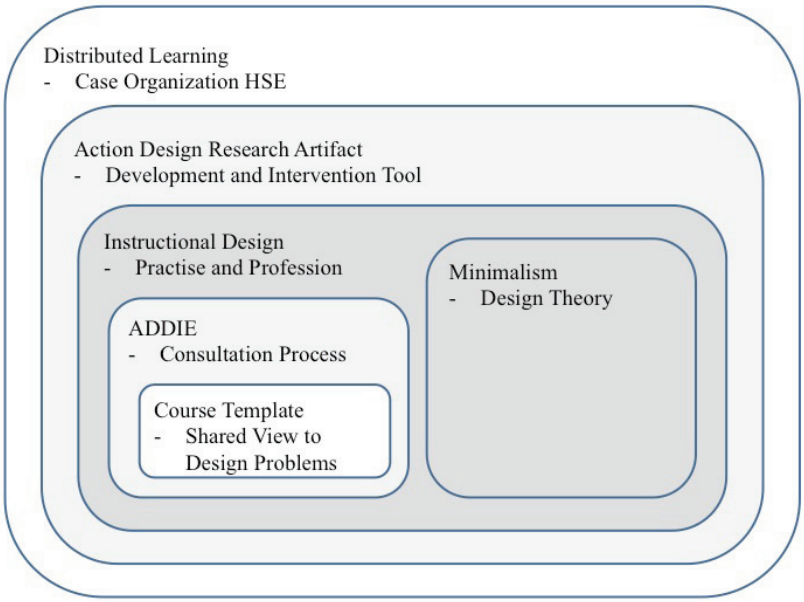

Figure 1-1 The research environment and focus

The research is in the realm of information systems science (ISS). The design research artifact and the design principles generated during the research may be used as an intervention tool in enhancing ICT usage within

another case organization. **Design principles** are the main scientific outcome of **Action Design Research** (ADR), which is the research methodology I have employed in the study. In ADR, IT artifacts are not static, but instead emerge as an ensemble from both design and interacting with the organizational context.

My main intended **audience** of this research consists of other instructional designers in other universities. The ensemble artifact and design principles emerged within my ADR process articulate the issues that are important in similar design situations in other contexts. As another outcome of my work, **design exemplars** were formed as examples of employing the artifact and the design principles.

Before I describe the research outline, I provide here a summary of the main entities of this study. My artifact consists of organizational practices that are communicated through the web-based course template, and supported with a consultation process (see also figure above):

1. The purpose of this study is to describe the efforts of making ICT enhanced distributed learning in a university understandable and commensurable to different stakeholders. In distributed learning, the responsibility for learning is distributed among instructors and learners. In addition, the teaching and learning activities can be distributed in time and space through ICT.
2. The research question in this study is "How to orchestrate ICT enhanced distributed learning" by employing an action design research artifact. In ADR methodology, knowledge is built by developing an IT-artifact as part of intervening in an organizational context and reflecting on the processes of artifact design and organizational change. The artifact has been developed for similar contexts in other organizations.
3. The purpose of instructional design is to provide efficient and fit-for-purpose instruction to be continuously evaluated against the organization's mission and individuals' goals for a design problem.
4. An instructional design process (ADDIE) operationalizes the artifact in practice. The instructional designer uses the artifact as a framework in teacher consultation. The instructional designer's task is to apply the knowledge about the problem domain embedded in the artifact.
5. A web-based course template provides a shared view to the problem domain during the consultation. The teachers may also use it as their tool for instructional design. The support personnel use it also in designing the development of the distributed learning environment.

6. Instructional design theory (IDT) is the study of how to best design instruction so that learning will take place. The design philosophy in this thesis is based on minimalism, which is an interpretative and constructivist learning and design theory. My research thesis in this work is the basic principle of minimalism: “Less is more”. The principles of minimalism are present in the template structure in addition to the consultation process

Next, I describe the contents of the rest of the thesis and the purposes of each part. The Problem Domain chapter (2) elaborates more on the research topic and study context, especially the stages of the design process. It also discusses the case organization, evolution of the research topic and the core notions in the field of practice. These include discussion about issues concerning ICT-based learning environments and instructional design.

This thesis is partly organized according to the stages of **ADR, a four-step procedure** published by Sein et al. (2011). The method is outlined and described in its disciplinary context in chapter 3, in addition to other methodological and theoretical discussion in relation to the research opportunities of this study.

The **problem formulation stage** in ADR (chapter 4) includes descriptions of the research domain and research problem. Because the research method is qualitative and interpretative, also the researcher’s viewpoints are also elaborated in relation to the methodological choices.

Chapter 5 (Building, Intervention and Evaluation) introduces the artifact and the processes that have been built within it. This second phase of the ADR is based on the problem description and theoretical premises designed in stage one. The evaluation of the utility that the artifact has produced in the organization is also discussed in the second stage of the research process.

Chapter 6 is devoted to the third phase of ADR. **Reflection and learning** in ADR is a continuous activity through which knowledge is abstracted throughout the research process. The iterative process and the evolving nature of the design, as well as the outcomes, require reflection and reconsideration of the choices made in the previous stages.

The goal in the fourth stage of ADR is to **formalize the learning** throughout the research process. An ADR project should result in general solution concepts for a specific class of field problems. Hence, in chapter 7 the whole research is reflected upon and the major findings and lessons learned are discussed. The final chapter ends the thesis with conclusions.

2 Problem Domain

This study describes the organization's development of ICT enhanced learning activity during 1996-2010. The frame of reference and social values of the case organization emerge from the field of higher education teaching and learning. In many research-oriented universities, teaching is based on research, but it is often seen as secondary to research. Therefore, the willingness to accept and employ new ways of teaching, such as ICT, is generally dictated by efficiency aspects of working. Hence, the costs of support functions have also been kept at a "reasonable" level. Even though teaching and learning is about knowledge-sharing, the methods are often very straightforward and are based on behavioral assumptions about the activity. It seems that informing is the driving force in education, not collaborative knowledge-creation, in which ICT may have a major role (Pedro, 2005).

The practice area has developed internally due to organizational change and through positive developments of the ICT infrastructure and skills of students, teaching staff and support personnel. Even though the template and the artifact have been developed and employed only within the HSE, they have not emerged in isolation. Many external factors such as professional networks and national activities have had an impact on the outcome too. In addition, the practice area in general has developed fast and new notions and frameworks emerge continuously.

2.1 Changing Technology and Vocabulary

Higher education has followed academic traditions for centuries. However, the development of technology has continuously changed the way in which educational information and communication are delivered. In addition, production and presentation of learning material have also transformed. Changes in pedagogical theories and practices and to the expectations of future uses of technology in learning have resulted in new fields of practice. The change has been especially rapid with ICT development and it has been expected that education will be transfigured online Gill (2003).

Matheos and Archer (2004) see that higher education is undergoing a change that may be the most significant since the initiation of the printing press over 500 years ago. Socioeconomic forces, such as globalization, have increased the demand for more flexible access to education. The World Wide Web as an innovation belongs to the same category as radio, television and other major technical inventions that act as enablers of content delivery and interaction (Saarinen et al., 2001, p. 18). This change has also

created a demand for new levels of administrative and supportive services in educational institutions, such as growing IT departments and learning technology units.

A new technology always raises expectations and it has its advocates and opponents. The pioneers create the first impressions and mark the path for many to follow. As opinion leaders, they also generate expectations for others. Research provides conflicting results on the success of technology enhanced learning (Piccoli et al., 2001).

The early expectations are often called myths. Myths are hypotheses or propositions that in common speech are often taken as granted, but in reality are based on assumptions that are seldom verified by facts, because there is not yet sufficient evidence available. Some flavor of exaggeration or drama is often present in myths. The following quotation from Gill (2003) shows how vast expectations ICT-based learning has risen after the emergence of the World Wide Web around the mid 1990's:

"The myth of e-learning is that online instruction will solve all of the problems of learning and performance improvement in the workplace"

Many regard myths as facts, not seeing that the suppositions do not cover all aspects of the problem space. The truth is versatile and usually found somewhere in the middle.

Numerous different terms are simultaneously used to represent the activity of enhancing teaching and learning with ICT. Naturally, the notions have changed through time too. The advancement of technology, in addition to pedagogical development, are the main driving forces in new term creation. This development of new concepts has produced confusion in both practice and research (Guri-Rosenblit, 2003). Old terms are redefined and different generations use different terms as synonyms or use one term meaning the other in another context.

Wentling et al, (2000, p. 3) reviewed the literature at the turn of the century and found many overlapping definitions. *Computer-based Training* (CBT) is often delivered via CD-ROM or as downloadable file(s) from the Web. It is usually multimedia-based training targeted to self-studying students on self-paced courses. CBT has also been used to describe any computer-delivered training, including web-based courses. The term *Online Training* -term has been used for all training delivered with computers over any network (intranet, extranet or internet). *Net-Based Training* has been used for Online Training and as a part or special type of e-learning. *E-learning* has been defined as a process where computers are used over the networks. *Technology Enhanced Learning* in principle equates to the support of any learning activity through technology.

A further example of the terminological change on a more detailed level from the technology point of view is *Collaborative Writing*, which is the predecessor of Wiki-type writing in the context of user-based content creation and sharing, *Web 2.0*. The activity has remained essentially the same, but the new technology or application makes it "new" again for new generations.

Many terms are based on technology, especially on devices, applications or systems. Of course, technology plays an integral part in current education, but it should not steal the focus from the needs of the actors and the activities' goals. Even though the technological change creates more delivery channels and new ways to interact, the purpose of the technology is to provide access to and improve contents or processes. Simultaneously, technology serves the fulfillment of needs, but it also influences the ways with which people act. Technology is an enabler.

Technology is in constant change. Historically, it is important to understand how technology and its usage have changed the teaching and learning environment, but to recede from the point of view that technology is the sole driving force of development I aim to focus on generic issues, which can be discussed regardless of the technology in use, namely collaboration, interaction and coordination. Therefore, I have chosen to use distributed learning to describe the practice domain of my research.

2.2 Distributed Learning

In *distance learning* a geographical distance separates communication between the trainer and participant. In addition, communication is two-way and technology is used in the learning process. Distributed and distance learning, as notions, cannot be separated, because the former is dependent on the existence of the latter. Distributed learning is related to notions such as networked learning, hybrid learning, blended learning and flexible learning. All terms refer to the same phenomena: combining face-to-face with online learning or technology enhanced learning. Matheos and Archer (2004) quote an early definition of a distributed learning environment:

"A distributed learning environment is a learner-centered approach to education, which integrates a number of technologies to enable opportunities for activities and interaction in both asynchronous and real-time modes. The model is based on blending a choice of appropriate technologies with aspects of campus-based delivery, open learning systems and distance education."

Matheos and Archer (2004) state that distributed learning emerged from the remark that after the mid-90s distance learning students in the United States were using two channels in their studies. They were studying at the same time as campus students and distance education students, contradicting the assumption that distance and face-to-face programs served different populations. This fact led to the use of the term distributed learning. It includes not only what has been referred to as distance education, but also the use of online technologies by campus students.

According to Dede (1996), distributed learning is an idea that reshapes both face-to-face activity and distance education. Dede wrote his article (Emerging Technologies and Distributed Learning) in 1996, when the Internet, World Wide Web, virtual realities, virtual communities, messaging systems, simulations, multi- and hypermedia, were often seen as the solution to problems in efficiency, cost reduction and pedagogical issues in education.

The new technologies *"enable a broader, more powerful repertoire of pedagogical strategies"* (Dede, 1996). The educational innovation of networked ICT is not in the automation of processes, but in how the technology shapes the messages, communication and users of it – how we master the increasing information flows and collaborate through ICT in our studies as well as in working-life and during leisure time.

The notion 'distributed learning' contains two important ideas. Firstly, in distributed learning, the responsibility for learning is distributed among instructors and learners, **and** secondly the teaching and learning activities can be distributed in time and space with ICT (Dede 1996).

Distributed learning contains both a technological and a pedagogical aspect. It beholds possibilities for a positive and purposeful change in both the instructors and learners' modes of activities in higher education. ICT enables the enlargement of the learning environment from classrooms to global networks with a vast array of materials and interactive communication methods. Distribution as a term timelessly emphasizes the possibilities of using new concepts such as Web 2.0 services or social media. Moreover, Dede (1996) emphasized that the Internet as a media works as a content delivery channel, but more importantly, it enables people to interact with each other.

Dede's visions, concepts and definitions of future developments are not dependent on specific technologies, applications or services. I share his view in stressing the media's ability, in general, to convert content delivery channels and change the form (i.e. multimedia) of instructional messages. Media can also change the ways we work. Therefore, it can be a catalyst to change organizations.

The Internet as a medium enables new types of messages, interpretations and networks to emerge. This approach *"gives instructors the flexibility to customize learning environments to meet the needs of diverse student populations, while providing both high quality and cost-effective learning"* (Matheos and Archer, 2004). To highlight further the features of distributed learning the following quotations are extracted from Oblinger et al.'s (2001) discussion of the definitions, possibilities and aspects of distributed learning:

"Distributed learning environments provide the opportunity to explore a subject in depth, allowing learners to study the material on their own time, or to gain additional experience outside of the defined classroom times or homework assignments. In distributed learning, the learning experience is no longer bounded by the length of the class session."

"Distance education and on-campus instruction are converging, with online delivery systems and approaches being employed for distant, commuting, and residential students. This convergence of 'clicks and mortar' in the form of technology-mediated education is distributed learning."

"Distributed learning is much more than an online substitute for lectures. Distributed learning extends the opportunities for interaction between faculty and student, incorporating simulations and visualizations, as well as collaborative learning."

"The future of distributed learning—and of higher education—will not be a one-size-fits-all approach. Far from spelling the demise of traditional classroom education, online learning allows for differentiation of institutions, learning styles, and pedagogy."

"The possibilities represented by distributed learning are actually highlighting the organizational, policy, and cultural challenges that should be considered, such as learning, strategy, audiences, markets, governance, partnerships, quality, policy, barriers and leadership."

"Distributed learning, rather than distance education, will become the dominant paradigm for higher education—although, in the short term, institutions are confronted with a multitude of challenges associated with the 'distance' component."

In contrast to the black and white myth-type discussion, wherein online education was seen as a rival method to face-to-face teaching, in the distributed approach online and offline activities complement each other. Another aspect, deeply connected with the basic tenet of distributed learning, is the learning philosophy within it. Because ICT-based collaborative technologies allow collaborative pedagogy, both face-to-face activity and distance education can be changed from "teaching by telling" towards an alternative instructional paradigm that emphasizes collaboration and instruc-

tor-guided “learning-through-doing” (Dede, 1996). This paradigm includes constructivist learning experiences in a real world problem-solving context. It highlights the strength of distributed learning as an integrative method for any instruction.

Learning space is a notion that has expanded with the growth of connectivity and virtual collaboration tools (Milne 2006). The physical environment is divided in to three parts in the table below, where one can see the privacy levels of different environments. The table is modified from Milne’s (2006) presentation.

Learning environment dimensions	PHYSICAL	VIRTUAL
PRIVATE	Home, residence	e-mail, portfolio, e-mail lists, collaboration tools, social media
SHARED	Classrooms, collaboration spaces	
PUBLIC	Libraries, lounges, transition spaces	

Table 2-1 Dimensions of a distributed learning environment

Traditionally, the learning space consisted of physical buildings containing services for different purposes: classrooms and small group spaces for face-to-face interaction, libraries, and transition spaces between the educational premises to one’s own residence.

The home residence is usually seen as a private area. Classrooms are a part of the learning institutions’ physical space; the same applies to public places where learning facilities are located. The public spaces may serve as informal learning spaces. Virtual space allows controlling the privacy of one’s own learning space. Furthermore, it is possible to share the space with others. Combing the virtual and physical spaces forms a distributed learning environment, where the levels of privacy may also be assembled flexibly.

ICT allows people’s activities and information to be distributed asynchronously in space and time. Even though the Internet has been said to liberate learning from space and time, there are limits. Connection to the network is still tied to place, devices and access. Time, in asynchronous work, is the most controllable dimension of them all. Place is important especially because of connectivity possibilities.

Modern university learning environments include computing classrooms that often are also used for traditional lecturing. Unfortunately, these spaces are rarely suitable for collaborative learning. Furniture, tables, screens and machines are connected to the floor or to each other, therefore restraining any rearrangements of the space. Teachers using technology are often trapped to the infrastructure with wires.

Attempts to make collaborative learning succeed in shared or public environments have been made by providing the classrooms with easily movable furniture, which can in a modular way form new arrangements of the space. The possibility to use mobile devices clearly creates enhancements that enable students to gather and produce learning material collaboratively. The same principle applies to private learning environment too. Wireless work and study from home or public spaces breaks the limitations of time, because one can access and produce material without physical contact to colleagues.

In the following, my use of the term distributed learning covers activities using online ICT in combination with offline methods in teaching and learning. This broad definition enables me to cover all relevant aspects of the activities, including the past, present and hopefully some of the future fads of practice and theory that will emerge in this field. In the widest sense, distributed learning is to do with all teaching and learning activities that are at least partly performed with digital media and devices employing digital content or delivery channels.

In my thesis, the focus is on the online part of distributed learning. In addition to the delivery view of distributed learning, I also see that the strength of distributed learning is not only in one-way delivery of learning materials, but includes many interactive elements that are most essential in any educational context.

Distributed learning is a mixed approach, which shows that we have choices to design the learning process and environment. Finding the right solution mix for a design problem is the key issue in instructional design. I will discuss these in chapters 2.6 (Instructional Design) and 5.2 (My ADDIE). In addition, I present a classification matrix for defining and presenting choice variables for ICT enhanced learning in chapter 7.2 (Design Exemplars). Too often the discussion about design options is limited to merely selecting an application.

2.3 Application – the Starting Point and the Solution?

Having an online distance learning course is different from participating in distributed learning, where ICT is only used in parts of the course. The goals of the activity should always be the first thing to consider in solving design problems. The media choice should follow the goal setting. Each situation should be thoroughly examined and the right tools for each situation selected. In many cases, we can flexibly choose between offline and online tools.

The following discussion about choosing a learning platform for an organization reflects the situation I was at in the beginning of the time period of this study. No specific applications for online teaching and learning were in use. The discussion describes the choice setting that I had before designing the template. I had the vision, that the template should be an interface that serves as an aggregated portal consisting of various applications and services as modules. The web site would not be an application itself. It should be regarded as a starting point for aggregation/syndication of all services and support that would be used on a course.

Therefore, the template is to some degree an abstract idea, but it contributes to the processes that are essential in planning and implementing courses. The template forms a tool for building learning and teaching spaces. At the beginning of this design process, a decision had to be made between acquiring an aggregated learning platform and building another kind of course site application.

It has been assumed that *if you build it, they will use it* (Ashhurst, 2003). In many instances this is not the case. If the system works, we only have a usable product, but not necessarily something suitable for e-learning (Ashhurst, 2003). In some organizations a necessary needs analysis has resulted in another extreme: "*our organization or institution is unique and needs to create its own online learning tools*" (Bonk, 2002). Considering the building costs, the in-house solution is only a feasible alternative in very few organizations.

Teaching and learning is about collaboration and therefore we should take a broader view than just consider the so-called learning management systems (LMS) that are dedicated and aggregated applications for managing courses. Ismail (2001) points out that often the LMS' have myopically been seen as the key solution for ICT enhanced teaching and learning.

A complete design framework of learning environments may also be built from modules. The interrelated and aggregated applications, which are only a part of the whole system, should, according to Ismail, (2001, p. 333) include the following key functions of learning support systems:

- Management system for management and measurement of training processes,
- Design system for analyzing and designing learning programs' and courses' modules and whole structure,
- Content management system for collaborative authoring environment for creating and maintaining learning content, and
- Support system for supporting teaching and learning activities; including assembling and using the learning materials.

Many LMS's contain most or all of the functions on Ismail's list. Anderson et al., (2004, p. 101) also stress that an online learning system should consist of several special levels of functions. In their framework, they include a user portal, which may be interpreted as a Personal Learning Environment (PLE).

Owing to extensive competition in the market, the applications mostly deliver quite similar services and functionality. This makes choosing the right alternative very complicated, since similar functions are slightly differently presented in different vendor's software. Combinations used in the evaluation of any software can grow indefinitely. Often the application is an entity, presented to the customer as a "take it or leave it" package, which in most cases does not allow tailored solutions.

Briggs et al. (2007) characterize proprietary collaboration technologies by three highly practical dimensions: technology, capability and need. With these dimensions, they present different technologies' capabilities in different situations. Their quite impressive hierarchy of technologies is summarized in the following. It comprises of jointly authored pages, streaming tools, information access tools, workflow systems, resource planning tools, and aggregated systems.

In a *jointly authored page*, more than one person may contribute. Modifications made by one participant appear on the screens of others who view the same page:

- Conversation Tools are text-based tools support two-way communication.
- Joint Document Authoring tools allow multiple authors to create a single deliverable, for example, a shared text editor, a shared spreadsheet, or a shared graphic editor.
- Group Dynamics Tools are for creating, sustaining, or changing patterns of collaboration among people making joint effort toward a goal. These tools are specifically designed to support the invocation of these patterns: generate (brainstorming), reduce (focus), clarify (understanding), organize (relationships), evaluate (goal attainment) and build consensus (agreement).
- Polling Tools are for gathering, aggregating, and understanding judgments, opinions, and information from multiple people. These tools are also used to invoke evaluation and consensus-building patterns of collaboration.

Streaming tools provide an uninterrupted feed of continuously changing data. These include application sharing, audio and videoconference, remote presentations and file transfer.

Information access tools provide ways to store, share, find, and classify data objects. Shared file repositories store digital material for the group. Social tagging systems allow affixing keyword tags to digital objects. Users may search objects based on tags. With search engines users may retrieve objects from repositories. The syndication tools allow receiving notifications of new contributions to pages or repositories.

Workflow systems are designed to streamline the processing of cases where people must execute operation, judgment, and approval events in order to resolve the case. These systems include workflow, document and case management systems in addition to supply chain and customer relationship management tools.

Resource planning tools provide capabilities for coordinating the use of resources for specific tasks; including scheduling, process tracking and dependency analysis.

Aggregated systems are collections of technologies from the other categories. Certain kinds of systems are integrated and optimized for particular purposes, such as learning, and therefore may deliver value over and above that which would possibly be available with an un-integrated collection of stand-alone tools.

- Virtual Workplaces are typically an aggregation of conversation, joint-authoring, document repository, and scheduling tools, often optimized to make it easier for individual group members to coordinate their efforts.
- Group Support Systems (GSS) are typically collections of group dynamics tools. The tools are integrated to make it easy for a team to move smoothly from one activity to the next.
- Project Management Systems are typically an integrated collection of resource planning tools, and typically incorporate progress-tracking tools for the project as a whole and for sub-tasks within the project.

The above classification scheme (adapted from Briggs et al., 2007) works as a list of individual and specific services that could be offered online separately. At HSE, the main alternative from which to choose was either to have an aggregated or a modular service. Three other types of dimensions for the decision also emerge: proprietary applications, open source solutions and (online) freeware. Choosing between these may often be a value-loaded question, but it also includes many important financial considerations. The decisions made in building the services and evolution of the case HSE is described in chapter 2.8 (Design Stages). The next chapter connects the discussion to international and national background.

2.4 Markets, Policies and Networks

Guri-Rosenblit (2003) discusses the unfulfilled expectations in e-learning implementations and distinguishes eight paradoxes and dilemmas in ICT implementation processes in various higher education settings worldwide. She lists the reasons why the implementation and usage of online services varies in different types of organizations:

1. The differential infrastructure and readiness of different-type higher education institutions to utilize the ICTs' potential;
2. The extent to which the "old" distance education technologies and the new ICT replace teaching/learning practices in classrooms;
3. The role of real problems, barriers and obstacles in applying new technologies;
4. The impact of the ICT on different student clienteles;
5. Information acquisition versus knowledge construction in higher education;
6. Cost considerations;
7. The human capacity to adapt to new learning styles and the ability to conduct research in face of the rapid development of the ICT; and
8. The organizational cultures of the academic and corporate worlds.

According to Guri-Rosenblit (2003), the listed issues illuminate partially the differences between the positive and negative expectations presented in the literature about the effects of applying ICT in higher education institutions (see also Piccoli et al., 2001). Furthermore, there are also big differences between countries in the application of ICT in education, especially between the developed and developing countries. Most of the developing countries do not possess the applicable resources to adopt new technologies (Guri-Rosenblit, 2003, p. 16). Many studies have emphasized that both governments and institutions have become more focused and strategic in their policies regarding the use of new technologies (Guri-Rosenblit, 2003, p. 16).

The Ministry of Education in Finland released a strategy for education and research in 1999 whereby an e-learning strategy was demanded from all Finnish Universities. This request followed the forming of the Finnish Virtual University in 2001. The first Finnish Information Society Strategy was published already in 1995. These demands, actions and policies have

clearly stated the demands for actions at a national level that have had an effect on all universities in Finland.

The penetration of broadband network connections and computer literacy are high in Finland. National level strategies have been the enablers of Virtual University activities; i.e. nationwide collaboration and projects. The Universities' strategies point out the necessary training of instructors in ICT and pedagogy to fulfill the requirements of the strategies in addition to emphasizing the relevance of up-to-date information systems to handle student registers, learning systems and their support functions. Community of practice -type networks (see Hildreth, 2004), have also been established in Finland. Especially IT-Peda, the network of learning technology support centers in Finnish universities, was active during 1999-2005.

ICT in learning can be regarded as a "matter on the side", or as a "tool only", but taking an alternative and wider perspective, the processes involved in distributed learning cover the whole array of organizing one of any university's core activities: teaching and therefore also student learning. One of the conclusions that the specialists (the members of IT-Peda) emphasized, was that technology enhanced learning has opened new forums for discussing the development of teaching in general. The processes we must take into consideration deal with the whole array of curriculum planning, IT infrastructure, teaching and learning skills, quality assurance, digital services, communication skills and digital delivery channels etc.

The planning of the solutions should start from the organization's strategic considerations, for example from the definition of learning, curriculum goals, course contents, student competencies and ICT's role in learning. The preparations should only end in acquiring applications.

2.5 Case HSE

In this study, the internal social setting consists of the units and people of the HSE and their activities related to distributed learning. The school had a staff of 450 persons from which 150 were included in teaching personnel. The student population at the graduate level was 3800, and at doctoral level 370 (in 2006). If one also counts the Open University in the student numbers, there were over 10 000 students at the school. In my work, I exclude the MBA and other adult education units of the HSE. In the following, I describe the practical demand for my actions, which are embodied and implemented in the artifact and most importantly in the processes attached to its usage.

The development of ICT, demand for pedagogical skills and changing working life have generated demands for the explicit planning of universi-

ties' activities related to ICT enhanced learning. For this purpose the HSE Center for Innovative Education (CIE) was established already in 1996. In its early years it functioned with project status. As was implied above, national activities have had an influence on the resources devoted in supporting ICT enhanced teaching and learning. Similar projects or units have been, and in some cases still are, present in Finnish Universities. Their numbers increased during the years that the Ministry of Education allocated earmarked funds for the activities to every Finnish university.

During that time HSE also coordinated the Helsinki Business Campus virtual university project. We collaborated with the Swedish School of Economics, because the problems in the technical and pedagogical support services were the same in both universities (HSE Annual Report 2001, p. 11). For example, we built a joint Media Lab for our teachers to practice the use of ICT tools and to develop digital learning material.

All these trends, both positive and negative[2] developments, have steered higher education organizations towards collaboration, even though they are competitors, contending for new students, staff and other resources. Universities collaborate in developing ICT systems and maintain joint support functions.

As discussed in the context of external constraints, all Finnish universities had to have an IT and e-learning strategy. The HSE's strategies emphasized well-functioning infrastructure, skillful users and adequate support functions. The most important principle in ICT enhanced teaching emphasizes the *appropriate* use of ICT in teaching. More about the strategies' effects on the setting is discussed in chapter 5.3.

Even though the action between people is most important in teaching and learning, the facilities, hardware and software form the infrastructure. I do not go into details about the capacity of the school's ICT devices or networks, but of course, their quality are important factors. Online learning applications and digital material production software are the key determinants of the success of ICT enhanced work.

Standards for both the infrastructure and content are key elements in making system integration in an environment where many applications and many diverse demands meet. Compatibility and usability standards aim to

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[2] After the national funding ended in 2006, some universities decided to decentralize or even close down their support units; others continued with internal and project funding. This kind of development generates inequalities between the different universities' teaching staff regarding the availability of support for teaching. The activities of the FVU discontinued in 2010.

help the users to cope with their daily work. On the other hand, new tools are often rejected, because they do not apply to chosen technical standards, even though they might be great enhancements for daily tasks. Security threats are one example of a viewpoint that can hinder, if used as primary criteria in decision-making, any innovations that could enhance efficiency and work processes emerging in an organization.

The level of technology usage in teaching and learning depends highly on the culture and practices in every individual organization. People and their interaction should be at the center of the activity design, not the technology (Jones et al., 2003). Next, we discuss the actors, services and skills required for distributed learning activities within an organization.

The actors are always a part of an environment and contexts. Those that are in central roles in our research are instructors, students and support personnel. The actors' appellations that are used hereon are:

- **Users**, students, are the central point of the whole process of learning, since they use the services that others have created and are maintaining.
- **Maintainers**, usually the instructors (teachers), are responsible for specific course spaces' or sites' contents and interaction management.
- **Coordinators** are the instructional designers who answer for the basic services of the processes and support other actors; they are responsible for the people and process planning.
- **Administrators** are responsible for the maintenance of the systems' infrastructure: hardware and software, in addition to the network facilities.
- **Other support personnel** are also of central importance, but are referred to in appropriate contexts, if necessary.

In teaching and learning context, all these actors are in the same social situation and supposed to work together to achieve a common goal – student learning. Even though they all share the same goal, other objectives exist and they are not always in line with the common target. In addition, different working cultures, which Guri-Rosenblit (2003) already referred to earlier, and professional languages differ among the actors. Collisions and misunderstandings are inevitable. Moreover, the computing skills and attitudes towards ICT usage and its purposes in general of the players' all have effects on the outcome.

The rapid expansion of World Wide Web system and the peer publishing within Web 2.0 services at the beginning of 21st century have received much media attention and the forerunners have had many followers. Applications

are much easier to use than before. This has realized in establishing a critical mass of users of many services. The Web usage is a citizen skill nowadays. The attitudes are more positive, even though the net is no longer as safe as it used to be. This development has made the task for instructional designers much easier because the motivation to use technology is no longer abstract, but "everybody is doing it". The users' skills and knowledge grow along with interest and active use. This decreases the need for technical training and guidance.

Even though the younger generations are more experienced computer users than those that came earlier, there is still a lot of heterogeneity among them as Rowlands et al. (2008) found in their study on "digital natives". For most students, using ICT is natural without any prejudices, because most of them have grown in an environment where ICT is present in everyday life, both during schooldays and leisure time. In Finland, most of HE students have experience in Internet usage before they start their studies (Official Statistics of Finland (OSF), 2010).

Student training is needed in those applications that are required on their way to professionalism in their own field i.e. word processors, spreadsheet programs and presentation applications. At HSE, there is a compulsory course for all students, which includes, in addition to traditional orientation studies, computing skills, academic writing and learning skills. Similar to teachers, they are information producers. The information flow from teacher to student is changing as more collaborative methods are used in teaching.

The disciplines differ too in their use of ICT (Arbaugh 2005). For example, some disciplines rely heavily on text-based material and others are traditionally areas where figures, tables, images and simulations are central in pointing out ideas in the field. The differences between disciplines do not actually explain all aspects of the different diffusion of ICT. In principle, every discipline could be active in ICT employment; the forms that it takes may differ. However, the attitudes towards ICT vary also according to the disciplines the students start to study. In general, most engineers are ICT-oriented and people in humanity disciplines less so (Talja, 2008).

As important as is the organizational attitudes towards ICT, are the smaller units', departments', culture, teaching paradigm and methods. We receive best results when the unit shares some teaching approaches, so that an individual teacher does not have to work individually in isolation.

At an individual level, the teachers' attitudes and skills are the key factors in diffusion. The infrastructure, maintenance and support personnel's responsibility is to design and deliver an appropriate ICT environment to the faculty and students for teaching and learning. The environment's ability to

function requires both adequate infrastructure and necessary skills of the actors to reap the benefits of collaboration using various techniques.

Actors firstly need understanding of the dimensions of the activity and secondly certain skills. The development of these skills in addition to knowledge can be provided in several ways. According to minimalism, the best way to introduce technology skills is linking it to practical work. The skills can be learned on a course or other training sessions, but self-study in addition to colleagues' aid is an important source too. Both the learners and teachers should know about learning, its management and methods. Guides and instructions should be available for self-study purposes. Personal support should also be obtainable.

2.6 Instructional Design

Instructional design, also known as instructional systems design, is a widely used methodology for developing systematic training programs (see Allen, 2006[3], p. 430). Similar to the history of the Internet, ID has its roots in the research work of the US military. The work on ID methodology started in systems engineering to make more effective and manageable training programs for standard military work roles.

According to Allen (2006), the ID methodology development has evolved in stages. The first ID-based training programs were implemented in the late 60s. Later, starting from the 70s many different ID models evolved around the original implementations. The first versions were based on behavioral patterns of learning. In the second generation of models, systems theory was used to control and manage the increasingly complex ID process. New instructional technologies were emerging too and a process development view was emphasized. Despite these new developments, the ID process was found to be too rigid to be used outside the military. Therefore, practices that are more dynamic were developed for civil use. During the third wave, ID was seen as an interactive process. Cognitive theory too was beginning to stand beside the behavioral model in developing ID. The fourth generation of models employed new learning theories, delivery systems, content analysis and even artificial intelligence.

During the last four decades, ID processes have transformed from strictly behavioral engineering models to tools that require expertise of many fields and take into account various notions and methods in human learning and learning technologies. The early processes focused primarily on classroom

[3] This chapter is based on Allen's overview of the ADDIE model in Advances in Developing Human Resources, Vol. 8, No. 4, 430-441 (2006).

education and instructor-led lectures, but the revised models have expanded to job-site and distance instruction – the latest revisions also take into account quality management processes. Therefore, to answer the needs of continuously changing work patterns, the methodology can also be applied in designing education for nonprocedural tasks.

Despite all changes it has gone through, the primary goal of ID has not changed. It aims at field-effective and efficient instruction that helps to prepare individuals to meet their work performance requirements.

The ID processes developed in systems engineering have been adapted to solve problems in workplace training and instruction in general. One adaptation has become a de facto standard or a generic framework for doing ID work. The model is a simple five-step framework, which has come to be known as the ADDIE (Analysis, Design, Develop, Implementation and Evaluation) model (see Allen, 2006, pp. 436-437). ADDIE's structure as a generic design process provides a systematic framework to determine the needs, planning, development, implementation and assessment of a (training) design problem:

1. **Analyze** learning goals and compare them with the skills, knowledge, characteristics, and abilities of the incoming students to determine what instruction is needed. The formative evaluation begins.
2. **Design** instruction to meet the needs. Develop a detailed plan of instruction that includes selecting the instructional methods and media and determining the instructional strategies. Review existing instructional materials to determine their applicability. Develop the instructional objectives. Test and re-design the instruction. Develop the implementation plan for the instructional system and design an information management system for training.
3. **Develop** and finalize instructional materials and learning platform for students and instructors. Revise the implementation plan. Validate each unit and/or module of instruction and its associated instructional materials as they are developed.
4. **Implement** the instructional system. The actual system is ready to become operational. In this phase, the instructional system is published under operational conditions. Gather feedback from the field on the participants' performance.
5. **Evaluate** continuously throughout the life cycle of the instructional system. Evaluation consists of formative evaluation consisting of process and product evaluations and validation.

The ADDIE process includes plenty of feedback and switchbacks between the phases. The modern ADDIE model includes a life-cycle evaluation that emphasizes continuous improvement of the instruction. The products and processes of the phases are continuously assessed for quality. Therefore, ADDIE is a problem-solving cycle, in the manner that van Aken (2004, p. 224) describes the concept. In summary, the revised and enhanced ADDIE model is a collaboration tool for continuous, revisable and flexible decision-making process. It emphasizes the importance of evaluation taking into account both organizational and learning needs from a quality assurance viewpoint. It is a practical tool for an instructional designer.

Visscher-Voerman and Gustafson (2004) conducted a survey of research studies of how instructional designers have actually worked. They found that many descriptive studies of instructional design conceptualize and visualize the design processes with various process models. However, most imply quite a homogeneous view of design, which follows ADDIE-type phases. Their study implied that the processes are actually more diverse than ADDIE-types of models suggest. The diversity emerges because of differences in productions, different development contexts and scales, schedules, or size of the project budgets, and the designer's experience or formal design education. The requirements of each context demand different design processes and activities.

The designers studied in the survey did not follow any rigid step-by-step procedure in their work. In general, they work according to their own paradigms and have different perceptions of good products and process. They emphasize differently the role and function of each of the ADDIE-like functions, and perform these activities at different phases in their working processes.

Consequently, Visscher-Voerman and Gustafson (2004, p. 84) see that each design process is unique. Design approaches are personal, and dictated by individual preferences. Similarly, I regard the ADDIE process that emerged in my work to be a personal tool for structuring work. Moreover, it is not to be followed in detail in every support situation.

In my practice, my goal has been that the process (described in chapter 5.2) is not even visible to the "customer". In most cases, providing tools for problem-solving is difficult enough. Flexibility, context understanding and interaction are needed. Exhausting the discussant with too many choices increases uncertainty and confusion. In my opinion, a consulting process is an expert knowledge exchange and a learning experience for both parties. At its best, it is peer conversation with commonly agreed goals and designing a manageable solution to the design problem.

In chapter 5.2, I show how the processes built around the template identify themselves as similar generic process phases that the ADDIE model offers. Next, I describe the course template, which provides a shared view to the problem space in course design consulting.

2.7 The Template

The knowledge base in 1996 was the evolving environment of different web site interfaces, which were developed without the availability of common standards. My aim was to establish a "general template" that would work efficiently on the screen and would be otherwise easy to use and update. In the design process, the main purpose for creating the template was the instructors' need to meet the challenges of enhancing ICT usage in distributed learning starting from the late 90s – all other outcomes and processes have evolved from this general demand. The other planning issues such as usability and support processes have naturally followed with the decisions that have been made in facing the primary problem. As I describe later, the tools and procedures have developed in cycles. During each cycle practical needs and demands were identified, goals were set and solutions to fulfill the needs were designed – simultaneously facing restraints and overcoming them.

My research question "*How to orchestrate ICT enhanced distributed learning*" may be formulated in a more human-centered form: "*How to make the transition as easy as possible for the users and organization?*" The *transition* here means two things. Firstly, it contains the active and deliberate choice between online and offline media in teaching by each individual teacher. Secondly, it regards the diffusion of an idea, a generic template for a web-based course, and its development over time.

The course template is the starting point for creating instances of it, i.e. the course instantiations as course web sites. The template's structure consists of several elements (see also the figure below). The idea is to suggest via the template a framework for a course interface and simultaneously make the course activities visible on the Web. The left side navigation contains links to the most commonly used functions on courses. Below are short descriptions of each page, i.e. function:

- Home - Front-page for the course site. The first display the users see when they enter the site. The best place to announce current activities and news.
- Enrolment - Instructions on how to enroll for the course or a form to enroll.

- Description - A description of the course contains the information that is found in the study registry/database.
- Introduction - A more detailed description of the course, where the maintainer might elaborate on the course information found in the study registry.
- Announcements - Past announcements of course activities.
- Programme - Timetable, syllabus. Might also contain links to material and exercises of the course.
- Instructions - Instructions for specific tasks on the course, perhaps technical advice if necessary.
- Material - Material listing in addition to download and upload area. It can be one page or consist of the following entities. These also could be found on the first level of the navigation to enable at most "2-clicks away principle" of any function.
    - Lessons - Files to be used in teaching and learning
    - Literature - List of literature, online or offline.
    - Links - Links to outside materials or best sites on the subject area
- Exercises - Material listing, download area.
- Discussion - Discussion area(s), at the minimum a café-type forum, but might contain a listing of specific thematic discussion forums.
- Participants - A list of participants, at its best a listing of student's own sites or personal publishing systems, portfolios, homepages
- Grades - Results of past studies (students should not be identifiable).
- Feedback - Can be one page or consist of the following entities:
    - Feedback forms,
    - E-Mail link and
    - Contact information page.

The introductory and instruction parts should be visible without logging in, depending on the application, of course. It should be possible to set all functions to restricted or open areas of the application, when the maintainers or other copyright owners so prefer.

People use the same artifact (or system) very differently. The principle of flexibility has been well put by Bratteteig (2007, p. 67): during the design process of an artifact, the designers have full control, but after the artifact has been handed over to the users, the users take control of the artifact and do what they want with it. There are three main principles in making modifications to this template after it is instantiated as a course site:

- All functions can be re-named, because the maintainers have varied goals and naming conventions for course activities,
- More functions or activities can be added and
- Any function and activity can be removed from the structure.

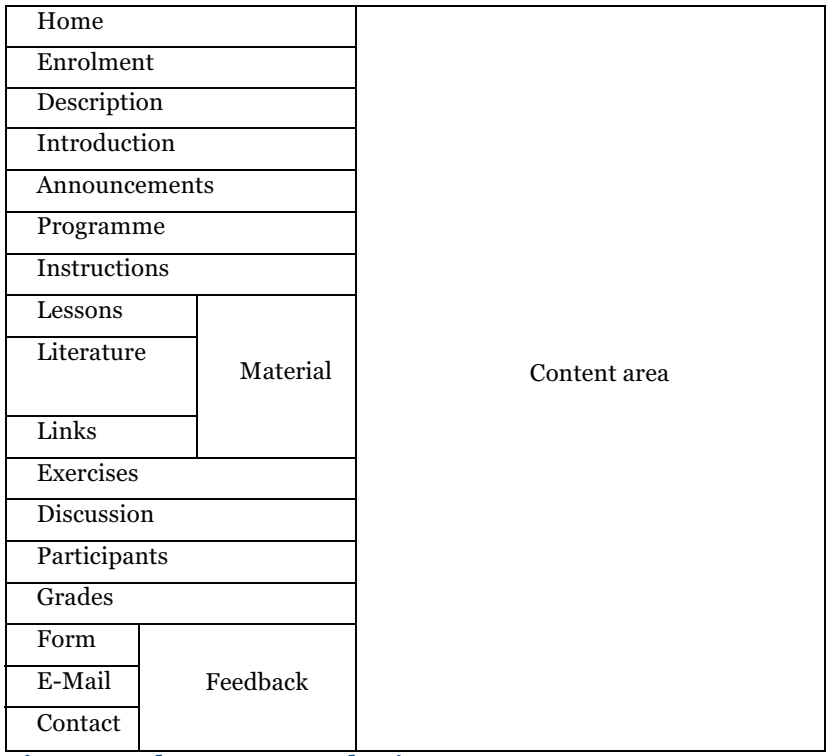

Figure 2-1 The course template's structure

The template is designed to support both distance and distributed learning, because the teacher's media choices may consist of online choices in all course activities. From both the maintainers' and the users' point of view the template could also be regarded as a "chronological storyboard" if the activities are ordered in time order in the interface.

Originally, I named the template as SRSS (Simple Resource Sharing System) to highlight its possibilities to aggregate various services to a single course site. Later, in trying to keep things simple, I changed the name to SR2, because it was easier to pronounce. During the last years, discussions with the users and maintainers resulted in another name change. We started to call it with the page-editor application's name (FrontPage), thereby diminishing the role of the template as an entity and emphasizing the maintainers' ownership of their course sites.

From users' viewpoint, Sweller's (1988) cognitive load theory supports designing the template's interface to be as simple as possible. Sweller (1988) states that human's short-term memory is limited in the number of

elements it can contain simultaneously. Schemas, or combinations of elements are the cognitive structures that make up an individual's knowledge base. Long-term memory consists of structures that permit humans to perceive, think, and solve problems. These schemas permit the brain to handle multiple elements as a single element.

The less the students have to learn and memorize new, changing and complicated course interfaces, the more they have the capacity to adopt new things that are relevant in the substance area they are studying. If the interface is efficient, easy to use and transparent, the students' working memory is less loaded with attempts to learn new interfaces. The cognitive load of the users should be kept to a minimum, even if the layout of the system would be dull. Similarly, teachers' cognitive load may be reduced with personal support and consultation.

Ideally, the interface collects all relevant activities of the course to a single starting point. The tasks in the activities can be handed out to the users in several ways using different media and variety of applications as was set out by Briggs et al. (2007) in chapter 2.3 Application – the Starting Point and the Solution?.

The major hindrance to the success of a modular approach is related to user authentication and therefore user access to services. In an ideal case, all the required services would be accessible through the organization's domain. Without this opportunity to login with organizational usernames and passwords, the modular approach creates extra difficulties in organizing access permissions for external services, especially with inexperienced users. Therefore, due to lack of the organization's resources to provide the required variety, and the coordination demands of external services we had to acquire an LMS, a groupware, to support some of the activities that could not be delivered within the template-based approach.

The template has been developed starting from projects via ad hoc solutions towards a generic artifact. The main periods that the template has gone through from a coordination and supporting perspective is described next.

2.8 Design Stages

The empirical aim in this chapter is to distinguish different phases in the diffusion of the template in this design process. The template evolved in four phases during 1996-2010:

1. *Bringing a new tool to do old things in a different way in teaching* (see chapter 2.8.1, 1996-1997 – The Project). The first phase included making pilot courses and supporting the instructors in their

work. This was done during a project where all (five) courses had similar interfaces and structures. They formed a coherent collection of basic courses in economics.

2. *Making the start of using the tool as easy and attractive as possible* (see chapter 2.8.2, 1998-2001 – Support Service). During the second phase, the ideas that were developed during the project were taken into action with other instructors' courses. The early adopters maintained their own course pages and needed more facilities to maintain the pages.
3. *Standardizing and controlling the innovation's usage by implementing rules and templates without killing motivation* (see chapter 2.8.3, 2002-2004 – Strategy). As the number of web courses grew, the demand for unified interfaces and processes to keep everything manageable by the support, instructors and students emerged in a new standardized procedure, which included easier management of the site structure and template.
4. *Making the template and artifact generic, to be used in different systems, in order to make the transition easy from system to system* (see chapter 2.8.4, 2005-2010 – Standardization with flexibility). Towards the end of the research period, a new technology/system was supposed to be taken into use. In addition, development and support of previously used applications were planned to be discontinued.

During the design phases described above, procedures to manage the processes were developed. The template was complemented with a consulting service (see chapter 5.2, My ADDIE). Hence, they formed a framework suitable for developing the entire course in a distributed mode; containing both face-to-face teaching and online activities. It is a medium for making media and didactic choices, which the instructional designers can use as a map in their work. Therefore, the template also serves several practical purposes:

- Making it easier for the instructors to start using Web in their teaching
- To point out "best practices" to the instructors
- More efficient creation of new course sites
- Standardization of the user interface to increase the usability
- A tool for organizational change
- Transmission of the ideas to other similar contexts

The artifact consists the template and the following processes attached to it:

- Online course site ordering form, which includes guidance for the choices
- Personal face-to-face didactic, pedagogic and technical consultancy that is suggested to the instructor after the order has been received
- Continuous support after the course has been created
- General knowledge of quality development, organizational constraints, possibilities provided by the infrastructure, and managerial issues.

In the figure below the actors in the process are the researcher, teachers and students. The four phases are presented as a general outline of the design process with a picture based on the schema described by Sein et al. (2011).

The phases of the research (Project, Service, Strategy and Standard) provide a timeline for the design process. The figure also contains the evaluation points of the third and final version of the template during the Strategy and Standard template. The scientific outcomes of the research, generated by the artifact building, are presented in the figure as design principles. The utility and benefits for the maintainers and users are also listed in the figure.

The fact that the system was continuously in production is clearly visible in the figure. All the versions of the template were implemented to the production system gradually, course by course, with the teachers. These phases of the template and artifact design process are discussed in detail in the following four chapters.

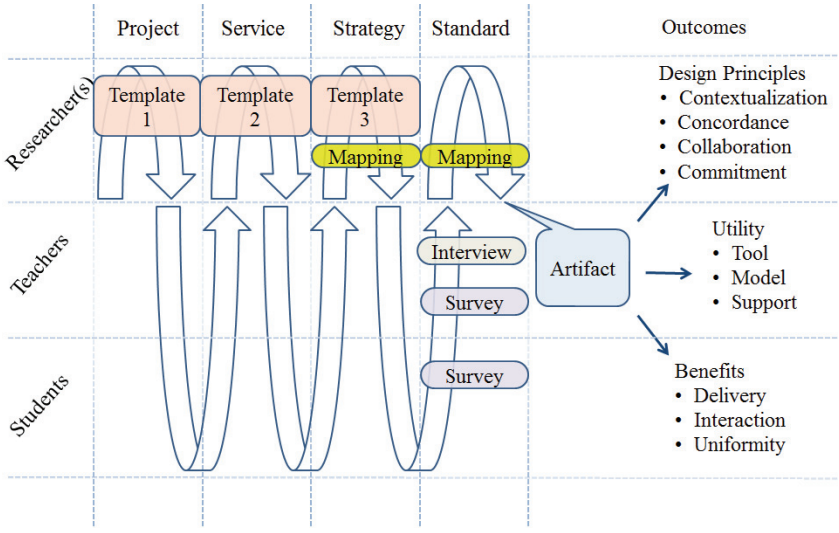

Figure 2-2 The design stages, evaluation points and research outcomes

2.8.1 1996-1997 – The Project

The primary need for a course template emerged from the first project that was conducted in our unit. During the project, a web site was developed for five economics courses in collaboration with students from the Multimedia Manuscript Programme (1996/1997) of the Theatre Academy. The design included layout, colors etc. in addition to the interface structure. In addition to the site creation, the contents of the courses were also produced and maintained. The project was called "Kauppa- ja taloustieteellisten oppimateriaalien kehittämishanke", which loosely translated means "Project for developing learning material in economics" in Finnish.

The project started in the autumn after winning competitive bidding by the Ministry of Education in 1996. In the same year the unit (Center for Innovative Education) was established. The project started by choosing four basic courses in economics containing exercises and material that could be partly animated. I contacted the instructors of the courses in addition to the incoming partners at the Theatre Academy's Adult Education Unit and started to plan the structure of the course sites in addition to the processes related to how to produce the material. A fifth course was added to the project during the second and last year of the project.

All course sites had a similar appearance, but the coloring varied from course to course. The template structure was most important. It emerged from the practical demand of delivering the necessary components of the courses. The project plan was written according to the specifications of the competitive bidding.

Solutions were also developed during the project in addition to the ideas that came in from the researcher's earlier work and the partners' experiences. The researcher employed general ideas especially from an earlier project where he mapped Finnish Web services. The interface for the courses included the following elements.[4] Not all the elements were present for all courses except for INFO and HAKU:

- INFO – The information page contained contacts, schedules and instructions.
- HARJOITUKSET – The page contains links to exercises that could be returned to the examiner via forms (email).

[4] INFO (Information), HARJOITUKSET (Exercises), KESKUSTELU (Discussion), KIRJALLISUUS (Literature), SANASTO (Glossary), LINKKEJÄ (Links), PALAUTE (Feedback) and HAKU (Search)

- KESKUSTELU – The discussion was a link to the unit's own server (Microsoft/FrontPage) where a web-based discussion board was running.
- KIRJALLISUUS – The (offline) literature used on the course was listed here.
- SANASTO – During one of the courses, a glossary of basic economics terms was written by one of the instructors.
- LINKKEJÄ – The links section contained links to external sites that provided data or other material was considered helpful in the studies.
- PALAUTE – An e-mail form for course feedback to the instructor and for site maintenance comments to the maintainer (researcher)
- HAKU – A search facility to find information on the course sites.

All internally produced material was published as HTML pages on the School's server (Unix/Apache). In the material there were also images from and links to external sites embedded in the text. The Statistical of Finland and the Bank of Finland even kindly approved my request to embed their data in the course pages to complement the static data that was internally produced. The external data was therefore dynamic and accessible via the course sites.

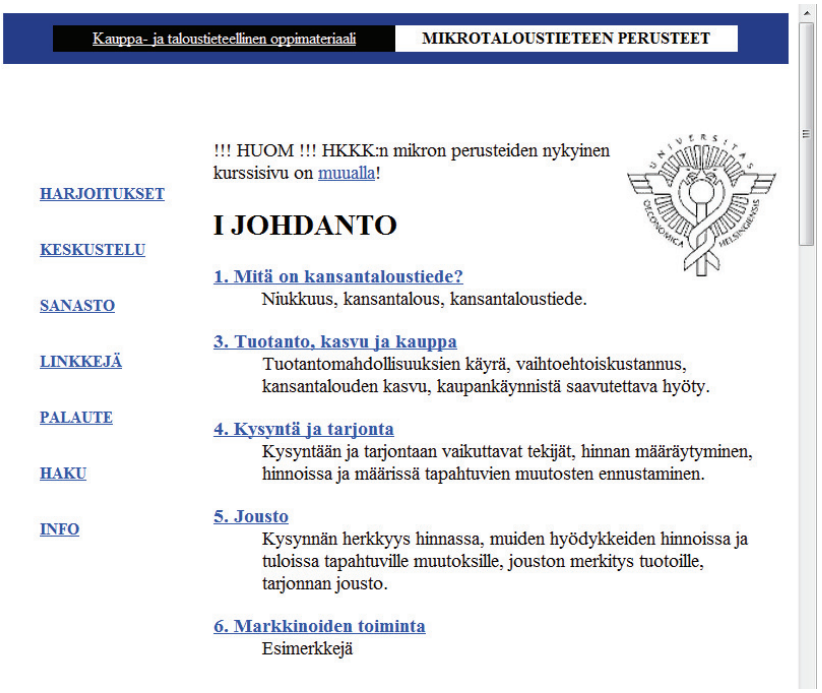

Figure 2-3 The Project, Template version 1

The researcher maintained the sites; the instructors provided only the material. The material production happened in two stages: the instructors produced the textual material and hand-drawn pictures to me who converted and edited them to HTML. From handmade drawings, digitally reproduced figures by another project participant were published in GIF-format embedded on the pages. The two or three stage process was used due to the lack of skills in digital image conversion or production by the original producers. The HTML was produced by hand as was customary in those days, but experiments were carried out with different converters. WYSIWYG editors were not yet very developed. Figure above is a screen capture of one the courses.

One important criterion in making the material and designing the interface was the lack of high-speed Internet connections. Most of the home users were in 1996 using slow modem connections and therefore the size in bytes of the material was kept at minimum. In addition, specific scripts were avoided due to the heterogeneity of the web browsers of the time. All users should be able to access the sites with any web browser; no other applications should be required.

The courses that were part of the project were compulsory courses, but using the online services was not. The www-services were produced to complement the F2F activities i.e. in distributed learning mode. Some of the students were very pleased to have the opportunity to return their exercises via the Web. Some even said in the questionnaire, which was conducted during the project, that it would have been very difficult for them to complete the course without the web services. The material was also used in another university course.

In general, the material was also planned as a self-study material, but the main target was the offline courses' activities and their support. The material was in open Web; as declared on the sites, copyright restrictions apply to their usage.

One of the instructors wrote a personal report of the project. He was pleased with the experience and emphasized the virtues of online working and material delivery. In his opinion, it releases the student and the instructors from boundaries of space and time, the interaction might increase between the students and the instructor, the material can be in itself interactive, and finally, the material can expand to other online resources. The instructor also pointed out in his report, that the planning of the material and online interactions is different from the face-to-face environment. In addition to usability issues, planning should include careful thinking about how the online environment can truly enhance learning. The attitudes of both users and producers also affect the outcome. Such outcome can be bet-

ter, if the tools are easy to use and are learnable. Using an online environment can also distract the user: he/she gives good scores to online courses even though the "fun" and learning happened because of the new tool, rather than due to the substance of the course. The instructor also planned the questionnaire that was completed during the project.

For me, the main lessons from the whole project, from a supporting point of view, were:

- Instructors' skills were not the level that they could use the Web efficiently in their work.
- The ICT facilities (software especially) were not applicable to the instructors because of the technical difficulties in using them.
- Students appreciated online services, but the numbers of students that are constrained to use distance education totally was small.
- If the amount of online teaching required to be increased, more computers should be available to students.
- Interaction through discussion boards, at least in the basic compulsory courses, demanded activation of the discussion.
- Using a site maintainer in the production of the material as a mere converter was not satisfying nor efficient.
- The use of online activities on a course can best be motivated when
    - The students are not within the same geographical area.
    - Students cannot assembly easily for other reasons.
    - Extra possibilities for discussion support the learning process.
    - In some cases the numbers of participants is not large.
    - There are cost savings for organizing teaching and learning (without hindering learning).
    - Students are familiar with ICT technology.
    - The maintainer is able to publish materials and manage the course (or support functions are well resourced and organized).

On other courses, during 1996 and 1997, only some instructors were maintaining their homepages and some departments also had web pages on the school's Unix-server. The pages were edited manually, and such maintaining required HTML-language skills. Demand for support in using the Web in general was slowly increasing.

During the final year of the project, in 1997, the unit purchased its own server where the course discussion boards and feedback facilities were placed. The www-server (cie.hkkk.fi) was planned to become the repository for online teaching materials and specific interactive services in general for the teaching faculty. In November 1997, when the researcher's tasks were

reformed to continue with related work after the project completion, it was stated in the unit's memos that the server "could work as a testing and development ground for the instructors' learning and research materials". The server contained MS FrontPage extensions that enabled feedback forms and discussion boards, which if innovatively used, enabled both open or authenticated text-based return of exercises, bulletin boards, interactive link repositories, discussion forums, learning diaries, and of course basic www-page editing and binary document delivery.

Since the FrontPage extensions in our IT environment did not allow binary document upload to web sites, a script was coded by a coder of the project to enable this possibility. The script was never installed to the server due to missing validating resources at the HSE computing centre. The missing upload service limited the future course sites' expansion towards imitating groupware facilities, otherwise the application enabled quite a lot of interaction, but the binary document delivery was limited to "from maintainer to users" direction only. Of course, it is possible to expand the group of maintainers to include also students, but the FrontPage editor was not easily reachable for students, neither in computing classrooms nor at home, so the binary document delivery services were mostly suggested to the instructors as a "one way only service". If, for example, student papers needed publishing, they should be delivered to the instructor who would publish them on the site.

During the project, the support for maintaining the personal homepages and teaching-oriented pages were mainly of an ad hoc type, created on demand through an individual instructor's interests, mostly on their personal homepages. Support for the activity was given by the school's webmaster on top of his other tasks. In 1998, to react to this situation, the CIE started to provide support for the activity. The units profile was changed to be a support service.

After this phase in the design process, we had an idea that the software of a course system could be used in ICT enhanced teaching at a larger scale than before. The next step would be to start developing the processes to get the system to serve more instructors and students in their work. The first steps had been taken in piloting the project's courses, now the task was to get the diffusion moving on.

2.8.2 1998-2001 – Support Service

The CIE-server's primary task was, at first, to be an intranet for teaching and its support. The second task was to become a system for the instructors' web-based learning material production and delivery. During this second

phase, I needed a template for those instructors who wished to start using the Web in their teaching.
Before starting to build SR2, I evaluated some LMS's in order to find an easy way to start working with teachers. The current systems were unfortunately not satisfactory for an easy starting point, and we decided to continue with the editor-based system.

The second version of the template was developed as a one page course template (consisting of frames) containing the basic elements in making and maintaining a web site for a course. The instructors themselves maintained the pages on their sites and they had free hands in making their pages look personal.

The basic idea of this modular system/idea, called SRSS = Simple Resource Sharing System, was introduced to some of the instructors at HSE. Another group with which the SRSS was discussed was the early "e-learning Community" at the University of Helsinki in 1998. Colleagues presented some doubts about the amount of "handicraft" work, that the SRSS seemed to generate for the support personnel. These concerns were never actually realized, due to the efficient arrangements that were made on the working and publishing processes. More about these is discussed in the following chapters.

The first courses were developed together with the instructors; basing the design on their past work. During the first year of the second phase, training of the maintainers of the system was given in addition to consulting about daily tasks. The main principle of the template was that it should be easily adaptable by the instructors – and the instantiations easy to use for students. The basic idea of the hyperlinked Web was the guiding principle: creating a starting point and template for all the elements of a course/site serves as the tool to manage the course activities by linking them together.

The researcher wrote a guide for establishing and maintaining a course site, simulating an actual online course. The material was produced as a self-study site and the template, SR2, was the same as that which was supposed to be used by the maintainers.

In the action plans for 1999, pedagogical training was included as a task of the unit. The self-study material was updated in 1999. Information gathering about which courses have web sites started the same year. The list of course sites was published for users on the Web. A proposal to join the Finnish Virtual University was also made during that time.

Along with the increase in the number of course sites, an idea of a more generic template was introduced in the researcher's to-do-notes. The goal was to design a modular template, which could be used in any groupware or publishing application. This was due to the new information system that the

school had purchased. In short, the idea was to use the newly established systems to produce a modular system for courses. There were several reasons to take this path and make a formal proposal for such an approach. This idea was summarized in the researcher's notes: "*A modular web-based production environment enables tailoring of solutions to specific needs. We need to standardize generic methods and a template for web-based activities, which consists of modules produced with any application. The modules can be tied together with the course web site's interface.*"

The modularity principle to be used could have been expressed as “the best dedicated services for the appropriate task”. As was explained before the idea diminished quite considerably due to practical problems, for example in authentication. Enthusiastic teachers used the principle only on some courses. Therefore, the work continued, but it took another direction. But again, the plans to integrate the course sites to the new portal or new intranet were never realized. The second step was implemented after HSE published its new web pages in 2001. A face-lift was made to the layout of the SR2-template on courses at the CIE-server, but the basic processes and links remained the same.

After the attempts to integrate/transfer the course sites into the schools systems failed, at the end of 2001 a license for a commercial groupware application (Optima) was purchased in order to ensure two-way interactivity, especially for student-to-student collaboration. Because the school’s ICT infrastructure was based on Microsoft products, the next step from moving from MS FrontPage to MS SharePoint was also discussed, but the application was then not scalable for course purposes.

A more structured approach to designing the ICT enhanced learning environment started to emerge via strategy work. The Ministry of Education demanded an e-learning strategy from each university.

2.8.3 2002-2004 – Strategy

The strategy work was started as early as in 2000 when an attempt was made to embed ICT enhanced teaching and learning to the general ICT management strategy. Because the ICT strategy work was postponed, a separate strategy was created for “ICT in Teaching” (Tieto- ja viestintätekniikan käyttö opetuksen tukena Helsingin kauppakorkeakoulussa - strategia vuosille 2003–2006) as requested by the Ministry of Education. The school’s board approved the strategy in September 2002. The development goals set in the strategy are discussed in chapter 5.3 (Formative Evaluation Criteria and Measurement).

After using the ad hoc course pages, it was concluded that a more specified process was needed in order to serve larger numbers of instructors and courses. An interface and layout for HSE courses as a look-a-like for HSE web pages was designed to give the course sites a coherent look with the school's Web presence. In addition, the support site, the self-study simulation of the course functions, was given the new layout. A study register and guide (Oodi) linking was added to the interface. All the course sites were mapped out during 2004 (see chapter 2.9 for the results).

This phase contained a name change. The SR2 started to be called "FrontPage", simply to introduce and emphasize the use of a tool that fitted well the software palette of the organization. During the third phase, the SR2 template was developed further with the help of a temporarily hired programmer who implemented many new features to the framework:

- Dynamic Web Templates (organization level maintenance "supposed" to be easier).
- Integration with Oodi database queries.
- New and compact layout.
- The structure of the template was rethought in a group session among the HSE support persons for distributed learning.

The frames approach was also abandoned during this transition. This project preceded our first attempt to implement SharePoint to teaching. This implementation was not fully realized either. In the final steps, the necessary IT infrastructure was not opened to the project and our programmer left the School before we could start testing and piloting the application. We continued with FrontPage and Optima. The basic idea for the FrontPage solution was still the same as in 1998.

2.8.4 2005-2010 – Standardization with flexibility

The fourth design phase also included the start to develop Windows SharePoint Services as a replacement for FrontPage. This work was supposed to be continued within the HSE portal/extranet project. In 2006-2007, we planned to modify the template in order to increase concordance between the sites. It was supposed to act as a template for online courses in the HSE Portal (SharePoint Portal Server). This project was not realized.

The strategy update for e-learning was accepted by the HSE board in early 2007. For research purposes and artifact evaluation, all the course sites were mapped out for the second time during 2007 (see chapter 5.5 for the results and comparison with the earlier evaluation in 2004). The personnel

(see chapter 5.4.1) and student (see chapter 0) surveys were conducted in 2006. The teacher interviews took place in 2007 (see chapter 5.4.3).

HSE was merged to Aalto University at the beginning of 2010. The CIE-server was stood down in October 2011. The transfer of the courses to the new applications started in June 2011. The future step in transferring the template approach to course sites will be with the Optima application and wiki platform in an Aalto University setting.

During this design phase the researcher became interested in design research. The research plans changed accordingly. There was already data from 2004 about how the template was in practice used on the school's courses. The results of the mapping are presented in the next chapter.

2.9 Course Sites in 2004

From 2003 onwards, we started collecting detailed data about the course sites. The aim prior to that was at first, to collect data that in those days would aid developing the support activities that concerned hundreds of courses. The new kind of data was necessary in keeping track, firstly of the maintainers, starting and ending dates of the courses, external users' account information, and applications in use, and secondly to provide data of the scale of the activities to give background to future strategy work and yearly planning activities.

While gathering more detailed data than simply the numbers and names of the courses and maintainers, curiosity of what is going on in the course sites was raised too. How were the applications used in teaching and learning? This knowledge would help in targeting support activities and teacher education to areas where they would mostly be needed. Due to limited time resources, producing very detailed descriptions of each course's activities was impossible, since it would have had to include interviewing each courses' participants and teachers and keeping track of all activities happening on the courses. It was considered that a "mapping of modules in use" approach would be appropriate and that this would tell enough of the nature and extent of the activities.

In 2004 (from April to October), the first mapping was conducted by a graduate student (Toivonen, 2004). My role was to guide the empirical work and provide preliminary outlines for the work. The main findings of the work are presented below.

In all, the number of sites and pages that could be interpreted as course sites was 298. Extracting from this the sites that directly referred to a specific course and were in use during the semester 2003/2004, the final data to be analyzed contained 190 course sites. The total number of courses dur-

ing that year was 432, meaning that about 40% of all courses had some kind of online activity.

Systems	#	%
FrontPage	98	51,6
Unix	65	34,2
Portal	7	3,7
Optima	13	6,8
Other	3	1,6
Combinations	4	2,1
FrontPage + Optima	1	
Unix + Optima	2	
Portal + Optima	1	
TOTAL	**190**	**100**

Table 2-2 Course sites in different systems (year 2004)

As can be seen from the above iteration of analyzable courses, it was not always evident which sites and pages could be interpreted as teaching or learning-related. The base data for finding the courses consisted of all listings of pages on the department web pages, the CIE web course listings, and CIE-server root. Evidently, there were many different types of sites found, test pages, and abandoned sites etc., but there were also five different systems in use for online course activities. The school had four systems that were used for course management and teaching. In addition to those, a few courses applied, for example, commercial providers' servers or other universities' systems. We included other systems in the analysis, when they were referred to as course sites in the listings. Some courses used combined approaches, where the instructions were first given in an open system and then students were led to the closed collaboration tool, Optima or elsewhere. The numbers and percentages of courses in different systems are presented in the table above.

The FrontPage-server has been running since 1998[5] when it was purchased by CIE as a recommended site for online course sites. Over half of the analyzed course sites were located there. The UNIX server had been in use from early 1990 to provide a platform for any kind of static web page publishing. The school's portal (starting from 2002) enabled the making of individual web pages and some course sites were located there. The Optima-application, which was acquired in 2001, provides full-scale online learning environment for collaborative work; i.e. it includes the facilities of an LMS.

[5] Discontinued during fall semester 2011.

Over half of the courses were on CIE's FrontPage server, which was the place where the template's second version was developed. The teachers were provided with it when they started building new courses on the server. In this phase, every third course was located on the UNIX server. There were also some courses that employed the first version of the template, which was developed during 1996-1998. The server usage shows that during that time, we were in a transition period. The CIE server was starting to be more popular among the teachers. The FrontPage editor, which was used in page editing, was gathering more interest because of it enabled WYSIWYG editing features, discussion forums and bulletin boards.

More interesting than the server distribution is the actual usage of online services, which is included in the results of the 2004 survey for functions used on the course sites. They are presented in table below. The table shows that the most popular items of the template concentrate on course information and material management; i.e. introduction, schedule, materials, and announcements and contact information are the top five items.

INDICATOR	**(%)**
Introduction	95
Schedule / Programme	76
Material (in general)	76
Announcements	70
Contact information	68
Material, other than lectures	67
Links	67
Exercises	59
Maintainer name	51
Last updated	51
Material (Lecture slides)	46
Access protected (even partially)	43
Layout (template in use)	38
Grades or results	34
Feedback (not just an e-mail address)	18
Examples of exercise answers	17
Participants	15
Discussion board	14
Enrollment (not just a link to another system)	8
Link to another learning system	7

Table 2-3 Occurrence shares of indicators in 2004 survey data

These indicators' shares were gathered by my visiting the course sites, and making notes about what kind of functions were found. The (emphasized) indicators in the table are based on the template's structure. During the survey, the researcher made observations and interpreted the meanings of the links in the interfaces and page contents. The lessons learned from the survey included, for example, introducing "instructions" to the interface and introducing the "grades"-link in the protected area for privacy reasons.

Those items that represent collaborative and community aspects of activities, such as discussion forums and participant listings, were not often found on the sites. This indicates that the collaborative work in distributed learning has been seen best to be exercised offline through face-to-face methods. This result cannot be said to solely emerge from lack of knowledge or negative attitudes towards online learning. In a small school with the campus located almost in the heart of the city, it is only natural that people wish to interact without the limitations of technology when possible. When interviewed, the students especially stated that they appreciate personal contacts with the teachers.

Therefore, the motivation to use online facilities has to be found from supporting the offline part of distributed learning. We should not aim at online learning per se, but towards practical use of technology to develop and support existing processes. By enhancing the current processes with ICT, we develop the skills and attitudes within both the personnel and students. Only after ICT is seen as a common method to make certain actions, can we expect it to be able to effectively change the processes towards more collaborative online activities. The penetration of ICT in daily routines helps in changing working culture and attitudes.

In an organization where there are alternatives to choose from and commands cannot be given, penetration can be increased only by voluntary acceptance and good motivation. Teaching is a good example of a process where there are always alternative methods available. In this regard, for example, it is easier to change a business process, such as payments, from offline to online mode by command. Something that traditionally has great freedom according to academic traditions, such as teaching method choices is more difficult to change. The change mainly depends on the teachers' own choices.

I should emphasize that I share the standpoint that teachers should be able to make independent choices of their teaching methods; including the choice of tools. The duty of an instructional designer, with a goal to enhance and ease personnel's work, is to provide grounds, justification and motivation for them to consider other alternatives too.

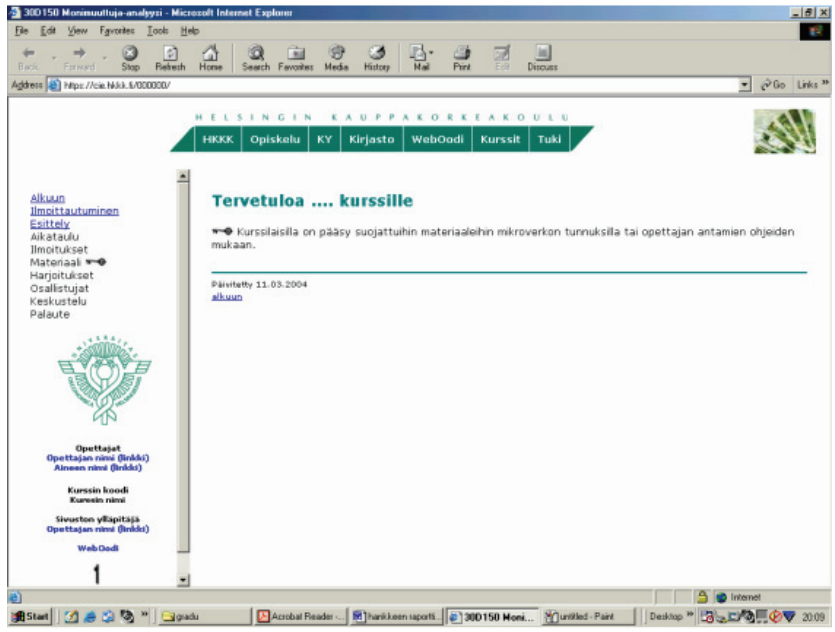

Figure 2-4 Template layout in 2004

An important detail from the survey data for my work was that the current template-layout was in use in 38% of the analyzed courses. In practice, this means that among the FrontPage-sites there were still some old layouts present in about 14% of them.

The template-layout that was current during the survey is presented in the figure above. This layout, as mentioned earlier, is constructed with html frames. In the top frame the external links point to the school's main site, study-related information on the main site, student union, library facilities, enrollment and study register, main listing of all course sites, and finally the support site for online learning.

The left frame includes the following internal course site links: start, enrollment, introduction, schedule, announcements, material (the key indicates protected information), exercises, participants, discussion, and feedback. These items in the template were presented to teachers as the starting point model for developing their courses. Below the school's logo, there are links to the teachers' and maintainers' contact sheets and discipline pages on the school portal in addition to a space for the course code and name.

The second to last item (Weboodi) is a link to each specific course's description in the study register – the same information that is found in the study guide. This link is provided to avoid the situation whereby teachers should produce their course descriptions twice. It also serves as a backup if the site is not maintained regularly. The study register provides current information, but cannot flexibly enough serve the same function as course

sites in terms of daily announcements and other more detailed information such as learning instructions. The last item is the page hit-counter (image) that presents approximately the number of visits on the page. The largest area on the template, right side bottom frame is reserved for page contents.

The support personnel filled out the contact information and external links when creating and launching the first course site; the part of the template that contains course activities, was supposed to be maintained by the teachers.

The reason for framing the site was to diminish the efforts to update the interface on each page, because, with frames, only one page has to be updated in the case of changes. The other reason was that each content page could be embedded in any other site without carrying any specific references to a specific course. In this way any content page can be used in many sites; for example, if on a course one has several groups that use the same basic information. There can be many sites that have some shared views to the same information without the need to update that same information on many sites. Shared disciplinary and other material repositories are also easily distributed with the frames approach, without losing the feeling of "one site" for each course.

In order to obtain a more general view of the current situation, we organized the results of the mapping according to the main categories that emerged from the data. The courses were categorized to four types of class. The number of analyzable sites reduced (to 181) since not all sites could be categorized. The starting point was to categorize the courses so that interactivity and quantity of information changes from level to level. The aim was not to be able to determine which category is better than the other is, but to distinguish different uses of the template and other online applications.

My preliminary assumption before the survey started, based on rules of thumb, was that we would find five categories resembling:

1. **Meta-Information** that would include a replication of the texts in the published Study Guide,
2. **Course Information**, that would extend and elaborate the published Study Guide's contents and include more detailed instructions,
3. **Material Delivery Channels** that are mainly sites for publishing lecture notes and exercises,
4. **Collaboration** that would include discussion forums and other online collaboration services,
5. **Online Course** where all activities are online.

After the graduate student had organized the data, she suggested four categories that were, in her opinion, the best to describe the whole supply of courses (Toivonen, 2004). The following four categories were reported:

1. **Course Information** sites include the template item called ”Introduction” or introduction to the course elsewhere; for example on the front-page of the course. This category does not include any courses where the indicators discussion, material, exercises, announcement, schedule, participants or grades take a positive value.
2. **Bulletin board**s are not material delivery channels, but on the other hand, neither are they as static as the sites labeled Course Information sites. In addition to introductory contents, they include schedules, announcements, or participant lists. On these sites, there are no discussion boards, material or exercise delivery channels.
3. **Material Delivery Channels** contain materials, exercises, examples and other information, but they do not introduce interaction between the teacher and the students or student collaboration. E-mail may be used in communication.
4. **Interactive Environments** support online learning such as discussions, personal feedback, collaboration tools or multiple-choice exercises. Noteworthy is that only one of the analyzed sites belonged solely to this category; all other sites also belonged to the previous, Material Delivery Channels, class. In this group, 93% of the sites included delivery of learning material.

In conclusion, the sites were mainly Material Delivery Channels, and only every seventh site could be interpreted as an Interactive Environment. None of the courses were 100% online in the survey. Additional information on some key indicators by group is presented in the table below.

The row containing shares of sites that provide contact information reveals interesting viewpoints to attitudes and practices. The more there is interaction and information on the site the more often contact information is also visible. This can be interpreted as indication of the following issues:

- In the classroom, everybody knows who the teacher is. In addition, if the course site is seen as extra work, the less information there is, the smaller is the will to maintain the site.
- There should be more commitment to, understanding of and expertise in maintaining web pages in general.
- There has been lack of guidance, motivation, culture and “standards” to maintain course sites. Only the active teachers update their pages frequently.

- The high occurrence shares of schedules and announcements in the last three categories show that the course sites have been used for delivering information about the timetables and other current issues during the courses. This can be interpreted as improved motivation to update the pages regularly and can be seen as an indicator that these modules have served the students as well.

Discussion forums are present only in the category of interactive environments because the item was one of the main selection criteria for the class. Only 14% of sites were using forums. If present in teaching, the discussions are clearly held in different forums than those online.

Categories, groups	**Course Information**	**Bulletin Board**	**Material Delivery Channel**	**Interactive Environment**
Group share (%) of total	5	14	76	14
Contact information (%)	30	73	70	78
Schedule / Programme (%)	-	100	79	89
Announcements / Bulletin Board (%)	-	65	77	70
Discussion (%)	-	-	-	96
Protection share (%) open/partial/closed	100 / 0 / 0	88 / 12 / 0	50 / 35 / 15	41 / <30 / <30
By server (the share (%) of the location of sites by groups)				
FrontPage	10	38	56	52
Unix	70	50	30	0
Optima	-	-	9	37
Other	20	12	3	0
Combination	-	-	3	11
Share (%) of template layout present				
	-	23	43	78
Number of items in interface (i.e. number of template items)				
Mode	1	1	4	6
Average	2	4	6	7
Maximum	12	9	33	13

Table 2-4 Key indicators' shares (%) by groups

The Optima-environment (21% of all protected sites) is always restricted to personal accounts; in the other systems (69% of all protected sites), folder-based protection was mostly used. In about 6% of all protected sites, file-level protection was used.

Surprisingly the template (FrontPage) approach results in higher shares than Optima, the groupware, in the Interactive Environments category. It seems that the bulletin boards and discussion forums that can be attached to FrontPage sites served the basic needs for communication and collaboration rather well. Another reason for this approach might be that the learning curve for maintaining Optima is higher than for FrontPage.

The style of categorization also affects the FrontPage shares in interactivity, since the survey maker included not only those sites in the category that have online discussion forums, but also those that were using words like portfolio, multiple choice exercise and pair work in their interfaces. It seems that, in campus-based teaching, collaboration is seen to happen best in offline situations.

VARIABLES / CATEGORIES	**Course Information**	**Bulletin Board**	**Material Delivery Channel**	**Interactive Environment**
Description				
Introduction	INCLUDED			
Enrollment				
Announcements	REJECTED	INCLUDED		
Instructions				
Schedule	REJECTED	INCLUDED		
Material	REJECTED	REJECTED	INCLUDED	
Exercises	REJECTED	REJECTED	INCLUDED	
Links				
Discussion	REJECTED	REJECTED		INCLUDED[6]
Participants	REJECTED	INCLUDED		
Results	REJECTED			
Contact				
Feedback form				
Feedback				

Table 2-5 Conditions for course categorization

The categorization of courses resulted in zero courses using the template in the first, Course Information, class. This might be due to the fact that in that class most of the sites were carried out without the template or any

[6] This category included also courses, where it was indicated that exercise or other feedback was given, portfolios or group works were mentioned.

other structure than the teachers' own layouts. In addition, they are most likely to be one of the oldest sites created for course purposes. The shares in the next classes are 23%, 43% and 78% respectively.

The number of items in the course interfaces confirms the intuitive assumption that moving towards more online interaction also increases the number of activities – the average number of items increases steadily starting from group 1. The extremely high maximum number of items (33) in group 3 is due to one teacher who worked quite independently outside the reach of the support personnel.

To be included in the categories, certain conditions for the course site should be met. The map above explains the system that was used in using the variables to form the categories.

The results of the second course site evaluation belong to the ADR process. They are explored in chapter 5.5 on page 95. They reflect changes that have happened during the following years after the first evaluation. Next, I discuss the disciplinary and methodological context of my research.

3 Methodology

This research is conducted in the realm of IS (Information Systems) science, which is at the confluence of people, organizations, and technology (Hevner et al. 2004, p. 77). ISS has traditionally been methodologically a very heterogeneous discipline. One of the continuous discourses within the discipline has been the search for the core of ISS (see Banville and Laundry 1992).

Information systems researchers are not interested in IT artifacts per se. People construct, interact with, and operate information systems, which consist of many components or artifacts as parts of a larger IS infrastructure, such as pencil and paper, software, computers, networks and human skills. Human skills may be in the form of, for example, the users' or system support personnel's professionalism. The systems have a function to support peoples' activities and decision-making. Therefore, information systems are regarded as social systems where IT is just one part of the ensemble. Hevner et al. (2004, p. 76) further define the role of IS as follows:

"Information systems are implemented within an organization for the purpose of improving the effectiveness and efficiency of that organization. Capabilities of the information system and characteristics of the organization, its work systems, its people, and its development and implementation methodologies together determine the extent to which that purpose is achieved. It is incumbent upon researchers in the IS discipline to further

knowledge that aids in the productive application of information technology to human organizations and their management and to develop and communicate knowledge concerning both the management of information technology and the use of information technology for managerial and organizational purposes."

My research topic is related to many sub-fields found in ISS literature; such as

- Computer supported collaborative learning and group support systems via discussion on learning management systems,
- ICT training and technology adoption in relation to user's skills in using and managing systems,
- Human-computer interaction and interface design through building the template for web-based courses, and
- Management of IS, and IT project management through organizational structures and constraints that are part of the artifact.

In terms of practice area, my research is closest to computer supported collaborative learning; i.e. online activities within distributed learning. In addition, the work is about designing an artifact for improving the distributed learning environment. Therefore, the phenomenon contains aspects of group support systems, ICT training, human-computer interaction, interface design, and technology adoption. On the other hand, my focus is not in the teaching of learning processes or any single point of view of these IS sub-fields. The artifact is designed to embed parts of them. Management of IS and IT project management are fields which are present in this study via my research methodology, action design research (ADR).

Hevner et al. (2004, p. 84) state that the critical nature of design science research in ISS lies in the identification of new capabilities needed to expand ISS into novel realms *"not previously believed amenable to IT support"*. In addition, such research is significant in the IS field only if there is demand for the ability to construct such an artifact, it is uncertain how it performs, and the activity is important to the IS community. They further underline that the objective of research in ISS is to acquire knowledge and understanding that enable the development and implementation of technology-based solutions to heretofore unsolved and important (business) problems. Design-science researchers approach this goal through the construction of innovative artifacts aimed at changing the phenomena that occur. In addition, to achieve knowledge and understanding of a problem domain, design-science researchers build, apply and evaluate artifacts. The artifacts' forms vary from software, formal logic, and rigorous

mathematics to informal natural language descriptions (Hevner et al. 2004, pp. 76-77.) Hevner et al. (2004, p. 80) also describe an IS research framework, where:

- IS research rigor comes from applicable knowledge, which is based on knowledge foundations (theories, frameworks, methods, instruments, constructs, models and instantiations) and methodologies (data analysis techniques, formalisms, measures and validation criteria). *"The knowledge base provides the raw materials from and through which IS research is accomplished. Prior IS research and results from reference disciplines provide foundational theories, frameworks, instruments, constructs, models, methods, and instantiations used in the develop/build phase of a research study. Methodologies provide guidelines for the justify and evaluate phase."*
- IS Research relevance is ensured with research that satisfies business needs that stem from people (roles, capabilities and characteristics) organizations (strategies, structure, culture and processes) and technology (infrastructure, applications, communications architecture, development capabilities)
- IS Research is about developing and building, justifying and evaluating scientific work using methods such as cases, experiments, field studies and simulation to add more to the knowledge base while applying the appropriate tools in appropriate environments.

In the next two chapters, I outline the methodological frameworks that are of relevance in my work. Key concepts of design research within the IS discipline are presented in the next three sub chapters (3.1 to 3.3). The methodological choices are analyzed in detail later in chapters (4.1 Positioning the Researcher and 4.2 Research Problem) as part of my ADR problem formulation.

3.1 Design Research and IT Artifacts

Design gives a form to an idea, but it is also concerned with the problem-solving process. Therefore, design is very much about communicating ideas, through an artifact, in a defined context (Bratteteig 2007, pp. 65-66).

In mid-sixties, Bruce Archer described design as an activity that is common to many disciplines. Design emerged as systematic approaches to problem-solving, informed by computing technologies and management theory. The goal of the early design researchers was to develop design into a

science (Luck, 2006). Later Herbert Simon defined the science of design as an analytic and teachable doctrine about the design process (Cross, 2006).

The original concept of **design science**, science of the artificial, is based on a positivist epistemological assumption, because it involves the adaptation of a hypothetical-deductive view of research and means-ends rationality: designers have pre-set goals and they produce artifacts to achieve those goals with a set of theory-bound assumptions and testable hypotheses. In design science, the focus is in design, specification, and evaluation of artifacts.

Hevner et al. (2004, p. 77) argue that technology and human behavior are not dichotomous in an information system (IS) and that they are also inseparable in IS research. This argumentation emerges from the pragmatists' paradigm, within which scientific research is evaluated in the light of its practical implications.

Iivari (2007a, p. 111) elaborates on differences of the term 'design' in different disciplinary areas. He defines the terms 'design science' as used in the IS context, and the 'design research community'. In the latter, 'scientific design' means that design products should be based on scientific knowledge, whereas 'design science' means that the design process is based on an explicitly organized, rational, and wholly systematic approach to design. The design process is seen as scientific activity.

Hevner et al. (2004) use the term 'design science' in their presentation of guidelines for IS research. In their discussion of the role of theories in research, they state that in the behavioral paradigm (problem understanding approach), theories that explain or predict phenomena are tested with empirical data. In design science (the problem-solving approach), research theories are also important, but in a different manner. In design science, **theories and models are not always tested, but they may be used as frameworks in artifact building and evaluation**. In the following, it is useful to note that the use of the term 'design science' in the article by Hevner et al. (2004) is an effort to contrast the building aspect of IS design (science) research with natural-behavioral science research (Iivari 2007a, 112).

The organizational strategies, structure, culture, technology infrastructure, applications, communication architectures, development capabilities and existing (business) processes affect the (business) needs that are assessed and evaluated within the organization. The (business) need or research problem emerges from these issues. If research activities are framed to address practical needs, research relevance is assured. **The goal in design-science research is utility** (Hevner et al. 2004, p. 80).

The **practice of design science research is based on building and evaluating artifacts**. Hevner et al. (2004, p. 78) stress that design is both a process (a set of activities) and a product (an artifact). As a process, design describes the world as acted upon. The artifact presents the world as sensed. Therefore, the research perspective of a specific problem should continuously shift between activities and artifacts. Following this view, the **design process can be seen as a sequence of expert activities that produce an innovative product (a design artifact)**. The evaluation of the artifact provides feedback information and better understanding of the problem. The purpose is to improve the quality of both the product and the design process. This build-and-evaluate loop is an iterative approach that is repeated many times before the design artifact is finalized (Hevner et al. 2004, p. 78).

Hevner et al. (2004, p. 84) point out that theories challenge design-science researchers to create artifacts that enable organizations to overcome clearly defined practical problems. Sein et al. (2011) add to this view that the outputs of this type of research do not include only instances of innovative artifacts, but also knowledge about creating other instances that belong to the class of problems addressed.

Hevner et al. (2004, p. 79) define IS research areas as the problem space, in which the phenomena of interest for IS research exist. The space is composed of people, (business) organizations, and their existing or planned technologies in addition to the goals, tasks, problems, and opportunities that define (business) needs, as people within an organization perceive them. These perceptions are shaped by the roles, capabilities, and characteristics of people within the organization. Orlikowski and Iacono (2001, p. 121) go further and define IT artifacts as those **bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/or software**. This is called the ensemble view of IT artifacts (Sein et al., 2011).

Hevner et al. (2004, p. 78) address two design processes, **build and evaluate**, and four design artifact types produced by design-science research in IS. The artifact types are constructs, models, methods, and instantiations (March and Smith, 1995). Orlikowski and Iacono (2001, pp. 131-133) use five **premises to conceptualize the IT artifacts**. These premises indicate that a one-size-fits-all conceptualization or theory that suits all research cannot be found:

1. By definition IT artifacts are not natural, neutral, universal or given. They are shaped by the interests, values and assumptions of people and therefore implicated in action and effect.

2. Their existence is bonded with their development and use. They are always embedded in time, place, discourse and community.
3. IT artifacts are in most cases not whole, uniform and unified, but to the contrary, they are built of fragile interconnected components, that often break down, wear down and shut down.
4. IT artifacts emerge from social and economic practices. They are neither fixed nor independent. Their instantiations reform over time when the environment changes.
5. IT artifacts are dynamic by nature, because in order for it to work, the changes in its context and conditions have to be accounted for.

In their definitions, Hevner et al. (2004) concentrate on the form of artifacts. Orlikowski and Iacono (2001) emphasize the context and social aspects of IT artifacts. In both articles, it is agreed that information systems research has a dual mission (Sein et al., 2011). Research has to include scientific contributions and assist in solving practical problems. According to Hevner et al. (2004, p. 81) the main difference between routine design and design -science research is the research contribution to the IS knowledge base – to its foundations and methodologies. Design-science research also deals with unsolved problems in unique or innovative ways or existing problems in more effective or efficient ways.

Artifacts are human made things. By definition, they have to be invented and produced. The design process of making artifacts may be analytical or generative. In **analytical design**, the reasoning is based on prepositional understanding and the process is rule-based and determined. In **generative design**, the process is indeterminate and subjective. IT-artifact design may include both types of design processes (Pries-Heje and Baskerville 2006, p. 34).

Van Aken (2004) discusses the differences between description-driven and prescription-driven research approaches. She sees that the focus, perspective and logic differ fundamentally between explanatory sciences (similar to physics and sociology) and design sciences (similar to medicine and engineering) paradigms (Van Aken 2004, p. 236). Description-driven research is problem focused seeking explanations, the researcher is an observer and the logic of research emerges from hindsight. In prescription-driven research, the logic is based on interventions and their outcomes with the **researcher acting as a player in the research scene**. The research question in prescriptive design sciences is focused on solutions and the outcomes are alternative solutions for a class of problems. Description-driven research seeks explanations via causal models and quantitative laws and is has to be proved. In design sciences, the models are instead tested

and grounded technological rules, which are justified heuristically with saturated evidence.

Pries-Heje and Baskerville (2006, p. 35, 50) go further and suggest that the term **design research** should be more a generic term and include other design approaches, for example participative design and action research, in addition to design science. In addition, Niehaves (2007, pp. 5-6) sees behavioral and design sciences as two complementary perspectives, not paradigms. This starting point enables combining the two perspectives in research especially within the IS discipline. IS research requires both perspectives to be applied. Cole et al. (2005) agree with this view: *"it is possible to argue that DR need not necessarily subscribe to an objective ontology"*. In system building context for a specific organization, a subjective stance is regarded as an appropriate approach. Paradigmatically action research and design research may be perceived to be not incommensurate.

I use the term design research in this thesis in the meaning Pries-Heje and Baskerville (2006) suggest, and Niehaves (2007) extends towards an interpretivist direction. My research describes the creation, use and evaluation of an artifact. The object of the research is an artifact, created for a purpose and evolving over time through interventions; therefore, subjective interpretations are necessary and objectivity issues are matters depending on honesty and the abilities of employing the data and creating accurate reflections of the past. Next, I continue discussing the methodological tools that I use in my work within the design research paradigm.

3.2 Action and Design Research

If one accepts the viewpoint that ISS is part of or is close to social sciences (see Gregor 2006, p. 613), one may also agree that positivist science and methodology do not necessarily have to be the only starting point for scientific enquiry in this field. Next, I discuss in more depth the concepts of action research and design research. It is important to understand their similarities and differences in order to see the benefits of their combination in action design research.

Similar to design science research, an earlier research method developed already during the 1940s, action research (AR) is also based on practical action, aimed at solving an immediate problem while carefully informing theory (Baskerville 1999, p. 3). The ideal domain of the AR method is characterized by a social setting where (see Baskerville 1999, pp. 11-12):

- The researcher is actively involved, with expected benefit for both researcher and organization,

- The knowledge obtained can be immediately applied, there is not the sense of the detached observer, but that of an active participant wishing to utilize any new knowledge based on an explicit, clear conceptual framework, and
- Research is a typically cyclical process linking theory and practice.

Baskerville (1999, p. 11) emphasizes that the researcher must be of value to those being researched, and both parties must successfully negotiate their goals. In AR, researchers aim to understand and describe processes; the goal does not include attempts to generalize research findings.

The **action research framework** can be described as a five- phase, cyclical process. Before starting the cycle, an establishment of a client-system infrastructure or research environment is needed. Thereafter, the following steps are iterated:

1. **Diagnosing**, during which the primary problems are identified in a rather holistic fashion,
2. **Action planning** contains specification of actions supposed to correct the existing problems,
3. **Action taking** implements the planned actions,
4. **Evaluating** the process's results is carried out collaboratively by researcher(s) and practitioner(s), and finally
5. **Specifying learning** is the phase when attempts are made to make explicit the knowledge gained during the process.

In design research, the methodology also includes a cycle, the build and evaluate loop (Järvinen 2005). The **design research framework** includes five steps that are interrelated and feed information backwards during the design process.

1. The process starts with **Awareness of a Problem**.
2. During the second stage, **Suggestion**, the quest for a problem solution starts with enquiries from the existing knowledge and theory base of the problem area. During the first two stages, a research plan or proposal is introduced in addition to producing a sketch of a tentative design of the problem solution.
3. In the third stage, the **development** of an artifact begins.
4. The artifact's performance is **evaluated** in the fourth phase of the process.
5. The final step in the research process, **Conclusion**, ends the design process.

As we can see from the above comparison, action research and design research share many fundamental features. They both are methods that intervene in organizations using a stepwise and cyclical approach to induce analyzable changes (Cole et al., 2005). In DR, the tool for change, an artifact, is designed during the research process. In both methods, the focus is on relevance of the research problem, emphasizing simultaneously both practical utility and theoretical knowledge-creation. DR and AR share a common philosophy, pragmatism, as a meta-paradigm.

To develop both traditions Cole et al. (2005) suggest a way to combine the methods with an integrated research process. The analysis of the approach of cross application of research criteria shows that the approaches share important assumptions. In essence, the two approaches have common roots. Therefore, the reasoning behind an integrating approach is not based on barely seemingly similar research processes.

Cole et al. (2005, p. 17) see that the steps usually included in these two methods can be combined to a four-stage model of **action design** (AD). The first published version of the framework (Cole et al. 2005) includes the following sequential steps:

1. **Problem Formulation**
   This stage includes features of the problem definition phase in DR and diagnosing the problem in AR. A design researcher conceptualizes here the perceived problem(s) as an action researcher starts with a client agreement.
2. **Building and Intervention**
   In DR, this stage is called “build” and in AR it includes action planning and action taking. In this synthesized approach, this stage may include both the building of an artifact and intervention to change the organization.
3. **Evaluation**
   The third stage is fundamental in both methods.
4. **Reflection and Learning**
   The final step abstracts knowledge to make a practical and theoretical contribution to the scientific field.

Orlikowski and Iacono (2001) call on IS researchers to conceptualize and theorize IT artifacts in addition to incorporating these theories and IT artifacts into IS studies. In their literature study they found that most of the IS research published during 1990-1999 did not discuss IT artifacts. They are usually assumed as self-evident and/or unproblematic. Even information technology was treated as absent in most of the studies.

Sein et al. (2011) argue that the current DR within the IS discipline does not emphasize interventions in authentic settings. The study of IT-artifact design is not often conducted in organizational context. The dominant view in DR is that evaluation efforts follow the building of the artifact.

AD is a methodology focusing on IS design research in an organizational context. AD is a practically oriented approach that is commensurately based on relevant aspects of both traditions: relevant rigor of DR and the pragmatist goals of AR. To enable the combination of paradigmatic epistemological differences between the research approaches, positivism and constructivism should be seen as a continuum, not as separate categories (Sein et. al 2007, pp. 106-109). Moving ahead from the discussion in cross-fertilization of AR and DR (Cole et al. 2005), in the second generation of the AD methodology (Sein et al., 2011), the framework has been reorganized. In addition to the focus change to reflection and learning during the research process, the reorganized AD methodology was also renamed as **action design research** (ADR) (Iivari 2007a, p. 115).

3.3 Action Design Research

The ADR methodology aims at balancing the knowledge interests of both IT-artifact design and organizational change. The IT-artifact is seen to be at the core of the IS discipline. Focusing on IT artifacts and design provides IS researchers a way to apply simultaneously both organization- and technology-oriented perspectives.

ADR is a methodology for scholarly knowledge-creation through design in context. It builds knowledge by developing an IT-artifact as part of intervening in an organizational context and reflecting on the intertwined and inseparable processes of artifact design and organizational change. Sein et al. (2011) suggest ADR be applied in IS research when **the IT ensemble artifact is dynamic and emerges simultaneously from intentional design activities as well as interactions between technology and an organizational context**.

The IT-artifact in ADR methodology consists of software-hardware instantiations that are part of an ensemble, i.e. bundles of material and cultural properties (Orlikowski and Iacono, 2001). The emergence aspect is manifested in the form, structure, goals, or even the conceptualization of the artifact. The design process is emergent due to the ensemble nature of the artifact. ADR is a combined approach consisting of two processes (Sein et al., 2011): engaging in a specific organizational setting to address a problem situation, and constructing an IT-artifact that addresses the class of problems typified by the problem domain encountered.

In ADR, during the two first phases, problem formulation and BIE, the research activities are continuously reflected upon. The finalizing fourth step consists of Formalization of Learning. I use this combined four-stage approach (Sein et al., 2011) in this thesis, as a framework for conducting design research in the higher education context. Some of the main chapters in this thesis are named according to the model's steps.

The following description of ADR is based on Sein et al. (2011) and earlier versions of the article. The authors have also added specific guidelines to the framework on how to conduct an ADR process. The stages are described below.

In ADR, the focus during the **problem formulation stage** of the research process is in defining an immediate or anticipated problem perceived in practice (by practitioners or end-users) or anticipated by researchers. **The research problem transforms into formulation of research questions**. The problem presents the opportunity for scholarly knowledge-creation. In the problem formulation stage, a research opportunity based on alternative theoretical bases and prior technology in use is identified and conceptualized.

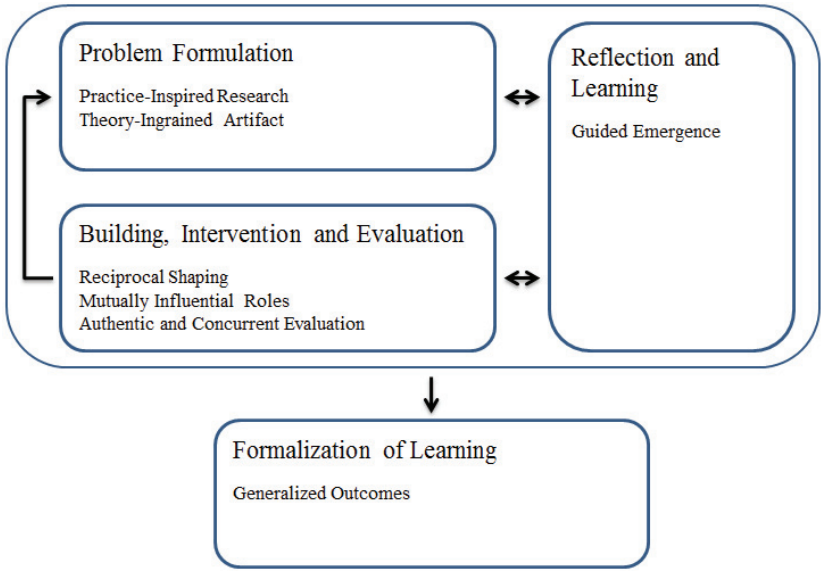

Figure 3-1 Stages and Principles in Action Design Research Methodology

This stage includes an empirical investigation of the problem in addition to the demand to determine research interests, project scope, and a practitioner participation plan. The research problem has to be formulated in such a way, that it can be addressed through building and implementing an IT-artifact in the organizational context. In addition, ensuring participation

and commitment from the target organization is important in the first stage, because in ADR, interaction between researchers and other participants is critical throughout the process. A researcher–client agreement similar to the AR process may be the basis for mutual understanding of the scope, focus, and mode of inquiry of the research effort. In summary, the tasks in the problem formulation stage of ADR are:

a) Identify and conceptualize the research opportunity
b) Formulate initial research questions
c) Cast the problem as an instance of a class of problems
d) Identify contributing theoretical bases and prior technology advances
e) Secure long-term organizational commitment
f) Set up roles and responsibilities

This stage is based on two principles, namely *praxis-inspired research* and *theory-ingrained artifact*. The former principle implies that field problems (as opposed to theoretical studies' goals) as knowledge-creation opportunities are central in ADR. Despite the practical viewpoint, the intent of the ADR research is not only to solve the problem: in addition, the researcher is interested in generating knowledge. Therefore, theories should form the basis for artifact design. The problem is an instance of a class of problems that requires a solution. In ADR, artifacts are considered ensembles, which include theoretical ideas, because the **action design researcher actively attaches theoretical elements in the artifact**. Instantiations are designed over successive cycles of refinement and evaluation – influenced by both theory and praxis.

The second ADR stage, BIE (**Building, Intervention and Evaluation**) is based on the problem description and theoretical premises designed in stage one. They form the initial design and are instantiated in the IT artifact, which is designed during the organizational intervention. Building, intervention, and evaluation are interdependent. The aim of the BIE is to support the iterative process intersecting the artifact and the organizational environment. In ADR, the presentation of the research problem and the design of the artifact are continuously evaluated to acquire knowledge about theory, building and intervention. **Design principles for the chosen class of problems are formed during the BIE stage.**

As there are variations found in AR and DR research projects, there is also the potential for a number of alternative research designs within ADR. There are two ends of a continuum of research designs for BIE: IT-dominant BIE and organization-dominant BIE.

IT-dominant BIE is suitable for ADR efforts where the aim is to create an artifact that requires a high degree of technological design at the start of the process. In this BIE form, early designs and prototypes serve as lightweight interventions in a limited organizational context. The emerging artifact and its embedded theoretical ideas are processed using interventions to challenge the participating organizational members' assumptions, expectations, and knowledge. This dialog is important in building the necessary organizational commitment for the ensemble artifact development to succeed. While the more mature artifact is introduced to the wider organizational setting, evaluation of the IT-artifact and the embedded theory in it within the end-user setting is started. The goal of the evaluation is to refine the IT-artifact by interacting with the organizational context as a whole.

At the other end of the spectrum, organization-dominant BIE, is suitable for ADR efforts where the primary contributor to the significance of the ensemble artifact is the organizational context, not the technology itself. This form of BIE requires an even tighter relationship between the technological and the organizational environments than IT-dominant BIE.

Both types of BIE processes are a joint team effort involving both researchers and practitioners. In organization-dominant BIE, the artifact building can be distinguished from intervention and evaluation only through retrospection and analysis.

Multiple iterations are needed to develop actors' ideas and assumptions about the specifics of the activity and context to improve the design and the emerging knowledge of the ensemble artifact. Each iteration ends with an assessment of the artifact and its embedded theory in the authentic setting.

The continuum of BIE types form a spectrum within which the ADR researcher(s) must choose how inventive an IT-artifact or how significant organizational change the research should produce. The choice of perspective and goal setting is influenced by the problem formulation stage. The tasks in this stage include:

- Discover initial knowledge-creation target
- Select or customize BIE form
- Execute BIE cycle(s)
- Assess need for additional cycles, repeat

The BIE stage is based on three principles: reciprocal shaping, mutually influencing roles, and authentic and concurrent evaluation.

The *principle of reciprocal shaping* emphasizes that the two domains, the IT artifact and the organizational context, are inseparable. In reciprocal shaping how the selected BIE design is executed, especially how the cycles of decisions are supported is determined. This principle and the BIE type

choice made have straight implications on the nature of the ensemble artifact to be designed.

The *mutually influential roles* principle reminds of the importance of mutual learning. All participants in an ADR project are regarded as learners. All participants bring their own skills and knowledge to the research environment. Researchers bring knowledge of methodology, theories, and technological advances. Practitioners bring practical hypotheses and organizational knowledge. The third group, end-users, bring their knowledge of situated work practices.

The perspectives and contributions of different stakeholders may be in competition or complement each other. In addition, the BIE process may engage practitioners and end-users in various and multiple roles. Therefore, a clear definition of the basic roles and responsibilities is important to enable reflection of the experience of each participant.

Together, the previous two principles show that there is a need to balance theories and perspectives from the organizational and the technological domains, in addition to the starting points of the researchers and the practitioners. These two principles define an environment where the responsible persons navigate to make choices that determine the roadmap of the research effort – which should lead to the realized design and set outcomes.

The principle of *authentic and concurrent evaluation* is characterized by the viewpoint that evaluation is not a stage that happens in retrospect as a final stage of the research process. In ADR, decisions related to building the artifact and organizational intervention are interwoven with evaluation. Even though the evaluation forms may vary based on the chosen BIE type, **evaluation episodes are carried out concurrently with building of the artifact and intervention activities**. The different types of evaluation episodes may be similar to formative evaluation. For example, cycles of initial artifact evaluations are not targeted towards value assessment, but to contributing to its refinement. The evaluation does not merely consider the hardware–software instantiation being built, but it also includes the process through which it has been shaped and re-shaped into an ensemble artifact, and the eventual organizational change brought about by its deployment. Therefore, authenticity is a more important ingredient in ADR than arbitrarily controlled settings. In spite of this viewpoint, later evaluation episodes may be designed so that they resemble summative evaluation.

The third stage in the ADR process, **reflection and learning** stage is continuous. The purpose of this stage is to abstract emergent knowledge from and about the process as well to reflect on the theories, decisions, goals and outcomes of the research. The tasks in this stage include:

a) Reflect on the design and re-design during the project

b) Evaluate adherence to principles
c) Analyze intervention results according to stated goals

This stage employs one principle, namely *guided emergence*. In ADR, the design of artifacts is dialogue-based. There is an ongoing dialogue between the organization members and the researchers. **Viewing the artifact as an ensemble and designing it in context contributes to the emergence of the artifact.** In relation to the design process, the users are not passive; instead, they actively shape the initial design and propose changes or exhibit emergent behavior that needs to be taken into account in refinement of the artifact. Another form of dialogue emerges from the synthesis of theories about organizations and knowledge of information technologies. The skills of ADR researchers are challenged by the feedback from users and the context while drawing on theories and practical knowledge. The ADR methodology recognizes and leverages both dialectics to encourage reflection and conscious choices that lead to the ensemble artifact as a synthesis, an outcome of the research process.

The objective of the **fourth stage** in the ADR process is to **formalize the learning** gained throughout the research process. The situated learning outcomes from an ADR project should realize in general solution concepts for a class of field problems.

It is possible that the BIE process may lead to a failure; therefore, it is necessary to recognize that the failure may have significant consequences for the practitioners and/or end-users of the artifact. Therefore, the risks related to the design process implementation should be analyzed, and the evaluation shared with the participants.

The formalized learning is then published as a contribution to the scientific body of knowledge. The tasks in this stage include the following:

a) Abstract the learning into concepts for a class of field problems
b) Share outcomes and assessment with practitioners
c) Articulate outcomes as design principles
d) Articulate learning in light of theories selected
e) Formalize results for dissemination

The only principle in this stage is *generalized outcomes***.** Regarding IT artifacts as ensembles makes generalization complex, because it requires specifying the research problem as an instance of a class of problems. **Abstraction of learning is problematic, due to the unique organizational configurations**. The specification of the set of problems is required, because it is essential for the characterization of the knowledge outcomes contributing to the scientific body of knowledge. The principle emphasizes that the researchers' goal is to ensure the subjective meanings

presence in the intervention and that they are theoretically interpreted. The knowledge about the instantiation, artifact building, should also be sufficiently abstracted to offer universality within a set of research setting constraints.

One principal form of generalization is to describe how the **IT-artifact provides possibilities for general statements of its applicability in other settings** (Sein et al., 2011).

3.4 Minimalism

IS design research, including ADR, is a practical research approach, but it must be conducted based on relevant theories. As discussed previously, the ADDIE model was developed to be applied with premises of different learning theories. The models position has been extended from behaviorist to cognitive theories. In practice, ADDIE-type procedures have also been used in various context-dependent ways (Visscher-Voerman and Gustafson, 2004).

Both methodologies, action design research and instructional design, require a kernel theory (Walls et. al, 1992), which should fit the purpose of the research. There are no general criteria to choose a kernel theory, but a theory must be present, because it provides a framework for generating research assumptions and premises in the intervention process.

In ID, instructional designers have a philosophy (epistemology and ontology) or a learning theory behind the design activity. In addition, an instructional design theory should be present that reflects the chosen learning theory. Therefore, in ID, we could have three frameworks in use: a learning theory, instructional design theory and an instructional design process to be followed in creating the instructional environment.

According to Reigeluth (1999), instructional design theory (IDT) is the study of **how to best design instruction so that learning will take place.** An IDT is drawn from learning theory and it is targeted to be applicable in designing educational problems. It does not necessarily describe what happens in learners' minds during a learning process.

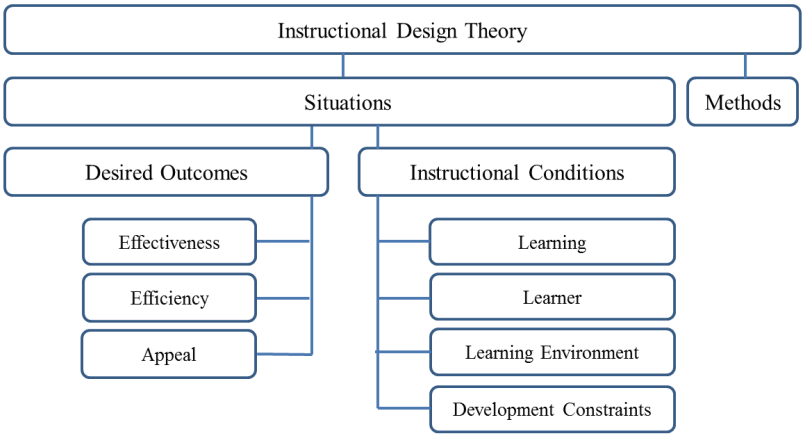

Figure 3-2 The components of instructional design theories

IDT's are concerned with what instruction should be like. They are design or goal-oriented. Situations and methods are the two basic components of an IDT presented in the figure above (Reigeluth 1999, p. 9). Methods of instruction facilitate the learning process. The methods in IDT are situational rather than universal: they specify the situations for which the methods (for example, problem-based learning) are inappropriate or appropriate. Therefore, IDT theories are probabilistic rather than deterministic. The choice of method depends on the situation. Situations contain the desired outcomes and instructional conditions. They indicate when or when not to use a specific method. The desired outcomes in an IDT include effectiveness, efficiency, and appeal. The conditions consist of learning, learner, environment, and constraints.

Minimalism (Carroll 1997) is the kernel theory in my research. It has been introduced as a learning theory as well as an instructional design theory. Hence, it also serves as a kernel theory for the ADR methodology (Sein et al. 2011, p. 40-41) and instructional design.

Minimalism is a theory of how to design instructions for computer use Carroll (1997). The primary requirement for instruction design is that it is a meaningful activity. The theory's principles, aimed at optimizing any type of instruction, are not required to be followed strictly, but rather understood like guidance to be adapted in design problems.

Applying the notion of minimalism to computer science and technical communication in the 1980s, Carroll was concerned with the emergence of personal computing and the lack of usable manuals to support their use. The amount of content in manuals was often enormous and not flexibly usable in learning situations.

In addition to diminishing the amount of training instruction content, Carroll and his colleagues emphasized encouraging and supporting work on

realistic tasks during the training they designed and carried through in IBM personnel training. Simultaneously they were developing the ideas of minimalism.

Their focus was in learning by doing rather than learning by reading in order to be able to engage the learners and encourage them to explore during learning activities. In addition, the learning instructions were designed to be modular – they would make sense in any order to enable the learners to use the instructions in a flexible manner because of the changing nature of their work and its goals.

Minimalist instruction is learner-oriented. Minimalism emerges from the idea of iterative design where design is understood as an iterative development and goal discovery. People as learners are regarded as active users who wish to learn but are not interested in only learning: they are interested in achieving something and often use their prior knowledge to learn new systems with trial and error methods.

Minimalism is grounded on four principles, each of which is further elaborated in the following by descriptive heuristics:

1) Minimalism is an **action-oriented approach**. One of the key principles is people's need to engage in real tasks or projects. Real tasks provide the learner with an appropriate framework. Users typically want to do things. Learners should be allowed to start immediately working on tasks. Getting learners to start working quickly is emphasized to ensure interest and sustaining activity. This principle reflects the use-centeredness of minimalism. The heuristics for this principle are:
   H1.1: Provide an Immediate Opportunity to Act
   H1.2: Encourage and Support Exploration and Innovation
   H1.3: Respect the integrity of the user's activity.
2) **Anchoring the tool in the task domain** reflects the idea that a tool is a means to an end. Training tasks should be meaningful for the user. A close link between the training and actual system must be retained. The amount of reading and other passive forms of training should be minimized by allowing users to fill in the gaps themselves. It is assumed that people engaged in a task will creatively reason and improvise that the tasks make sense. Instruction should be designed to permit self-directed actions by increasing the number of active learning tasks. Familiarity of the domain guides and motivates learners by engaging prior knowledge. It may also result in inappropriate use of prior knowledge. The following heuristics should be applied in following this principle:
   H2.1: Select or Design Instructional Activities that are Real Tasks

H2.2: Create Components of Instruction that Reflect the Task Structure

3) **Error recognition and recovery activities** must be include in the instruction. There are several ways to increase user competence and comfort levels in handling mistakes. Situations, where erring is most likely should be spotted in order to diminish less productive and more frustrating learning. Removing all indications of possible errors is not the point, but providing the learner ways to handle the errors that are bound to happen at some point.
   H3.1: Prevent mistakes whenever possible
   H3.2 Provide Error Information when Actions are Error Prone or Correction is Difficult
   H3.3 Provide Error Information that Supports Detections, Diagnosis and Correction
   H3.4 Provide On-the-Spot Error Information
4) **Support reading to do, study and locate**. Learners use the material to follow task guidance and ideas, to locate task-related information or they just study the material. Learning activities should be self-contained and independent of sequence. They must fit as much as possible the diverging needs and propensities of the intended audience. This principle reflects the user-centeredness of minimalism.
   H4.1 Be Brief; Don't Spell out Everything
   H4.2 Provide Closure for Chapters

In minimalism, the core idea is presented in the saying "Less is more". Farkas and Williams (1990) argued that many of the minimalist ideas were already present in practice. They criticize Carroll's comparison of the minimal manuals with the systems approach documentation rather than the contemporary practices. The manuals that Carroll used as a comparison material were, according to Farkas and Williams (1990, p. 183), often tutorials for an inexperienced user, not for an explorative user who is acquainted with using different systems. They also see the idea of exploratory learning as problematic and time consuming. Users are learning the systems through trial and error. The ideas of enabling quick starts working with real tasks were also seen as restricting the planned and anticipated results of the training.

Farkas and Williams (1990, p. 186) appreciate the idea that the minimalist instructional design process includes taking into account users' needs and behavior in realistic domains. In addition, the checklist-approach to documentation ensures that the relevant perspectives of the problem solution will not be forgotten.

Farkas and Williams (1990, p. 185) also value the idea of exploiting the user's prior knowledge in learning and the goal to minimize the documentation's length in order to concentrate the learner's attention to what should happen on the screen with the application. Similarly, Lambrecht (1999) values the minimalist approach, because it focuses on the work context and student experience. The software features are secondary to students' needs. Instruction should support problem-solving and critical thinking. These minimalist ideas are in line with constructivist assumptions that lead to more learner-centered teaching – instruction should stimulate thinking rather than remembering step-by-step processes (van de Meij, 1992, p. 7 and 10). Especially in adult learning cases, the core of the "*minimalist approach to teaching is the assumption that learning is inevitably a construction of meaning by the learner in response to the learner's current understanding and expectations within a social context*" (Lambrecht 1999, p. 146-147). She designed a course for prospective business teachers using the minimalist approach with constructivist principles (Lambrecht 1999, p. 148). The course was based on real cases generated by students to solve business problems using (MS Office) software.

Carroll's instruction was based on creating minimalist documentation, tutorials for training computer use. Lambrecht combined the minimalist instruction ideas and constructivist approach to a course context, solving real business cases. Carroll emphasized documentation's role in self-study. On the other hand, Lambrecht extended these principles in a collaborative classroom setting. My approach of using an ADDIE-like process (see chapter 5.2 My ADDIE) introduces similar ideas to consulting teachers in enhancing ICT usage in distributed learning. In my case instruction is activity, not documentation.

Carroll and van der Meij (1998) see that the principles and heuristics of minimalism are not rules to be followed blindly or strictly. They merely allow for better designs. In addition, they work well only in combination with a thorough treatment of basic design issues such as context, audience and task analyses, which are the key foundations of the minimum set of discussion topics in starting a consultation for course design.

Minimalism is a design philosophy that is the paradigm for my ID work both in research and in practice. According to van der Meij, (1992) minimalism is a use-centered approach because its priority lies in supporting usage of an application. Minimalism is also a user-centered approach because it adapts to the audience as much as possible. This approach is visible in the way that I have conducted my work with my ADDIE-type process. Discussions are used to determine goals and solutions in the problem space.

4 Problem Formulation

ICT usage in classroom is everyday practice in higher education. ICT has replaced many methods and tools in teaching and learning, but it has complemented them too. This leads to the situation where facilities have to be offered to both early adopters and less advanced users at the same time. ICT usage has spread most rapidly to areas where the benefits are obvious and the processes are easily manageable. Those, who do not have an interest to use the technology, but in fact have an obligation to do so, have to be motivated and introduced to the practice. For example, the results of the first course site survey at HSE in 2004 indicate that digital information and material delivery are used on many courses. In contrast, online collaboration and communication are not extensively used.

There are various reasons for the slow speed of diffusion, as I stated earlier in describing the problem domain. The applications are complex in many cases. Technology is constantly changing. The development of both technological and pedagogical concepts is fast. Universities are demanded to produce flexible alternatives for teaching and learning activities, which often result in purchasing of a LMS.

With the template, my purpose has been to design a starting point that is most simple, and which as much as possible resembles familiar ways of working for instructors and users. With the artifact, my aim is to reduce the mystique that surrounds the adoption of new technology in order to enable the users to learn the principles and ideas easily and to start developing themselves towards more advanced levels of online activities. Therefore, my research problem is related to adoption of ICT, but not to the diffusion of a specific application. My aim is to familiarize the maintainers and users to processes that are new to most them.

The design process history and the problem domain were described earlier in chapter 2. Next, I discuss the research process.

4.1 Positioning the Researcher

I have been active in making interventions in enhancing the infrastructure and developing support and training in the field of distributed learning. Other forces, changes and interventions have also influenced the development and they were pointed out in chapter 2 (Problem Domain). The evolution of the template design and work processes were described in chapter 2.8 (Design Stages). Simultaneously with the stages of the design process, my research focus has also changed over time.

Before 2005, during the earlier stages of defining this research effort, I was in search of suitable theoretical and methodological frameworks. Before 2002, my focus was on the publishing processes of learning material. Even though, for example, Media Richness Theory would have been a good starting point for this research area, the viewpoint seemed too narrow. Therefore, in 2003, I widened my perspective by including organizational issues, induced by the school's strategy. This decision enabled the inclusion of areas such as the support functions and strategy development to the research framework. I considered Diffusion of Innovations Theory by Rogers (1995), Customer Channel Model by Haapanen and Vepsäläinen (1999) and Coordination Theory by Malone and Crowston (1994) as theoretical frameworks for my research. With these theories, a case study would have been a suitable research method.

Again, examining these theories revealed that they were too static to be the basis of a research that should highlight changes within the organization. The practical development goals of the school's strategy in addition to my studies of action research and design research enabled me to organize and formulate this research as a design project to induce change. This path started in Spring 2005 by sketching the first version of the artifact for orchestrating a distributed learning environment. After the proactive viewpoint in design research (Cole et al., 2005) started to emerge, I attended a seminar in 2006 on the same subject. Thereafter, I gradually adapted proactive design research as my research methodology. Minimalism emerged as the theoretical basis of the research later, mainly as a natural choice influenced by the research methodology's interpretative perspective.

In the following, I describe ontological and the epistemological background for the choices I made. Simultaneously, the discussion reflects on the topics I had to rethink after holding a positivist viewpoint to research for over two decades.

The ADR methodology was developed during the writing of my thesis. I was fortunate to be able to follow the process starting from 2007 until its publication in 2011 (Sein et al. (2011). In my research, ADR was chosen as the methodology, because it is flexible and rigorous, giving me enough room to use suitable methods in describing the research problem and research process in addition to reporting the results of the study in a coherent way. Employing the tools used in, for example, economics science, the discipline of my earlier career, would have resulted in different research settings and results.

I mentioned earlier (in chapter 3.1) that the ISS design-science paradigm is the counterpart to the behavioral science paradigm. This does not mean that IT artifacts are not studied in the behavioral paradigm of the discipline.

According to Hevner et al. (2004, 77), behavioral theories seek to predict or explain phenomena that happen, for example, in an artifact's use or intention to use it, perceived usefulness of the artifact, and its impact on individuals and organizations. Many of the behavioral studies have focused on the instantiations of systems, but the evaluation of constructs and methods have also been the focus of researchers.

The main methodological difference between the two paradigms or perspectives is that behavioral science researchers attempt to understand phenomena and their implications. On the other hand, design-science researchers try to understand proactively the processes of constructing and exercising problems addressed by the artifact and the feasibility of their approach to its solution (Hevner et al., 2004, p. 77 and 98-99).

In research within the behavioral sciences the development and justification of theories that explain or predict phenomena within the paradigms typically includes employing statistical and other empirical methods in testing the theories. In design science, the focus is on the building and evaluation of artifacts, also using empirical methods.

The goal in behavioral science research is truth (what is true) and in design science, it is utility (what is effective), but both approaches, especially if using common guidelines, can contribute to science and the discipline. The discussion focuses essentially on the difference between positivist and interpretivist paradigms (see Hevner et al., 2004, p. 78-81, 98).

Niehaves (2007) discusses the epistemological perspectives on design science research and sees that epistemological assumptions have great influence on how DR is conducted and evaluated. Bratteteig (2007 p. 69-70) emphasizes too that design research is concerned with creating knowledge about design processes, design results and the relations between them.

The guidelines Hevner et al. (2004) provide have been interpreted as being based on an implicit positivist epistemological assumption (Niehaves 2007, p. 8) that a researcher is able to achieve objective knowledge. Niehaves (2007, p. 7) points out that a socio-technical perspective is inherent to IS research. Therefore, a research philosophy should also recognize the social aspects of knowledge-creation and use. Niehaves (2007, p. 8) argues, based on literature reviews, that design science is not a "third paradigm", amounting to positivism and interpretivism, but that both behavioral and design research can be conducted within different paradigms. Niehaves (2007, pp. 9-10) concludes, after reflecting on Hevner et al. (2004) guidelines, "*Design science research is not only a positivist domain, but is also open to alternative epistemologies, such as interpretivism*". Interpretivism opens up the possibility to pose not only strictly formed re-

search questions, but also gives room for uncertainty and intuitive processes.

Niehaves (2007, p. 10-11) encourages researchers to take an interpretivist perspective on the guidelines and seek to produce and apply knowledge of tasks or situations in order to create effective artifacts and allowing the subjects to have an influence in the process of knowledge acquisition.

The interpretative perspective is my viewpoint in undertaking my research, thus answering to Niehaves' (2007, 11) call that further research would "*investigate more comprehensively the impact of alternative epistemologies on design science research (evaluation)*". Having an interpretive viewpoint has also affected my choice of the research method, ADR. It possesses the epistemology of making the researcher's influence to the process transparent in contrast to attempting to externalize the researcher to providing objective information.

In relation to the discussion on epistemological and methodological issues above, I provide the reader here with some background regarding the philosophical discussion (see Niehaves, 2007) of my research and myself as a researcher, whose research is based on practice.

Iivari (2007b, p. 41) says that the need for constructive research methods, which allow disciplined, rigorous and transparent building of IT artifacts as outcomes of design science research make it possible to distinguish information systems science as a design science from the practice of developing IT artifacts. Archer (1995) too discusses the distinction between practitioner and research activity. Both are types of enquiry of communicable knowledge, where the latter stresses scientific knowledge and the former otherwise important knowledge. Relationships other than the distinction between research and practice are research about practice, research for the purposes of practice, and research through practice (Archer 1995, p. 11). In research about practice, the researcher studies the research object with scientific methods appropriate to the context. Similarly, using scientific methods, in research for the purposes on practice the aim is contributing new knowledge to practitioners and scholars in certain areas.

Baskerville (1999) emphasizes that the (action) researcher must be of value to those being researched, and both parties must successfully negotiate their goals. In this study the mutual goal could be described as "*providing a an easy to use and flexible catering of services and facilities for different levels of web-based education enables the instructors to make efficient media choices according to educational goals, the instructors' own skills and their students' learning needs*".

However, my work should not be categorized as research about practice, if this mode is seen strictly as positivistic way of making research. For inter-

pretivist purposes, Archer (1995, p. 11-12) defines a third mode, research through practice, as research activity, which is carried out through the medium of practitioner activity. He calls this action research, but the definition applies to ADR too. This research mode sheds light on attempts to construct, enact, embody and/or test something. Archer (1995) sees this kind of research as activity pursued through action in and on the real world, where its complex findings reliably apply only to the place, time, persons and circumstances in which the activity happened. Similarly, ADR is an attempt to accomplish a synthesis between the traditions of action research and design research, where in practice the research paradigms have diverged from what Archer depicted in 1995 creating an epistemological gap. Niehaves sees this gap as an obstacle that can be overcome by allowing pluralism and diversity in research perspectives (Niehaves 2007, p. 8).

Since design research is a practical field I have selected the key theoretical framework to be drawn from practice too. In instructional design my design philosophy is based on minimalism, which is an interpretative and constructivist approach. The paradigmatic starting point of this research lies in design science within information systems science. The problem domain and application area is distributed learning at HSE.

The starting point of this research is problem-solving, but my epistemological viewpoint is based on interpretivism, i.e. from an ontological perspective, the real world exists, but knowledge about it is always understood, interpreted and even influenced by the subjects' own standpoints in relation to the environment. The literature referred to in my research is both scientific and practical, since my method combination and research areas are very practice-oriented.

As a consequence of my assumptions I have chosen the ADR methodology, which allows and is particularly designed for research emerging from these viewpoints. Using the ADR approach, I am able to add detailed analysis of the processes in the study and include in-depth reporting of the learning process to the research framework.

My work as an action design researcher is essentially collaboration with the instructors and other support units' personnel. The collaboration can be characterized as haven taken place in supporting activities on a daily basis, seminars, instructional workshops, service design etc. Our common knowledge is embedded in the artifact. The teachers' work may be seen as analogous with handmade crafts (Gregor and Jones, 2007, p. 313), which contain implicitly the knowledge of those who have previously designed a similar artifact, i.e., a course web site.

To describe my self-positioning within the instructional design paradigm, I refer to the perceived roles of designers. Visscher-Voerman and Gustafson

(2004, p. 86) found four paradigms: instrumental, communicative, pragmatic, and artistic. In the instrumental role, the designer is an expert, responsible for the design, using expert knowledge to develop products. In the communicative role, the designer is a facilitator in helping clients specify needs and develop products. The responsibility is shared with the client. The pragmatic designer relies on input from users and is responsible for design. The artist uses his/her own subjective knowledge and reflection and is fully responsible for the product.

I have worked in a combination of communicative and pragmatic roles. This kind of working habit suits well making interventionist research with ADR. The collaborative style also allows for an interpretivist approach in research, as Niehaves (2007) suggests. This view emerges from my working practices of developing the template based on the teachers' input, while simultaneously keeping continuously in contact with them to build other processes around the template.

ISS as a discipline is interested in human interaction with applications and devices. My study can be seen as action oriented service design, which is more concentrated in organizational processes and human interactions than in systems building. The starting point is the multi-perspective approach of combining positivist and interpretivist methods within IS design research (Niehaves 2007 and Sein et al. 2011). My case is clearly an organization-dominant type of ADR.

4.2 Research Problem

Simplification of complex research problems and environments is essential in order to provide understandable results in research. Van Aken (2004, p. 224) states, "*The mission of a design science is to develop knowledge for the design and realization of artifacts, i.e. to solve construction problems, or to be used in the improvement of the performance of existing entities, i.e. to solve improvement problems.*"

The distinction between a problem and a class of problems is crucial in generating abstract and transferable knowledge in ADR. Focusing on classes of problems and producing design principles (Sein et al., 2011), technological rules or design exemplars (Van Aken 2004), enables the researcher to move through interpretative analysis from explaining individual observations to prescribing plausible solutions to be applied in similar contexts and problem spaces.

Benbasat and Zmud (1999) describe guidelines on how to present academic research results to practitioners. They demand that IS research should include more contextual description and work on how research ide-

as could be implemented in contexts other than in which the original research was made. Academics should also be exposed to the business and technological contexts in which the phenomena they study are present.

Many research problems do not emerge from practice, which also has an influence in the academic language and makes it different from practitioners' vocabulary. The prescriptive outcomes of academic research should be constructed so that they can be applied in specific, unique and complex situations, avoiding, on the other hand, being too general.

The essence of design-science research, according to Hevner et al. (2004, p. 91), lies in two fundamental questions: "What utility does the new artifact provide?" and "What demonstrates that utility?" In the rest of this thesis, I attempt to present evidence to address these two questions in the HSE distributed learning case. I describe and evaluate the design process and the outcomes of the artifact's usage.

In summary, my **research topic** is support of distributed learning. The **research purpose** in this context is to define the instructional design processes, which are aimed to lower the threshold for less advanced users adopting online learning. Simultaneously, this goal includes providing a flexible and efficient way to use online services for advanced users demanding tailored solutions as part of the learning environment. My **research thesis** in this work is the basic principle of minimalism: "Less is more" The practical **research problem** is finding ways to enhance the development, usage and diffusion of online course environments. Therefore, the **research question** is "How to orchestrate ICT enhanced distributed learning?"

The research question does not contain any normative goal setting. It states that the **class of problems** I am studying focuses on:[7]

- Process-design (the statement starts with a how-question),
- Object-design (the process includes an artifact) and finally
- Realization-design (the process includes design and implementation of the intervention).

The lack of normative goals in the research question emerges from the idea that no single instrument can be the only enabling factor in a change process. A normative starting point would lead to considerations on which is better – offline or online. That would not lead to the goals that I have set for my work and research.

[7] see van Aken (2004, p. 226) for a discussion on the three types of design

Naturally, the goal of action design research is to induce change, but in the case of ICT enhanced distributed learning I see no value-based arguments valid in the sense that any method would intrinsically be better than another. Strict comparisons and evaluations of methods and tools, of course, reveal qualitative differences, but in principle, a method can only serve better than another can in a certain context. Therefore, the term "orchestrate" is used in the research question. "Management" as a term would indicate control, not collaboration.

The outcomes of my research, the design principles (contextualization, concordance, collaboration, and commitment), reflect the key issues in a class of problems that have been found to be important during this research. They all emerge from the viewpoint that people are central in organizational change. The principles express the need to organize services so that the solutions are fit-for-purpose, useful, efficient, flexible and easy to use. The needs are generic organizational demands. They are intended for instrumental use (Van Aken, 2004, p. 223) in other similar situations (Benbasat and Zmud, 1999, p. 10-11). Next, I describe the BIE process in which the principles emerged.

5 Building, Intervention and Evaluation

In this chapter, the artifact and the related activities are presented. The ID process, which is central in applying the artifact in practice is presented in chapter 5.2 (My ADDIE). In principle, all initiations of the template should be designed employing the ID process with the maintainers in order to find a tailored solution for the specific course context. The evaluation principle of ADR is realized by different stakeholders' evaluations, which are presented in chapters 5.3 to 5.6. The artifact is depicted first the next chapter (5.1).

5.1 The Artifact

My mission has been, through minimalist principles, to provide our teaching staff sufficient information so that they can make an educated choice on how and in which situation to employ ICT in their work. The organizational problem in my context is designing an easy to use digital learning environment within an organization.

As a starting point in the template design process, we had a situation where the organization members had a web server as the place to publish their web pages produced with hand-written html code. Some enthusiasts

were attending html courses in order to be able to provide their students with course pages, but obviously this solution did not suite larger crowds. To solve the problem of having minimal resources, I focused on low cost solutions, which could be easily implemented.

Leaving aside the current solution of html coding as too laborious for teachers, I had two further alternatives. One would have been acquiring an LMS and the other using a web editor for publishing. The main reason for choosing the editor was its similarity with the text-editor application the organization had in use. In order to lighten the burden of learning new skills in an unfamiliar context, I created a template of a basic course site, with which it was easy to introduce the possibilities of using online services to the teachers.

The **course template** is presented to the users (through a web browser) and maintainers (through the editor) as the **course site** with its **course interface**. The course template is surrounded by constraints and the ADDIE-type consultation processes which together form the intervention tool, the **ensemble artifact**.

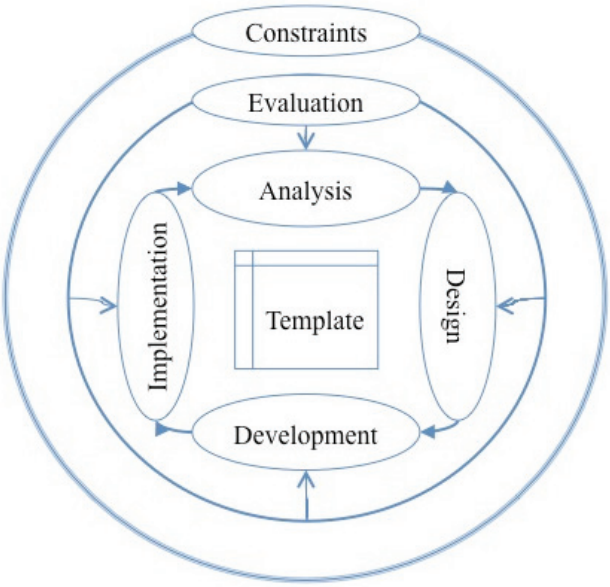

Figure 5-1 Processes related to an instructional design web template in a constrained quality improvement environment - the ensemble artifact

The artifact's development was connected to the template design cycles, especially the strategy phase (see chapter 2.8.3). In the figure above, the environmental constraints that limit the design choices are also present in the artifact, which is a modification of Allen's (2006, p. 438) presentation of the revised ADDIE frameworks. I have included the template at the core of the artifact and added the constraints as the model's outer layer, which

includes interaction and organizational constraints, including the quality management aspects in the process. The figure underlines the ensemble view of the artifact. The template's aim is that

- The teachers use it as their tool for instructional design to deliver distributed learning;
- The support personnel use it as an instructional tool to familiarize teachers with distributed learning; and
- The support personnel use the template to develop the online services.

The ADDIE model does not restrict the ways in which developers build the instructional system in detail. It presents simply the generic steps and procedures, which can be flexibly varied in different situations, for example in making quality checks in phases of the process. All ADDIE phases must be designed taking into account the constraints – procedures, rules and restrictions – that have shaped these organizational functions. The level of constraints (organizational issues) in the artifact are discussed further in chapters 6, 7, and 8 where the learning and conclusions of the design process are presented along with remarks considering the quality improvement aspect embedded in the artifact. Organizational goals are discussed also in chapter 5.6.

The importance of the evaluation of the ADDIE process itself is highlighted in the artifact. All ADDIE phases include evaluation. The objectives I have loaded into the artifact and the template should be seen from an interpretivist and constructivist point of view. Individuals have specific skill levels, ontologies and epistemologies. In addition, the circumstances where the template is used are often diverse in addition to continuously changing.

In the artifact, the constraints of the design and research environment consist of the limitations and restrictions that restrain or boost the processes. These include technological, organizational and individuals' variables. The quality management aspect in instructional design is embedded in the figure in the constraint layer. It reminds us about the purpose of instructional design, which is designing of efficient and fit-for-purpose instruction to be continuously evaluated against the organization's mission and individuals' goals.

Planning the simultaneous functioning of many interdependent processes requires collaboration, maintenance and flexibility. The artifact contains many services that are not clearly visible to all of the actors. Therefore, the orchestration process requires human resources to interpret the context. This idea is represented in the instructional design process and its usage as a consulting tool.

5.2 My ADDIE

The aim in models of instructional design is to provide frameworks for designing the systematic procedures in planning instruction. The elements of the ID models give structure and meaning to an ID problem. The models enable designers to visualize the problem and to break it down into manageable units.

Minimalism as the design philosophy in my practical work has emerged from the circumstances, roles and goals I have had in my work as an instructional designer. The principles of minimalism are presented in the template structure in addition to the consultation process. Using an ADDIE type process as a teacher consultation tool operationalizes the artifact in practice.

Allen (2006) states: *"One of the greatest challenges continues to be the low level of training expertise being required of those functioning as trainers in organizations"*. Every new method or unfamiliar technology a teacher chooses to use result in different, perhaps untested teaching practices. The variance within a process is a matter of standardization and customization (Shostack 1987, p. 35). A standardized process is usually something that cannot be altered and the outcomes of the process are usually the same. Customized process refers to something that can be tailored to different individuals to produce different outcomes.

Supporting learning of complex domains with written manuals and tutorials is problematic. As a consequence, people often try to solve a problem by themselves, or by asking someone for help (Novick and Ward, 2006). Using the artifact as a framework in consultation, the instructional designer is able to minimize the learning efforts of the teacher by customizing the process.

In person-to-person consultation, by asking the right questions in the real task context, the action and building of the course site can start immediately. New ideas may come up while discussing the different alternatives at hand; even trying out them immediately in the application is possible – learning by doing rather than learning by reading, as Carroll (1997, p. 28) expressed the idea. Errors may be corrected immediately and possible difficulties of the future course implementation may be considered in advance.

The consultation process may be very flexible to support exploratory learning. The approach also diminishes the problems emerged by the modularity principle in Carroll's minimal manuals approach – dependencies are difficult to handle in a written tutorial (Farkas and Williams, 1990, p. 185). The context, which builds up during the consultation about the skills and prior knowledge of the teacher in addition to the course goals allows the

instructional designer to fit the consulting process to the demands for the specific problem domain. The dependencies are considered during the consulting process.

Applying the minimalist design philosophy involves making tradeoffs within this framework rather than following it as a set of recipes (Oatey and Cawood 1997). Therefore, the instructional designer's task is to apply the knowledge about the problem domain embedded in the artifact. The teacher is an expert on the subject area of the course. If the teacher should know the entire problem domain, there would be no need for an instructional designer as a consultant. The artifact has to be visible to the consultant only. Hence, the minimalist principles in consultation provide the teacher a "less is more" experience by combining his disciplinary expertise with the instructional designer's knowledge.

The core of the artifact, the template, is mutable and therefore the responsibility of using it is shared. The support process is bound to vary from person to person (both the advisor and the supported person). Epistemologically, when humans are involved, different interpretations of the situation are possible. Even every context will produce different applications of a support process.

According to Niehaves (2007, p. 7) socio-technical system thinking is inherent in IS research. This approach is visible in the ADDIE process too. Going through the support process includes individuals' subjective perceptions of the whole process and its context. After achieving enough technical skills to work with technology, the difficulties become different. One is able to choose.

In principle, it would be ideal to find a suit-all learning model, but in practice, this is obviously impossible. There are many different learning models within a higher education institution. Choosing just one would limit alternative approaches' success significantly. It is good to have alternatives because students too will inevitably face different working practices and working methods when they enter their careers in society. Therefore, instructional designers should provide solutions that teachers and learners need – defined collaboratively keeping the learning goals and the whole setting of the activity in mind. Consequently, the ICT environment should be pedagogy neutral, so it can support different approaches.

My person-to-person consulting process actually resembles very much the ADDIE process even though the formal ADDIE has never been the starting point in my work. ADDIE serves well in making the mixture of the ideas clearly visible. The following description of the ADDIE phases is a combination of ideas presented by Shervey (2008), Allen (2006) and myself. Sher-

vey's (2008) process is here modified to reflect the approach I have chosen in my work in similar instructional situations.

The idea in the following presentation is to simulate the consulting process in a situation, where the maintainer is unfamiliar with online teaching and the support person is the instructor of the maintainer in this new area.

5.2.1 Analysis

Analysis is the starting point of the whole process. The depth of the discussion depends partly on the maintainer's attitudes, interests, motivation and knowledge.

Lecturing, syllabus, exercises, group work, presentations and seminars are the usual tools for a teacher to arrange course activities. The pattern of using these methods is usually inherited from the experiences the teachers have had during their own student times.

The analysis phase should be started with mapping the overall picture. Instructional goals should be compared with the skills, knowledge, characteristics, and abilities of the students to determine what instruction is needed. The instructional designer should also take into account the maintainers' skill levels in ICT and pedagogy.

The analysis may be started by sketching a manuscript for the course. It can be regarded as a blueprint for instructional design on a specific course including production responsibilities, scheduled roadmaps for specific tasks and checkpoints for continuous evaluation of the process. The first step is to define and analyze the following themes by discussing with the maintainers of the course site.

5.2.1.1 Goals

In higher education, the purpose of the learning experience is usually known prior to the consultancy, but they should be re-discussed since they also have an effect on the design of the online environment.

- Define what the students are expected to learn, so that the course site will contain clearly defined learning goals and instructions on how to act and what to do in practice.
- Define the main units and functions of study to decide what functions/activities will be shown in the template. This is the part where the template has a critical role as a basis for discussion and serving as an example of what one can do.
- Are the defined goals in line with the degree and study program level goals and measurable objectives?

5.2.1.2 Learner Characteristics

The characteristics of the learners who will participate have to be mapped out.

- What motivation and prior skills should they have to have in order to complete the course successfully? This affects the production of the learning material and process guidance.
- Are all students participating in the course on campus or are they, or some of them, located elsewhere? The information has an influence on choosing the communication, material delivery, and announcement methods used on the course – what parts of the activity should be online and what can be dealt with in the classroom.
- Are the students familiar with ICT? Have they used the learning environment before? Are there other students than our campus students on the course? This will influence what instructions the students are given and decisions on how outsiders can access the possibly restricted areas of the course site.
- In this stage, it is good to map out the needs of the maintainer to develop him/her. What kind of teaching paradigm the teacher has? What kind of prior skills he/she has and what has to be acquired in order to cope with the tasks that come with the course.

5.2.1.3 Media Choices

The media to be used – strengths and weaknesses of different tools and procedures – must be decided upon.

- What kind of material is needed on the course – could multimedia be used instead of text-based materials? This decision has an effect on the learning/training load and workload of the maintainer, but it also affects the students. In which format it would be best to deliver the digital contents – exercises, lectures etc. Employing extra expertise in material production will increase the costs. What kind of guides and other support materials are available for maintainers and users?
- Are there needs to tailor-make services that are not present in the template? Is there a possibility to aggregate other applications to the learning environment? Do the basic functions' naming conventions suit the current needs or does something have to be altered?
- What kind of interaction and collaboration will there be on the course, for example group or pair work? Should students be able to produce and deliver material to other students? This information

helps in determining what application in general should be chosen for the course.

- Does the collaboration happen asynchronously or synchronously? In this context, new techniques could be introduced, which could even help in seeing the processes and methods from different viewpoint.
- Are there going to be online discussions during the course? If the answer is yes, could the discussion be divided effectively to include theme discussions that would take place both face-to-face and online? Are the discussions assessed? This information is necessary for deciding how many different discussion areas or forums are needed for the course site and what is their purpose. A café-type discussion forum could be suggested as "standard procedure".
- Online participation is related to the characteristics and context of the participants. Can all attend the joint meetings, e.g. lectures? Which parts of the course activities are possibly manageable from other locations than classrooms? Will, for example, bandwidth be a problem for mobile or remote students? The accessibility and usability of the learning materials should be designed according to context.

5.2.1.4 Time

The manuscript/blueprint for the course can be used as the basis for the timeline of the course. Consider the schedule and available time in use for the actors:

- Material production
- Starting the course and preliminary actions
- Implementation (the time the course is active)
- Wrapping up the course and evaluation of the students' performance.
- Evaluation of the course design and implementation.

5.2.1.5 Costs

The budget available for the project may contain procurements, but most often it contains human resources i.e. time of personnel devoted to supporting the course. The manuscript or blueprint for the course can be extended to include the budgeting of the course.

- How much money and other resources can be used in this work?
- Does the local infrastructure provide all the necessary services that have been anticipated in the media choice decisions?

- Does the budget allow using external experts? What kind of basic support is needed that is readily available and what has to be acquired outside the organization? What are the costs and opportunity costs for the teachers themselves?
- What is the most cost-efficient delivery channel for the course? Delivery channels may be chosen from different media: paper, recordings, local network or the Internet.
- Could the students produce parts of the learning materials? The users' role is extremely important and must be carefully planned to meet the learning goals.

5.2.2 Design

The design of learning objectives, tasks, methods and assessment should be systematically planned. Allen (2006) includes the following steps in the design phase:

- Design of educational requirements includes determining training needs, assessing target population characteristics, and selecting tasks for instruction.
- A plan of instruction should be made for selection of instructional methods and media.
- Existing instructional materials should be reviewed to determine their applicability.
- After the instructional objectives have been developed, they have to be tested before the instruction design.
- An implementation plan of the instructional system is developed and the design is continuously evaluated.

The performance objectives and assessment instruments' should be decided upon before planning and developing of the instructional methods. How will students demonstrate and show evidence of their learning on different goals and objectives? Each of the learning goals should be subtracted to more detailed and measurable learning objectives. The objectives should be known by students and preferably discussed with them in line with their own objectives, goals and expectations.

- Does the learning material provide different viewpoints to the required learning objectives? Materials produced outside are abundantly found from the Web; using these may improve skills relating to source criticism. These issues must be discussed and appropriate tools should be available to verify origin of the (student) works.

- Does the online learning environment provide a good view of the whole learning process for the students? Do the students have the tools and time to reflect on their learning?
- Do the chosen assessment tools and related tasks measure the learning outcomes?
- How do students receive and give feedback, continuously (web, classes, etc.) or only at the end of the course?
- Legal responsibilities must be taken care of, especially in the case of online learning. Both the students and teachers have their copyright to any (original) works they produce. Privacy issues are sometimes very delicate and may come up in many situations when some part of the course includes activities in public domain.
- Ethical issues have traditionally been concerned with plagiarism, especially in online learning. Scientific communities have their own norms and rules, which must be conveyed to students too. In an online environment, the netiquette must be emphasized. In different media, the culture has developed in certain ways and taking one discussion style to another media may produce unexpected results.

5.2.3 Development

In the development phase, the learning materials are assembled and tested according to the manuscript for the course procedures.

5.2.3.1 Learning Environment

The main functions of the environment are activated in this stage. Support personnel and the maintainer discuss the details and customization of the site. The maintainer is responsible for maintaining and modifying the site – the support personnel serve as a guide.

The main issues in this stage are the choice of platform, needs for group work and other interaction. There might be the need for a broker-organization who provides the site, if the available environment does not satisfy the needs.

This stage also includes revisiting the blueprint for the whole course, especially from the viewpoint of what, when and how the course information, supporting materials and learning contents are provided. The site is built according to the blueprint/plan, but one should be able to alter it, if required, during the course.

5.2.3.2 Materials and Standards

Material production and compilation is an essential part of the development phase. University teachers in Finland often wish to create their own materials. Some use works published in external locations. With self-made material one has to take into consideration the teachers own skills and budgetary issues in making the learning content. The choice of publishing using different media depends on the context and on all aspects of the project starting from the target group characteristics, ending with the choice between publishing platforms.

The possibilities of externalizing the material production depend on budgetary issues. In scientific education, the externalization of content production is solved naturally by using the scientific articles that are accessible through the organizations library or using external commercial database services. Another, often neglected, source of learning material, are the real life sources as news and statistical sources that are freely available on the Internet.

Using standards is important, because they enhance usability, accessibility and transferability. In this area, often the maintainers have to rely on the supporting personnel and the online applications' features. The content standards are partly handled by the applications in use, but the support personnel may suggest additional features for the course materials such as using keywords, writing styles and accessibility advice.

5.2.3.3 Production

Depending on the media choices, in addition to decisions on the learning goals and materials made earlier, the production phase may be extensive or quite light. Often the typical material is text-based accompanied with some other features such as still pictures or graphics based on data. This is especially the case in business economics and economics.

The production phase includes considering the structure of materials and of course all the activities that are a part of the course. The material should include meta-information about the contents in addition to copyright and usage information. The material might also be organized from learning objects (LO) – the sources of the LO's must also be documented. Usability planning of the materials and the complete online learning environment should include network accessibility considerations that take into account possible disabilities of users.

***5.2.3.4** Tools*

We need to map out the needs that go on top of the usual text and spreadsheet-based productions tools if multimedia content is to be part of the

course. In addition, the needs for collaborative tools should be discussed (video-conferencing, desktop conferencing, joint writing, blogs etc.) The learning goals, methods and tasks should determine the tools used in the activity.

5.2.3.5 Manuals, Guides and Support

Support personnel have to provide the necessary guidance for both students and teachers. Production tools, templates, layouts, learning platforms and other collaborative tools have to be covered by the support service. In many cases, the support is not constrained only to providing the necessary guidance in text, but physical presence is needed too. This requirement has an influence in increasing costs of instruction and teaching.

5.2.4 Implementation

The implementation stage includes the operationalization of the plans and gathering feedback from the participants via testing, piloting and training the maintainers and users. The learning materials are published and course activities are available.

5.2.4.1 Testing

The final testing may be done light or by conducting a pilot with experts or representative participants of the course. In practice, in most cases, testing is minimal and it may be skipped altogether and done during the course.

5.2.4.2 Communication and Marketing

The basic information about the course is produced during the previous academic year. The preliminary information includes all the basic information about the course, but some things change between the planning period and the start of the course. For these issues we need other sources and delivery channels.

The basic information about the course is provided in a study guide – online or in paper – which includes contact information, descriptions of learning materials, important dates and addresses, etc. To enhance accessibility, the metadata information of the course should be carefully produced, especially in the case of open courses and learning materials. Changes to the information are usually announced on course sites, but other channels and media such as email, billboards, online discussion areas and SMS may be used. The information channels should be decided in advance and preferably, they should be the same for as many courses as possible within the organization.

5.2.4.3 Preparations

Just before the teaching starts, in addition to the information communication, we need to make preparatory actions for the course to succeed. The students must have access to all relevant online applications, which may require registration to small groups. The related approvals must be managed.

Users should be familiarized with the methods as well as to the tools that are used on the course; preferably, before the course starts in order to save time for the learning activities. Familiarizing new students with the online application and other procedures that may include collaborative online applications should be conducted. Other facilities, such as classrooms, equipment and software are, in a university, provided by various support services – the service providers may differ much from organization to organization. Pre-course tests for knowing the learners' help in personalizing and planning the course may be of value.

5.2.4.4 Instantiations

In this section, the activities that will happen during the course on course sites and in the classroom are discussed. In an ADDIE process, the implementation phase is in most cases seen as the last of the preparatory phases in the design process. This is interesting, since, in my opinion, it leaves out those activities out from the instructional design processes, which are more time critical than any of the previous stages. The during-the-course-processes are not part of the ADDIE. The instructional design contribution is seen at halt after the course starts, starting again with evaluative processes after the course. I have included the during-the-course-activities, instantiations, to the process.

It should be remembered again, that almost any activity that can be conducted face-to-face activity can be brought into an online environment. The media choice is the key in planning distributed learning,

In ADDIE-type processes, the planning is usually carried out in advance – well before the activity starts. If situations change during the course, we need ad hoc solutions. The following ideas may be a part of pre-course design, but they also may be taken into the action during the course. They may be initiated by the teacher, but also by students.

- Course information and materials may also change during the course. This is especially inherent to those activities where the students create materials themselves.
- Interaction is important in any course. Interactive activities may be inserted into the course at any time. In many cases, there may be random tests, theme discussions, commenting, tutoring and men-

toring, peer evaluation and support, independent reference collection, literature critique, simulations, multimedia materials, substitutive exercises, multiple choice exercises, continuous feedback channels, visiting lecturers, reflective discussions, learning diaries, group formation, level tests, joint writing, announcement boards, creating guides and even personal supervision, etc.

5.2.5 Evaluation

In ADDIE, evaluation is continuous, as is similar in the ADR process. Both frameworks also have a summative evaluation at the end of the process. I additionally include in this phase the wrapping up of the course and future developments, in addition to the final assessment of the students' work and student feedback.

In measuring the success of the course, the main question should be of how successful the students were in achieving the desired learning outcomes. Student learning evaluation is the main objective during this phase, but my interest is also on those processes that are aimed at supporting learning and teaching.

We should assess the whole process, not just students or teachers' work. How was the project in all conducted? Is there any need for adjustments in the support processes or maintainer activities? Has the project been managed well? During the course planning and implementation phases, information should be gathered on the successes and failures of the performance. Corrective actions should be possible also during the course. This is where organizational issues from a quality improvement viewpoint can be evaluated. The summative evaluation should also revisit the results of the continuous formative evaluation. The final evaluation should include all the main steps of the ADDIE process: considering the requisites, planning, production, startup, implementation, and concluding the course.

5.3 Formative Evaluation Criteria and Measurement

How to improve performance during the ADR process and, how to find out to what extent the problem is solved? What, when and how to measure? Are there other contributing factors affecting the outcome in addition to the artifact? We might have different types of artifacts: concepts, models, methods, and instantiations, in addition to product, process, technical or sociotechnical artifacts – the evaluation must be tailored in the context. Hevner et al. (2004, p. 85) propose that "*IT artifacts can be evaluated in terms of functionality, completeness, consistency, accuracy, performance, reliabil-*

ity, usability, fit with the organization, and other relevant quality attributes."

The course template is the most visible part of the ensemble artifact for the users and maintainers. The usage of the template for creating course instantiations has been mapped out twice, in 2004 and 2007. The results of the first study were documented in the earlier in chapter 2.9 and serves as a comparison point for examining the changes during the later implementation period of the strategy. Earlier, in chapter 2.8, I also described the design process stages in detail. In this chapter, I outline the evaluation activities, which were conducted during the ADR process. The evaluations include four elements, which are summarized here before their more detailed descriptions follow in the next chapters:

- Mapping instantiations, the Course Template in Use
- Questionnaires and interviews
- Organizational goals and quality improvement practices as constraints - self-evaluation
- Dependencies and constraints – technology, infrastructure, organizations and skills – self-evaluation

Mapping instantiations, the Course Template in Use

Since there are controversial results about the efficiency of online learning (Piccoli et al., 2001), I have often intentionally avoided the popular concept of e-learning and used instead the term of distributed learning or another term. One reason for this choice is the controversy over defining these terms. How much should one have online activities on a course so that it would be considered an online course? These difficulties to define clearly the notion empirically led me to measure the activity that is present and visible on the course pages instead of trying to calculate shares of virtual or online activities in relation to offline work. In developing online services it is more useful to know how they are used than approximating an arbitrary "virtuality" percentage share.

One of the variables used in the mapping of course sites is the penetration ratio of the course template among all courses. It informs about the popularity of online activities in general, but it also tells about which kind of functions are best suitable for online activities, as seen by the teachers. The ratio may be used to show the necessity and use value of online activities in distributed learning. The penetration ratio is, though, not alone sufficient to indicate the success of the interventions. Therefore, we gathered more detailed information on how the online services were used.

Teachers use the template as their tool for course design and delivery. The usage of the template as course instantiations has been evaluated thoroughly twice, in 2004 and 2007. The first mapping of course sites was done in collaboration with Hilkka Toivonen (2004) and the second in 2007 by me. These researcher-led evaluations are reported in chapters 2.9 and 5.5 respectively. The aim is to show how the teachers have been using the template and how this activity has changed.

Questionnaires and interviews

Evaluation was also carried out on users' and maintainers' perceptions. An IT-survey of students in 2006 is described in chapter 0 (FrontPage had not been used by 19% of the respondents. 17% of them knew the principles and had been using it. 33% knew the program and used it according to given templates. Only 8% regard themselves as creative and knowledgeable users able to also support their peers. In 22% of the answers, the respondents see themselves as fluent and versatile in applying the software.

The results show clearly that the groupware application Optima is less known and respondents do not see themselves as competent users of it as they do with FrontPage. These results suggest that Optima is an application that is more complicated and includes more functions, but also indicates that FrontPage with the aid of predetermined model structure (the template) may be easier to master.

Student Survey in 2006). It was conducted in collaboration with the IT Department and Marjaana Törö (2007). The survey shows students expectations and opinions about the learning environments. The evaluation process was centered on the template. The School's other web-based learning platform is only present in some usage comparisons. In addition, teacher interviews conducted in 2007 by Marjaana Törö (2007) are part of the evaluation process. The results are reported in chapter 5.4.3. In addition to the student questionnaire and teacher interview, the personnel's' IT service satisfaction survey was conducted in 2006 by the CIE and IT department – the Learning-related services were included too. This survey is discussed in chapter 5.4.1.

Organizational goals and quality improvement practices as constraints - self-evaluation

In principle, the goals set in the HSE eLearning strategy from 2002 are embedded in the artifact. The quality improvement evaluation is discussed in chapter 5.6. The main objectives spelled out in the strategy were:

- HSE's objective is not to be a distance learning university.
- ICT supports campus-based face-to-face education by enriching the learning environment.
- The ICT systems support comprehensively the processes in teaching, research and administration.
- The starting point for using ICT in education is both in assisting working in routine tasks and enabling the value added of ICT usage.
- A uniform and easy-to-use web-based learning environment is offered.
- The learning environment requires an integrated support service function.
- Technical and pedagogical support is provided to develop teaching and learning.
- The teaching personnel will have a clear and multifaceted perspective on pedagogical alternatives, including using ICT in teaching, and their implications for example in copyright issues and media literacy.
- Interactivity and problem-orientation in learning activities will be increased through ICT.

In the strategy, it was required that it would be updated in 2006. The revised strategy was published only internally as a development plan in late 2007. The document departed from the original strategy by emphasizing:

- that the ICT infrastructure should support various devices;
- support functions' collaboration; and
- providing clear guidelines about copyright issues in ICT-based material production and delivery.

Dependencies and constraints – technology, infrastructure, organizations and skills – self-evaluation

The ensemble nature of the artifact requires taking into account many factors that have effects to the context where the artifact is supposed to be used. The issues introduced in the problem formulation phase were also discussed from an evaluative viewpoint in chapters 2.4, 2.5 and 2.8. The discussion continues in chapter 6 (Reflection and Learning).

5.4 Questionnaires and Interviews

5.4.1 Personnel Survey in 2006

In October 2006, we conducted a user satisfaction survey in collaboration with the IT department. The CIE support services were included in the questionnaire. We had a maximum of 65 answers of potential total 495, which gives only a 13% return rate. Only 21 (32%) of the respondents indicated that they belonged to academic staff. This means that only approximately 14% of the regular teaching staff returned the (online) questionnaire. Therefore, the results only indicate some hints of the whole population of the teaching personnel.

In general, over half of the respondents' views reported that they possessed adequate software (74%) and equipment (62%) to conduct their work. The support service for FrontPage and Optima software in addition to other support services received the following distribution in the user evaluation (1 = poor, 7 = excellent, 8 = NA):

Service / Rating %	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
FrontPage support (64)	0	0	2	**2**	11	13	5	69
Optima support (64)	0	0	2	**2**	6	9	8	73
Office applications' support (64)	0	0	2	**2**	6	9	2	80
General user support (64)	0	0	0	**3**	9	19	8	61
Training (64)	0	0	0	**3**	11	20	5	61
Service Skills (56)	0	2	2	**7**	4	27	9	50
Service orientation (57)	0	2	0	**4**	11	28	14	42
Friendliness (56)	0	2	0	**2**	5	30	8	43

Table 5-1 Results of the IT user satisfaction survey

The most striking observation in the table is the number of "cannot answer" column (8=NA). For example, the FrontPage support question was answered by 64 respondents of which 69 percent (44 people) either did not wish to answer the question or did not have any experience of the service. One may assume that the 20 people, who answered, belonged to teaching personnel and have used FrontPage. Most respondents evaluate the success of support and training functions positively, reflecting that the support process has fulfilled its goals as part of the unit's activity. The success of the tailored personal support mode is reflected in the figures concerning positive opinions about the support personnel's friendly service orientation and professional skills. The free-form feedback gathered in the study show positive results, but also criticism. The respondents found the service in general as prompt, positive, friendly and patient – with the exception of occasional delays.

We also asked the respondents to rate their own skills in using the software they need in their work. The answers regarding FrontPage and Optima are provided below.

Skills / Rating	1	2	3	4	5
FrontPage (63)	19	17	33	22	8
Optima (62)	45	27	13	13	2

Table 5-2 Users perceptions of their own skills

FrontPage had not been used by 19% of the respondents. 17% of them knew the principles and had been using it. 33% knew the program and used it according to given templates. Only 8% regard themselves as creative and knowledgeable users able to also support their peers. In 22% of the answers, the respondents see themselves as fluent and versatile in applying the software.

The results show clearly that the groupware application Optima is less known and respondents do not see themselves as competent users of it as they do with FrontPage. These results suggest that Optima is an application that is more complicated and includes more functions, but also indicates that FrontPage with the aid of predetermined model structure (the template) may be easier to master.

5.4.2 Student Survey in 2006

The student questionnaire (Törö, 2007) on ICT-based learning was conducted by including specific questions to the IT departments' ICT service satisfaction survey. The response rate was around 4%, which means that 102 students of 3800 potential respondents answered the survey. The respondents represented most of the subject areas at HSE.

The students were given the possibility to rate their three best sources for course information. Most (40%) chose the course sites as the principal source. Their second source, on average, was the official study register system, and the third most popular were the study register and school portal. Clearly, the efforts to enhance the use of electronic means in delivering course information met their demand.

The first rated first choice for the respondents to acquire course materials was the course sites; 65% of the students chose this alternative as the primary source. The second rated first choice, on average, was the paper form course materials the teachers prepare for them (18%). The most popular second best alternative is the paper form material. In general, the students prefer to have the material available online, but also provided by the teacher as prints. This reflects the school's policy that students had a personal

printing quota that they have to apply in printing the course material in addition to their other printing jobs.

The same pattern than that in choosing the best alternative for information and material delivery channel is visible in student's use of the services. The most used channel for material and exercises is the course sites – 80% of the respondents used the system; 35% of the respondents had used Optima for the same purposes.

Interestingly, even though Optima is marketed as the collaboration platform, 28% of the student respondents reported having used the courses sites' discussion forums in comparison to 24% of respective use for Optima. As I have noted earlier, the discussion forums are the gray area in comparing the functionality of FrontPage and Optima. FrontPage is an information delivery channel enhanced with some collaborative functions, but Optima is a fully functional collaboration application for producing and sharing material among participants. Of course, the students' usage of these applications is dependent of the teachers' choice of platform. In the open-ended part of the questionnaire, the students' opinions about using Optima range from a total ban to suggesting heavily increased usage.

In general, the students prefer the template-based course sites to Optima. This result reflects many aspects and differences between the applications. The course sites are used by the teachers tenfold more than Optima – the course sites are simply more used and familiar than Optima. In addition, the need for online collaboration is not great in campus-based teaching and learning. Optima requires more learning efforts than the easy-to-use course sites, where the functions that the students can and have to master are fewer than in the LMS, i.e. Optima.

The course sites are seen, perhaps from the reasons reported above too, to be more user-friendly. FrontPage achieves, on a scale of 1-7, an average of 5,4 for usability, in comparison to Optima, which scored 3,7. The general average score of Optima was 3,6, and for FrontPage 4,8.

The low results for Optima may also reflect the fact that in Optima we do not use a template to give a model for the maintainers. A course template for Optima could result in better results for it. This assumption is reflected in the survey results when the students were asked to evaluate the system's structure. FrontPage sites scored an average of 5,2, in comparison to Optima's 3,6. One student even demanded that the structure of Optima should be more logical and simpler. The note may mean the structure and layout that the teacher has built in the application, or it may reflect the user's view of Optima's user interface in general. Optima's content structure is built by the maintainer in the working space, but otherwise the application's interface is static.

In some free-form feedback, the students reported that online collaboration is seen as too complicated a way to learn in a campus environment where the students actually can meet easily. The students appreciate finding the course-related information and materials in one place with an easy-to-use format.

5.4.3 Teacher Interviews in 2007

A study (Törö 2007) was conducted to map out the experiences of teachers had in using the school's online learning environments, FrontPage and Optima. The interviews were conducted by a graduate student in order to have an objective situation in the interview. If I would have been present as the service provider, the answers might have been different. The study was aimed to find out if the goals set to the systems had been met.

To supplement the results of the personnel IT survey, 12 teachers were randomly selected for interviews from different disciplines in our school (Törö 2007). The interviews lasted half an hour each. The sample includes both experienced and non-experienced IT users. Among these were three FrontPage users, one Optima user and eight people who had used both. Therefore, in relation to the distribution of the average platform choice, Optima is over-represented in the sample. It must be noted though that the choice of the system for a purpose is different from being a devoted user of a system. The results of the interviews represent best the choice of platform aspect in teachers' work, if they have experience in both applications. They can be expected to be experienced to give grounds for their choices.

It must be remembered that here only 12 teachers represent 150 teaching staff members; in the student survey, we received only 102 respondents from almost 4000 students. The results and comparisons are not necessarily representative.

To compare the teachers' opinions to the students' views, the teachers were asked to put their three most important course material delivery channels in order of importance, similar to how it was asked from the students in their survey.

The best way to deliver materials for teachers was to print it on paper and deliver that to students. Five respondents had this opinion. This is in deep contrast to what the students see as the best alternative. Four respondents see Optima as the best and three teachers prefer the course pages. The course pages were seen as second best for four respondents, and paper prints for three respondents. Two respondents chose Optima as the third best delivery channel. Even though the results may not be representative,

they encourage pondering qualitatively the reasons for the choice of alternatives these teachers preferred.

The paper-based delivery channel is well organized in our school. Teachers may digitally deliver their material to the school's printing house. There they are printed and sent to the bookstore from where the students can collect them, or the teacher may take the material to the classroom as handouts. In addition to familiarity, this is a convenient way for the teachers, if they prepare the materials well ahead of the face-to-face meeting with their students. Students do not mind getting this service either, even though they prefer, on average, the digital alternative to paper. Other reasons for choosing the paper-based approach are IPR issues and costs. Finnish legislation allows more flexibility in using paper-based material than in the digital approach, where the contracts nationally are missing or restricting on the fair use of educational materials. The students' printing quotas also have an effect on transferring the printing costs to the teachers (department) instead of students.

The same question asked from the students about their usage of the applications was asked posed to the teachers in the interviews. Teachers who use Optima, like to employ its variety of functions. They use discussions, material delivery, exercise delivery, and return, etc. The students are put into work and interaction in Optima. They produce a lot of material themselves within the application. None of the FrontPage users in the teacher sample used discussion forums in FrontPage. One part of the teachers use FrontPage to information and material delivery, the other delivers exercises, links, and exam results.

The functions for the course sites in use are chosen according to the subject matter and number of students. For example, online discussions are not used extensively on smaller courses, because there is space for discussion in the classroom.

The teachers were also asked about support services. All teachers who themselves maintain their online sites (11), got their support mainly from CIE. They also naturally get support from their colleagues. The teachers mentioned that after they have learned the applications, there is little need for support, with some exceptions, which need special skills and knowledge of the applications.

In contrast to the students view, teachers see Optima's structure slightly better than FrontPage's. On 1-7 scale Optima scores 5,9 (by 9 teachers) and FrontPage 5,7 (by 10 teachers). It may be assumed that the teachers see the structures they themselves have created as almost as good and clear on both applications.

If the teachers evaluate the systems from the student perspective, the results are opposite, but with the same margin. The usability score for FrontPage is on average 5,4 (by 10 teachers) and for Optima (by 9 teachers) 5,2.

The general scores were also seen almost equal for both applications. FrontPage scores 5,5 and Optima 5,3. Optima divides opinions among teachers more than FrontPage, similarly to the case with the students' survey results.

From the maintainers point of view FrontPage receives an average of 6, and Optima 5,1. Maintaining the course sites were considered to be simple, but also Optima is seen as easy to use, after the maintainer has learned to use the application.

In the questionnaires and interviews, the focus was on the usability and other features of the applications. The idea was to show how the users see the applications to find out if the premises set for using these two applications for specific task sets (courses) were reached.

To sum up, it seems that the teachers have found the applications and know how to apply them for the tasks that they see fit in organizing their own teaching work. FrontPage with its interactive elements is used in daily information and material delivery for the intended purposes. Optima is used for tasks that demand more online interaction. This creates also demand for the students to work more actively in the Optima environment. It generates more work and increases learning costs in comparison with the simpler approach of material delivery and participating on lectures.

Offline and paper-based activity is still seen as a good alternative for sometimes unnecessary and artificial use of online activities. The students demand effectiveness in learning, what they see as unnecessary is immediately evaluated as a poor practice. The channels should be chosen according to the activity and its goals, not solely by teachers' preferences.

5.5 Course sites in 2007

Our activities, also influenced by external incidents, resulted in a dramatic increase of course sites employing the template. During the transition period from year 2004 to 2007, many things happened that influenced the teachers' decision to leave out platforms other than FrontPage, this also made a difference in how things evolved during those years:

- Only three courses were outside the schools' systems in 2004 and the number did stay stable. These courses were left out from the analysis, if they still were found on the listings of course sites.

- In 2005 and 2006, we had already started a project to transfer all existing page-based course sites from the old to the new FrontPage template.
- The Unix-server stopped functioning in February 2007. Much of the data was lost. Consequently, in 2007, we had practically only two applications for course activities – FrontPage and Optima.
- The shares of Optima courses of total course-sites had not increased. The application has its own non-template-based layout.

These actions and incidents resulted in over three times more – from 95 in 2004 to 331 in 2007 – courses that were using the template during the second survey. Practically every non-Optima course with online activities had the template in use.

About 180 existing course pages were transferred by the CIE support personnel to the new sites using the renewed template. The transfer process was done so that the site contents and structures were transferred to the new application by the support persons. Then we familiarized the teaching personnel to the new template. In practice, we transferred and created all of the over 300 course sites during two years. The process was designed so that with every course a transition schedule was made with the teacher. The aim was not to handicap the course activities. Many new course sites were also created during the transition period.

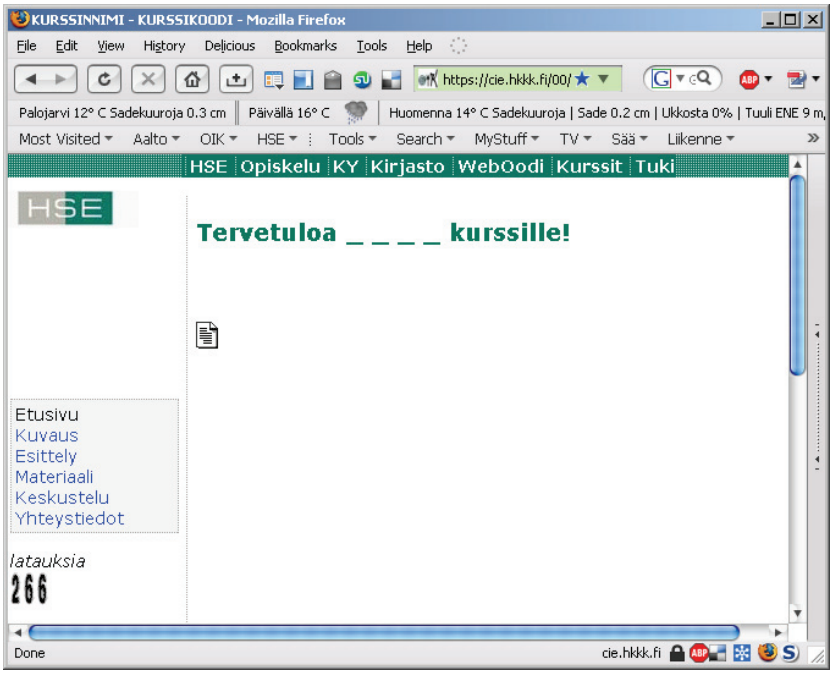

Figure 5-2 The new template layout in 2007

The new template (in the figure above) had mostly the same items than the previous one in order to keep the transition easy for the maintainers. A slightly new way for editing pages was introduced to the maintainers. Frames were abandoned. Those items' information that the support personnel had to create previously were transformed into individual pages (contact information especially, which earlier was located in the navigation area). The minimum number of items in the template – suggested to the teachers in the beginning – in this new layout was only five items: FrontPage, Description, Introduction, Material, and Contact. Later, we added Discussion as the sixth element to the minimum set, because in our new strategy it was emphasized that online interaction during courses should be encouraged. The Discussion forum is usually used as a café type of service for course-related discussions and questions, but also experimentations with theme discussion on the subject area have been increasingly used.

The 2007 evaluation was done in the same manner as that for 2004. I evaluated all sites by going through their functions in use and marked down the observations. These numbers are counted just for the courses that were template-based, i.e. FrontPage courses in 2007.

From the 2004 mapping, all FrontPage courses the graduate student evaluated are presented here for comparison. During the evaluation in 2007, 57% of all possible study courses had an online web site or working space (at the end of 2009, the ratio was 70%). 57% of the sites were in Finnish, 43% in English.

A shift happened from 2004 to 2007 in the shares of how much was protected on course sites, as can be seen from table below. For comparison, the variables/functions that were present in the interface during the 2007 evaluation, but not in the 2004 evaluation, are presented by empty lines in the table.

In practice, even though there seems to be an increase in openness ratio, the usual way in both years to use protection was to protect only those parts of the sites that contained the teachers' own material or course grades. In 2007, 60% of sites included material and (not in the table) 33% of all sites included protected material. Concerning course grades, about 25% of course sites published them, and of all 16% published protected grades.

The Description link to study register's information about the course was not present in the first survey. In the second survey, almost three-quarters of the sites had the link active. The link is generated manually by the support person while creating every new course site, so that the link shows the current up-to-date contents.

Criteria	2004	2007	Description of criteria
N	95	331	FrontPage-based course sites included in analysis
Items	5,6	6,8	Average of the number of interface items
	%	%	
Layout	55,8	99,4	Template layout in use
Openness			Information protection or open access
All open	46,3	60,4	
Partially protected	51,6	39,6	
All protected	2,1	0,3	
FrontPage	-	88,5	Site homepage contains some information
Description	-	72,2	Link to course description in study register
Introduction	93,7	66,2	Site contains an introduction to the course
Instructions	-	39,9	Site contains course instructions
Enrollment	10,5	30,2	Link in the interface to enrollment
Announcements	81,1	47,1	Site contains course announcements
Schedule	80,0	49,5	Site contains a course programme or schedule
Material	84,2	59,8	Course material is published on site
Exercises	60,0	32,3	Exercises are published on site
Links	14,7	13,3	Links to external sites
Discussion	14,7	13,0	Online discussion possible via the site
Participants	10,5	4,2	Participant listing is found on site
Results, grades	33,7	25,7	Exam or exercise results are published on site
Contact	85,3	66,5	Contact information is found (name is not enough)
Feedback	34,7	66,2	Feedback opportunity is provided on site

Table 5-3 Comparison of course sites mapping results

The consultation process (ADDIE) includes a discussion about the choice between using the items Description and Introduction. The Description link is a straightforward link to the study register in contrast to the Introduction, which should be provided and edited by the maintainer. The figures show that even the Description link is widely used and the Introduction link is in use on two-thirds of the course sites on average too. Even though the share of Introduction-pages has dropped from almost 94% to 66%, it only indicates that many teachers use the link to replace the unnecessary work of copy pasting the course information to the introductory page. As is suggest-

ed by the support people to the maintainers, they can choose between the alternatives and even use both, if they see it appropriate. On 43% of the courses, both items were in use. This indicates that many teachers also use the introduction page to give more information about the course than there is in the online study guide.

In addition, the evaluation of course instructions was omitted in the first survey. In 2007 about 40% of course sites contained instructions. They serve as reminders of the processes and procedures of the course.

The share of Enrollment link present in the interface increased, even though all courses follow the same procedure in enrollment; students register for the courses online in the study register system, Weboodi. The CIE support people created some exercise group enrollment systems together with the teachers in special cases, for example, when the course in question is a mass course (200+ students).

The share in announcements on sites decreased compared to the 2004 mapping. The same phenomenon applies to all except the last item, Feedback. On the other hand, the average number of template items on course sites shows a minor increase. In the 2007 data, we had 16 interface items evaluated, of which 43% (6.8 items) were, on average, in use on the course sites. The mode of all items was 8 and median 7.

It may be assumed that the teachers learned to be critical in their choices of items and information they provide on their sites. The information – and updating responsibilities – is often diminished to a minimum. Experience of what is the teachers' personal best way to use the online channel in their work may have increased. In addition to these reasons, the recommended model in the template actually diminished, showing only 5-6- items that were considered the most important. Many teachers may have been satisfied with the recommended model and the pages in use are used more efficiently – just as was recommended by the support personnel (see more discussion about the alternatives in chapter 2.7). One possibility of the decrease in item shares is the fact that many teachers may also have established their pages from external demand (students, colleagues, department decisions, etc.) – not according to their personal preferences.

Regarding the individual items' shares, there is some decrease in using pages like schedules, materials and exercises. The share of discussion forums and external links remained the same, implying that the number of courses using those functions has risen.

Even though widely used, the template has been developed without extensive user involvement. In addition to the teacher survey and interviews, attempts have been made to make informal queries of the functionality of the template, but it has always been seen as "OK". Therefore, many user opin-

ions have been gathered in daily discussions, during consulting work; with talk-aloud experiments, reflective comments from expert peers, strategy work and weak signals from the organization. No formal request was ever published to the faculty to use any application or interface – just recommendations in different situations, which, fortunately, have been interpreted as "the practice". There had been alternative templates that other people have been using, either their own layout or a template, which has been widely used within some subject areas, for example ISS and quantitative methods. In general, the attitudes range between some users enjoying the simplicity of the template to some technically advanced users who have seen it too restrictive and suited best only "for beginners".

In conclusion, the way the template is implemented, in addition to being economically efficient, reduces administrative work and enables the support persons to use their time more efficiently in other business. The template is fit-for-purpose, and as a generic idea, could be transferred to any other platform.

5.6 Organizational Goals and Quality Improvement Practices

A framework should be evaluated according to how well it mediates the designer's intention and how effectively it works as a tool in reaching the purpose of the design activity. Allen (2006, p. 438) regards the ADDIE process as an active part of quality enhancement and a tool for change. The ultimate aim in my intervention is on an organizational level to increase the purposeful usage of ICT in teaching and learning. This goal also includes a quality enhancement aspect in four areas: management, support, administration, and delivery (Allen 2006), which are a part of the constraints layer of the ensemble artifact. The evaluation of these functions is conducted with self-evaluation. The results are reported in this chapter.

The goals that the artifact is supposed to fulfill are many. From the adoption point of view, one of the empirical aims in my work is to distinguish different phases in the development and diffusion. Especially the following issues – containing overlapping goals for designing the template as described in chapter 2.7 (The Template) – are related to the development and management function of the whole activity:

- Bringing a new tool to do old things in a different way in teaching.
- Making the start of using the tool as easy to use and attractive as possible.

- Standardizing and controlling the innovation's usage by implementing rules and templates without killing the motivation for some degree of personal creativity.
- Making the template generic, to be used in different applications, in order to make the transition easy from application to application.

In addition to these development phases, the intervention enabled and enhanced several other goals and development targets:

- More efficient creation of new course sites i.e. less time-consuming work for support personnel
- To point out "best practices" for the instructors by introducing a template
- Making it easier to compare course activities and distinguish levels of online activities.
- Produce a tool for organizational and cultural change.

The artifact, which was developed around the template, serves several practical purposes for users that have a straightforward linking to organizational development and quality improvement processes:

- Following the usage and development of the numbers of course sites and their actual usage provides information for deciding the appropriate levels of needed support services and required infrastructure. The continuously updated data easily allows this kind of evaluation and simultaneously enhances process evaluation and improvement. The actual usage reflects the benefit that the teachers see in using the applications. It also shows what areas should be developed more.
- Providing applications that are easy to use and simple, produce timesaving for users, maintainers and administrators.
- Planning a framework for quality improvement in the form of an intervention process provides several positive effects. Evaluation of the development, design and intervention processes allow to set general goals and implementation targets, define measures for evaluation, in addition to express lessons learned and show improvements in a coherent way. User interviews and questionnaires may improve the process and measures to give results from different perspectives.

Of course, the learning outcomes are evaluated for each course, but with regard to the course design process itself, not very often. To have a broader view on quality assurance we need to look at the process too, not just the

learning outcomes of the courses. The quality management aspect of ID in the artifact reminds us about the purpose of ID, which is the design of efficient and fit-for-purpose instruction to be continuously evaluated against the organization's mission and individuals' learning goals.

Have the above goals been achieved? Modularity was the original idea in developing the template. At the outset, the course site was planned to be a portal for course-related information and its activities. In principle, since the template is "just an idea" the activities gathered together in the course site could be compiled from different sources and applications just by linking and providing instructions to the users. It also could be transferred easily to another application. Administrative reasons guided the usage of the template to a more closed mode than was originally intended. Nevertheless, the modularity principle of the template and the embedded artifact may be used in another context. The user and maintainer evaluations showed evidence that a template may be useful in building clearly structured course sites.

The School's intranet project was aimed to be the platform for transferring the template into another application, but the project was never realized. The next opportunity emerged after the School joined forces with two other universities to form a larger one – Aalto University. Merging three universities resulted in planning a new joint learning environment for the new University. This also means that the artifact, including the ideas developed for transferring have been used to plan the new environment. The idea of using templates will be further developed in other systems too. The artifact as a wider framework to address organizational issues has been employed as well.

In brief, the template and the artifact have passed the weak market test (Kasanen et. al. 1993, p. 253): the construction has been in active use and accepted within the organization. The following steps are a summary of this research process, following the constructive approach (Kasanen et. al. 1993):

1. A practically relevant problem with research potential was found from orchestration of distributed learning within a higher education organization.
2. The problem domain of the research has been described to increase understanding of the topic.
3. A course template and an artifact were created to manage and solve the problem.
4. The evaluation of the design process shows that the solution is in use and it works.

5. The theoretical connections and the research contribution are depicted in the design principles emerged from the research effort.
6. The scope of applicability of the solution to a class of problems have been reflected and discussed.

6 Reflection and Learning

Reflection and learning is a continuous phase in the ADR-process. It is present during both the problem formulation stage and BIE. Some of this reflective discussion was presented already in the introductory part, whilst describing the problem domain.

In the organization-dominant BIE, artifact building can be separated from intervention and evaluation only through retrospection and analysis. Therefore, I summarize and reflect on these issues on a meta-level in this chapter. My aim is to highlight the central issues found in the evaluations in order to show that the learning from the whole process may be transferable to another context.

The ADR process demands that this reflection and learning stage consists of discussion on design cycles, ADR principles and intervention goals, and results in general. Therefore, my goal is also to increase knowledge about the specific context of my research. The following chapters emphasize the combination of structured (guided) research activity within the case organization and the flexibility (emergence) that was the main mode in the design process.

6.1 What was the Problem?

The design process started from a practical demand: to build web sites for few courses and learn what so-called e-learning could mean in a HE institution. In 1996, various demands and expectations were about. They varied from cost reductions on mass courses to collaborative learning experiments and multimedia learning experiences in virtual worlds. The problem domain expanded as the development of the artifact shows. With the widening scope through strategy work, true research opportunities opened to complement practical needs. The organizational problem was eventually to design, through specific stages, a supported digital learning environment for the organization.

After realizing that the project-based working method – consisting of aid for specific courses only – was not enough, a more systematic approach

brought with it methods of analysis and reflection. The growing need for maintenance and support generated further demands:

- Formalization of working methods (quality control),
- Documentation of current activities (data about the level of activity),
- Process descriptions (an ADDIE-like outline and standardization with user guidelines), and
- University's strategy alignment together with action plan for the specific area.

Owing to learning during the design and research phases, to which the formal evaluation measures were contributing, the practical development requirements transformed into research questions within a class of problems that may be regarded as shared with all similar units throughout the Finnish learning technology scene in HE. ICT enhanced teaching and learning was no longer seen – at least from the support service practitioners' view – as an IT-dominated support function, but rather as an active profession, which worked at the crossing points of many teaching and learning-related administrative core functions, in addition to being a specific subarea and a tool for educational development and organizational change. These ideas also had an effect on the emergence of design principles, the outcomes of my research.

During the design process, in general, the variety of ICT applications grew and they became easier to master than previously. Another contributing factor was that the skills of the users were also better. The demand for different types of applications changed from all-round environments to dedicated applications, which serve only one or a couple of specific functions. A new paradigm was emerging. It emphasized collaborative learning, which was made possible by technological advances. The technology allowed greater interactivity. These expectations and assumptions were documented as development goals in the school's strategy as well.

Even though technology has allowed different kind of modes, has the activity changed to more collaborative mode as was demanded in the 2002 strategy? More communication and material are delivered via the network than before, but the culture has mainly remained teacher-led and has concentrated on material delivery. Students and teachers use collaborative media in their activities other than learning and teaching. Can these leisure time positive experiences be transformed to be a part of academic teaching and learning? Higher education organizations are experiencing, albeit slowly, a cultural change, which includes a growing portion of distributed work in space and time.

In my research environment, the organizational commitment to the design process can be described to have been positively neutral. The management supported us with basic resources and positive feedback. In the IT environment, the basic level activities were supported, but developing integrated services did not proceed. Therefore, the emergence of the design principle of commitment has a background from both positive and negative experiences.

The teachers were extremely rational in their choices and used the technology to the limit they regarded as contributing to the logistics of the course activities within their campus-based teaching and learning environment. Of course, not all teachers solely concentrate on the logistics of their courses. Many are interested in developing the students' online activities to more collaborative direction.

My research problem is not about diffusion of a specific application. The template's purpose was to lower the threshold for using technology. The aim was to familiarize the users to processes in general. My goal has been in designing an access point that is simple and resembles familiar ways of working. The template is a model for an ICT enhanced course web site, an instructional tool for course design, and an online learning environment.

Taking into account the environment and its development, the ensemble artifact was created. It had to deal with the complex environment and interrelated processes without being too complicated. The minimalist approach taken was visible in the interface of the template and in the iteration with which the template was gradually transformed into a more standardized form. The artifact and within it the template served as a problem-solving tool in service planning and teacher consultation.

Distributed learning as a notion consists of both technological and a pedagogical aspects. It also contains a transformation aspect in both the instructors and learners' modes of activity. In practice, the premises of distributed learning can be seen in the way technology supports the processes, but the change in the teaching and learning culture of the organization is not visible. The responsibility for learning is often seen to be the burden of the teachers, and not yet the privilege of the students. This is especially the case regarding online activities on a course.

6.2 Building and Principles

Hevner et al. (2004, p. 82.) stress that the fundamental principle of design-science research is that "*knowledge and understanding of a design problem and its solution are acquired in the building and application of an ar-*

tifact". The authors provide seven guidelines for design science research, which I use below to outline the contributions of my research:

1. **Design as an Artifact**

   "*Design-science research must produce a viable artifact in the form of constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices), or instantiations (implemented and prototype systems).*"

   The artifact in this research has been used in some form in all types.

   - As a construct, the template in the center of the artifact provides the basic vocabulary to be used in naming the functions of a web-based course. The naming conventions are a model and a template, an example, which can be freely modified by the maintainers (instructors). The idea is to simplify and keep the course interfaces structurally uniform for easier use by users (students). The aim is also to give the maintainers a starting point from where they can continue to use the structure as such, or alter it to meet their needs (teaching goals, for example). The ensemble artifact serves the same functions than the core, but it includes higher-level functions surrounding the course activity.
   - The template is used as a model for a structure of a (web-based) course. The template was at first developed for certain courses during a project, but it served as a good basis for its further collaborative development with instructors of other courses in their disciplines. As a model, the template is a real world generic representation of many actual courses. The ensemble artifact provides the means to place the course design in context with other dimensions affecting the outcomes of the design process.
   - The template serves, during the development and planning phase of courses, as a starting point for discussions about media choice and other arrangements concerning the management and delivery of the teaching activity. In this context, it plays the role of a process description of the course. Therefore, it and the artifact in whole, is a method, because it allows the support personnel and instructors to discuss and decide upon the "best practices" or media choices in specific contexts to reach the learning goals in different phases and functions of the course. Teachers can use it as their tool for instructional design. Therefore, it is also a method for delivering teaching.
   - The template has been developed during many years and it has been used in many courses. As an implementation, an instantiation, it itself is not a unique template, since it is fully modifiable

by the instructors in their courses. It has been a working system since the beginning – constantly in the production phase. Because the template is "just an idea", the intended purpose of it does not lie in its existence or form, but in its application. The artifact is the focal point of processes that can and have been be created around it.

2. **Problem Relevance**
   "*The objective of design-science research is to develop technology-based solutions to important and relevant business problems*."
   Hevner et al. (2004, p. 84) point out that the objective of research in information systems is to acquire knowledge and understanding that enable the development and implementation of technology-based solutions to heretofore unsolved and important business problems. The artifact in this research was created to solve the practical problem "how to ease the delivery and diffusion of web-based tools enhancing distributed learning". The template's purpose is to make it easy for the non-ICT-oriented instructors to maintain their course spaces, to unify the interfaces and to diminish students' memory load in using the course spaces (usability in general). In addition, a unified and common template of the courses is supposed to diminish the support personnel's workload. The specific problem domain and context, in which the template is used, is present in the ensemble artifact.
3. **Design Evaluation**
   "*The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods*."
   The evaluation methods in this research include a student questionnaire and interviews of the instructors. These results are explained in the Evaluation part of the thesis (starting in chapter 5.3).
4. **Research Contributions**
   "*Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies*."
   The template is being used in analyzing the processes of three different user groups: students, instructors and support persons. The template has been continuously developed in actual work, and users have greatly influenced its development. In analyzing the processes, I apply a combined research approach, action design research; a synthesis of action research and design research. The description of the whole research process contributes to general knowledge in sim-

ilar contexts. The transferable design principles are the outcome of the ADR process.

5. **Research Rigor**
   "*Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.*"
   The artifact has been used as a knowledge base in supporting the design of hundreds of courses and the instantiations of it have been evaluated by all user groups and with various methods.
6. **Design as a Search Process**
   "*The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.*"
   While the artifact was developed, the processes around it evolved at the same time. The processes and the template – the ensemble artifact – were developed in a sequence of iterations that were obligatory in the planning of the support that was required in its use. The environment and context are explicitly part of the design artifact. The versions of the template that were in production were used in an actual environment and under restrictions coming with the organization; therefore the versions were also tested at the same time by actual users and the satisficing solutions were further implemented in other instances, i.e. other courses (see Hevner et al., 2004, p. 89.)
7. **Communication of Research**
   "*Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.*"
   The audience of this research is colleagues in other Learning and Teaching support units, instructors, students and management personnel in universities. Readers, who are not familiar in design research, may find some insight into doing this type of research. The author's desire is to report this research in a way that is understandable to most readers.

The artifact has been developed and employed only within the HSE, but it has not developed in isolation. Many internal and external factors that were discussed in earlier chapters have influenced the design too. The external forces include the strategy demands on behalf of the Ministry of Education, and increasing quality assessment activities through accreditations and quality system audits. The internal demand consisted of not only wishes for a working application by teachers, but also via the annual performance ne-

gotiations, which included discussions with the school's management. The negotiations included reports of past activity and plans for the future. These processes contributed to the outer level of the ensemble artifact.

The template at the core of the artifact has been developed through several iterations, each of which has been a compromise of lessons learned from its earlier usage and ideas generated within the internal support services and the national network of educational technology experts. Therefore, the artifact has evolved through constant feedback and continuous collaboration within the research environment.

6.3 Stated Goals and Intervention Results

As the research process of the ADR research method envisages, building, intervention and evaluation have been interwoven in my research. The template has continuously been in use and under development. Therefore, there is no determined specific acceptance date. Many of the processes that have been included in the artifact have not directly been seen by other actors, because the activity is part of back-office work. The users and other support services see only different implementations of it. My practical work is formalized in the artifact.

The initial target for starting the design process was to learn how ICT could be of aid in teaching and learning on a few courses. In the beginning, the knowledge-creation target was to improve the processes and spread good practices as they emerge. This included planning the instructional design processes to support these activities.

The initial goal in the first design phase (The Project) was accomplished with understanding of the necessity to fit better the teachers' ability to create and maintain a course site with the applications in use. The making of an easy to use template and implementing a course server started with consulting the teachers in using the environment. It was also critical to find out that online activities demand more instruction, motivation and guidance towards students than classroom-based activity, where the processes are known and familiar to participants.

During the second phase (Support Service), the idea of a modular solution where the course activities could be linked to the best state-of-the-art applications emerged. This was supposed to enable flexible use of any system available on the Web. In practice, the use of the template in this respect was limited to the minimum. The main reasons for only internal linking within the school's own systems were the following:

- Adopting new systems imply learning costs
- User administration without system integration increases confusion

- Some teachers do not appreciate open systems for copyright reasons
- Students need a safe and simple environment to practice the substance
- The Internet is a constantly changing information repository of non-authorized information
- New authorized information sources are often not known and therefore not used in education
- Dynamic environments imply coordination costs in general
- Adding collaborative online interaction to logistic operations requires a change of teaching and learning cultures.

Owing to these reasons, the course sites in practice did not emerge as open platforms, but mainly material and information channels using internal information sources. On the other hand, open and closed approaches could have been implemented simultaneously with the template through simple linking from the template to other systems. A decade later, current technology allows application integration on the user interface level; for example, by encapsulating the applications in plugins resulting in one common system (Paulheim and Probst, 2010).

During the research period, traditional practices survived as the main stream, and in many cases for understandable and well-grounded reasons. The open culture that is based on sharing, which started to emerge in the latter part of the first decade of the current century, might change the way in which people think about the modularity idea in addition to sharing and collaboration in principle. The influence of peers should not be underestimated.

Later, in the design process the emphasis widened into organizational processes. During the Strategy-phase, the research process also started with artifact-based thinking. The artifact's role developed into a back-office tool to analyze and develop the environment. The ensemble artifact is a tool for the support personnel, not for users or maintainers. It is a framework to keep in mind while working with the constraining variables of the environment. It also contains evaluation aspects where the measurement of success is naturally an integral part. The ensemble artifact shows the general view of the whole activity and it reminds the support personnel about the many interrelations their work includes when instructing and guiding the users in addition to adding new ideas within the system.

Some of the goals set in the HSE eLearning strategy from 2002 may be seen as hindering the development of online learning. The School's objective was not to enhance distance learning. Instead, the goal was to support campus-based face-to-face education by enriching the learning environ-

ment with ICT. On the other hand, the focus was indeed intentionally in distributed learning: supporting routine work tasks and finding the ways to enhance the skills of the teaching personnel to employ the value added of ICT. The value added is, in my opinion, found in reduction and facilitation of routine tasks, but more importantly in the employment of a dynamic and collaborative learning environment, which may diminish the barriers of space, time and ownership of the learning process.

There are always learning costs involved with the adoption of new processes and applications that may hinder the pace of development. On the other hand, the value of ICT may be seen in a campus-based culture only in information and material delivery. In addition to the learning-related hindrances, the teaching culture is still very much teacher oriented and interaction is restricted to historically predetermined situations.

The course template was developed primarily to be a tool for the maintainers, the teachers. The tool was firstly intended to be an easily accessible tool for course site maintenance; simulating the publishing process of the editing tools they have previously been using. The starting point included the vision that after the maintainers had learned the principles of the generic process, they may have a good starting point to learn processes that are more complex. These include using other ICT tools for communication and interaction in learning. This leap calls for learning new processes and new applications. Therefore, the culture must change for the leap to be possible. ICT must be on the roadmap to show new ways of interaction and it may also facilitate the change.

The strategic goal of integrated support services was answered by developing internal collaboration. Interactivity and problem-orientation were supposed to grow by using the artifact as a consultancy tool in developing the learning activities with teachers. According to the personnel survey, the service performed well in general. The strategic goal of the ICT systems' role in supporting the processes in teaching was operationalized by developing the course template, "a uniform and easy-to-use web-based learning environment". Penetration rate of the course template is only part of the evidence that the artifact has provided utility. The student survey results especially support the view that the template-based produced positive user experiences.

The fourth design phase, standardization, was as an outcome of the strategy and quality work that was done during the previous period. Plans for starting to use new systems with the same idea were made. These plans did not come into practice. The forming of a new university reshaped the whole environment and practical goals once again.

As the formative evaluations showed, the use of the template increased and was in everyday use until October 2011 when new systems were implemented. The students on average appreciate online delivery and communication channels. The demand for the support of using the template and maintenance of the course sites diminished reflecting the fact that teachers adopted the system and the ideas the template allows them to do. The template has served the purpose.

Generating change is the most important thing in an ADR project. The design process resulted in increasing amounts of online activities within the organization. Material delivery increased and more courses had online functions. The change has not included, in my opinion, sufficient qualitative changes; especially the online interaction has not visibly increased. The culture of teaching and learning has not changed. The artifact has enabled creating a systematic view of the environment and its processes, which could be employed in further work or other contexts.

Finally, if the answer was the artifact, what was the question – the ultimate goal? The activity in the case organization started with a project that emerged after a couple of years as a unit. At the beginning, the mission was oriented towards course publishing, until the connections to other support services within the administration work became visible. Collaborative working with teachers and other support units became a central part of the work. Therefore, in retrospect, the goal was to integrate ICT tools to the university's core functions of teaching and learning. Online learning activities and the use of ICT in general cannot be separated from other activities related to teaching and learning, but it is a specific area to be regarded as a distinct professional practice.

This thesis describes what I learned in making the use of ICT in teaching and learning understandable for different stakeholders from both practical and scientific perspectives. The aim on this report has been in developing a story on how my framework has been used in instructional design for different purposes.

Minimalist principles have guided both the design and the research processes. The artifact emerged from a minimalist course interface to an ensemble for presenting the learning environment's activities, goals and constraints. The artifact reminds us that an individual course is a part of a greater whole. Therefore, the course activity must be seen in context and in relation to actors' goals and the environment's constraints. These include administrative practices and constrains in addition to managerial strategic settings. The artifact contains a description of the course activities (via the template), but it also presents guidelines on how to perform and operationalize learning goals in specific circumstances (the ADDIE process). It also

takes into account the generic goals of planning and implementation (management, support, administration, and delivery) and emphasizes that quality improvement and change are the general goals in developing teaching and learning. The same role that the course template has as a discussion and development tool, the ensemble artifact serves in describing the larger organizational environment. It is a tool for introducing, planning and development.

7 Formalization of Learning

Learning about AR, DR and ADR gave me the theoretical starting points – minimalism as a learning and design theory. They also provided a framework for how to present the practical results – design ideas and viewpoints turned into practices. The ADR methodology enabled the above-described practical design and intervention efforts to be transformed into scientific analysis. ADR is a flexible method, since it does not restrict the use of intuition during the research process.

The goal in the design process was to produce a platform for change. The ADR method produced a lens through which the lessons learned could be scientifically formalized and narrowed down to design principles. The principles may be transferred into other similar contexts. In the following, I analyze the design process and practical research results in relation to the design principles and design exemplars.

7.1 Design Principles for Orchestration

The task of instructional designers in organizations is to disseminate and develop good practices in the field. This work includes many fields of operation and expertise. The class of field problems is reflected in the design principles that emerged within my research topic.

Four principles emerged from this study: **contextualization, concordance, collaboration and commitment**. Contextualization should have an effect on the design on many levels starting from an individual user's viewpoint all the way to the organizational aspects of goal setting and institutional constraints. The concordance principle guides the emergent process to a possible real-life solution through framing the possible outcomes. Collaborative development iteration cycles make it possible to build an artifact that reflects the actors' real needs. Commitment at the organizational level ensures that the possibilities that the implementation of an ICT system beholds in enhancing organizational practices and culture do have a

possibility to be realized. The utility of the intervention may be seen only after considerable time.

The design principles emerged from the research context, both from practice and theory. They emerged through the lens of the minimalist approach guiding the processes through appreciating flexible and collaborative methods in aiming for systematic work processes in a given context. My research thesis “Less is more” contains these constructivist ideas. Furthermore, the research question, "How to orchestrate ICT enhanced distributed learning?" concentrates on organizational issues rather than technical artifact building. Instructional design processes demand concentration on larger entities than just individual courses. The principles reflect the enduring social aspects of the ICT adoption problem domain, which are often neglected in ICT design projects, but can be fruitful in reaching the organizational targets that are expected to be the result of the endeavor.

The four principles are very generic, but not necessarily abstract in nature. On the other hand, they are not cookbook recipes either. They cover aspects that could aid problem-solving interventions in other contexts. The target audience for the dissemination of the research results may be defined as personnel working with instructional design. This group of people may find the design principles emerged from my work as usable concepts that they may apply and have to make decisions about on a daily basis. I hope that the principles will stimulate critical thinking in defining the objectives of a similar project in another organization. In the following four chapters I discuss the content and emergence of each design principle.

7.1.1 Contextualization

The principle of contextualization emerges within a higher education organization mainly because of the varying situations the teachers and students meet in their work. Pedagogical goals and learning material in addition to teaching and learning methods set the starting point for course design. All of these differ from course to course and have an effect on instructional design.

This principle was present already in the project-phase of the design process. The starting point was first to take into account the needs, which teachers and students have in using the instantiations of the template as part of their course context, the distributed learning environment. Contextual issues affecting these decisions and choices were discussed in more detail in chapter 5.2, where ADDIE’s role as a tool to operationalize the artifact in a given consultation context was described.

During the later phases of the design process, the principle of contextualization evolved taking into account the larger environment, including the constraints and other functions of the outer layers of the artifact. On an organizational level, contextualization is about communicating guidance, during and after the ADR project, on how to perform in an environment with a given set of goals, constraints and requirements. The instructional designer should assist in finding the appropriate methods, media and processes for an activity by taking into account various viewpoints. These include matters concerning the ensemble of infrastructure, technology, applications, standards, skills, policies and rules. The combination of these, their relations, mechanisms and joint processes are central in planning activities in the environment. The emergence and usage of my ADDIE process is an integral part in operationalizing the contextualization principle. The organizational constraints are embedded in it, but it is simultaneously informed by the constraints. The artifact is mutable in this respect.

The guidelines that Benbasat and Zmud (1999) presented for practical relevance of research contain a direct link to my contextualization principle. An important question in an effort to enhance a system's adoption within an organization is how to communicate the main ideas clearly. In my case, I followed the theoretical ideas of minimalism. Other related questions include considerations about the actors, their expectations, previous knowledge and characteristics. Therefore, the basic message should be the same for everybody, but it should include contextualization and customization to enhance different practitioners' or user groups' understanding of the activity's specific goals and circumstances.

Similar to a situation where academics try to communicate with practitioners via scientific articles, we must deliver the message in a utilization process in such a way that it is useful in the receiver's context. In our case of distributed learning, contextualization is extremely important due to the actors' differing goals, roles and responsibilities in the process.

Contextualization includes concerns, not just of communication, but also those that emerge from the individuals' preferences and the organizational goals. In our case, it must, to a certain extent, also contain technological issues. The relevancy of daily activities is based on the demands that are generated from many sources, which include a wide range of different tasks starting from organization level strategic decisions and ending in urgent crisis when something goes wrong on a course. Lack of knowledge about the context, the problem domain, and its development goals will produce a design that is not fit-for-purpose and is additionally unable to provide a platform for further development of the activity.

Contextualization must not be understood as an ad hoc and reactive process. The designer of the support processes should be able to define the key problem(s) and use the appropriate theory base in each situation. The most important skill of an instructional designer is to know how to respond to requests to plan an activity within a given context. *Contextualization is providing meaning to goals and communicating the means for interpreting the environment where the activity takes place. Instructional design means providing the activity with appropriate solutions that are in line with both individuals' and the organization's goals, but introduced within an understandable context.* Minimalism and simplification can be seen as efficient working philosophies in delivering the main message.

7.1.2 Concordance

The concordance principle reflects the need for all to stakeholders to understand the environment in addition to its utilization and purpose in a sufficiently similar way. Having an ensemble viewpoint to the artifact (Orlikowski and Iacono, 2001) requires that the relevant parts of the system are regarded as interrelated. This implies a certain degree of harmonization and standardization. *In creating mutual understanding, the artifact and the template serve as a model, starting point, vocabulary, tool and environment in conveying ideas and, therefore, concordance of practices and design within an organization.*

A distinct feature in our case is that in a design process the instructional designer should carry the responsibility of setting up the activity appropriately according to the constraints of the organization and the surrounding larger environment. Often teachers do not have enough knowledge about the technological or organizational constraints. Therefore, the role of consultancy and facilitation is to ensure harmonization.

The course site's layout is an example of the concordance principle. Harmonization requirements can be presented through the template's structure to the users too. Visually, the need for concordance was obvious during the first design phase. The projects' five course sites were designed and implemented in the same way. In the later version of the template, the principle of concordance was released in order to provide some freedom for the teachers to design the layout of the course. After the number of courses using the template had increased considerably, the third version of the template was designed to follow a unified interface and layout for all courses. On an organizational level, in addition to implicit guidance during an ADR project, appropriate support documentation must be produced to enable the organization to continue using the artifact.

The artifact is a tool for an instructional designer to bring the context-dependent knowledge to the actors' working processes and tasks. An instructional design model (such as ADDIE) provides the means to maintain the coherence and concordance of activities together. The template is used as a unifying tool on the course level design processes. Missing concordance in both support and design processes will lead to inefficient activity without common goals. Some of the failed efforts to integrate other services to the template are examples of the importance of this principle.

The principle of concordance does not contradict the contextualization principle, which is inherently set to ensure flexibility. Balanced together, the two principles contribute to the learning environment. The first one ensures flexibility to enable innovations. The second emphasizes usability, producing an appropriate level of similarity in instantiations and processes.

7.1.3 Collaboration

Collaboration within the research environment is the essence of action design research. Therefore, the ADR researcher should plan how to create a collaboration network that remains in the organization after the ADR project has finished. Ideally, the organization would form a user community of the artifact.

Iivari (2003, p. 570) states that artifacts are useful as means of achieving certain ends. He also sees that many artifacts are not only the work of a designer, but that they may be emergent in nature. They are formed as outcomes of local actions through use, interpretation, negotiation and redesign of the system. These emergent features cannot be planned by a priori design. Iivari (2003, p. 571) sees that "*the enhancement of work systems is an interdisciplinary and collaborative effort, in which experts from different fields collaboratively take part in. The resulting ensemble artifact is emergent in nature and therefore a synthesis of the initial design and additional properties produced during the collaboration".*

The idea behind the flexibility in modifying an artifact has been well put by Bratteteig (2007, p. 67). During the design process of an artifact, the designers may have full control, but after the artifact has been handed over to the users, the users take control of the artifact and do what they want with it. This happened with the course template due to its flexibility and mutability. For example, the course sites have been used as personal data storages. Design is aimed towards use, and the usefulness and the use practices determine the success of the artifact.

The instructional designer is orchestrating the processes in designing the instantiations of the artifact. Orchestration is not based on control, but col-

laboration. Orchestration is visible to maintainers through consulting and guidance. For example, our unit's support services were highly appreciated in the personnel survey.

An instructional designer can have many roles in a design process. The role depends on the situation and the type of the project. In principle, the instructional designers' work is about choosing, informing, guiding, advising, discussing, motivating and networking. This should be done flexibly respecting the other actors' views in relation to organizational goals. The instructional designer's role is to create value in choosing, in collaboration with other actors, the working methods and processes of the design activity in addition to the final product. The objective should also be continuously improving the learning environment, not just applying the artifact. Improving the environment requires collaboration with other actors, who are responsible for their part in the surrounding activities, the outer layers of the artifact.

A large part of service building and development happens in collaboration with other support personnel. Without collaboration in service design, the parallel and interlinked administrative processes do not meet the teaching and learning activities' day-to-day needs. Consequently, integration and collaboration were among the goals in the school's strategy too.

In my case, the collaboration principle has continuously been present as a guideline during all research stages. In different instances, the roles of the main collaborators have changed. At the beginning, during the project phase, the teachers participating in the project were in focus. In building the support services, other units such as the library, IT department and student administration were the main collaborators. The strategy phase included interviews of personnel, altogether over 40 people. During the strategy-phase colleagues from other universities also joined forces in the exchange of information and practices as part of the FVU activities. The quality improvement aspects of the artifact lead to collaboration with university-level quality improvement units. Later again, the teachers' role as collaborators increased. The standardization phase contained collaboration with the teachers during the daily support tasks.

7.1.4 Commitment

Any ADR project is most likely to be only one activity amongst many others in the organization. If parts of the organization do not support the project, even the most potentially successful project may not have the desired outcomes. In some cases, collaboration does not happen naturally. Even within a small organization, formal contracts may be required in order to commit

the necessary stakeholders to the project's goals. The commitment often shows in resources, either human or financial resources. The availability of necessary resources and infrastructure must be ensured.

Commitment by the participating organization to the project is a key element in ADR. Commitment emerged as a design principle in my research due to the special nature of higher education organizations. In a university context, the differing goals of actors may create tensions in organizing the teaching and learning facilities.

Even though the organization would be committed to providing a service and the infrastructure, more is needed in producing change. As I reported earlier, during my research stages, many infrastructure development plans were not realized. The service continued, but it did not evolve as planned.

There was also increase in the usage of the applications, but the qualitative change did not proceed with the same pace. As I reflected upon earlier, taking collaborative practices into use demands a conceptual change among the service builders, but also within the application's users. ICT too often replaces only the material and information delivery channels, even though it could be best in complementing human interaction in distributed learning. Fowell et al. (1993) stated, "*A revolution is gathering momentum in higher education*". The revolution has taken place in the ways that people interact in their leisure time. This is not the case in distributed learning. The online services are not yet the extension of the classroom as was predicted. They serve mostly as announcement boards and material delivery channels.

Many see ICT's role solely as a mechanical tool to deliver and perform tasks. This point of view may lead to the situation where the tools are produced to support only existing processes of the organization. In my case, the existing processes include the way that teaching is generally delivered to the students. Most teachers naturally teach following the lecture-based model with which they were taught. The demand for new practices with new tools remains small if the infrastructure does not support collaborative methods, which are present in modern working life. Therefore, we need the organization to commit to change. The commitment to cultural change can be supported and boosted by the infrastructure. Implementing collaborative network services have an effect on practices. To realize the possibilities that online activities may bring to distributed learning, we must design solutions that enable the change in practices of teaching and learning, but also improve the learning environment. Changing only one variable at the time does not produce results.

To combine effectively ICT with teaching and learning, orchestration of ICT in Education is needed. I regard the combination of ICT and collaborative learning clearly as an area of expertise.

7.2 Design Exemplars

To highlight the idea that producing change is also the teacher's active choice, I present three design exemplars as examples of different types of courses. They are representations of categories of distributed learning. The exemplars are, similar to the design principles, outcomes of my research. The exemplars are based on the data gathered from the course sites in addition to the experiences of using the My ADDIE process in consulting.

The ADDIE-process includes the aspects of object, realization and process design in addition to algorithmic prescriptions, which van Aken (2004, p. 226-227) sees as the basis of creating design exemplars in making design (science) research. Design exemplars are related to technological rules. Van Aken (2004, p. 221-228) defines a technological rule as a chunk of general knowledge, linking an intervention or an artifact with a desired outcome or performance in a certain field of application. Technological rules may be used as design exemplars of managerial problem-solving.

A design exemplar is a general prescription, which has to be translated to the specific problem at hand; to solve that problem, one has to design a specific variant of that design exemplar. These prescriptions or technological rules may be heuristic, qualitative or quantitative. This knowledge can be applied to a certain field of application and for a class of problems.

The course maintainers have to make choices about informing users, delivering the learning material, and communicating with users. Of course, the infrastructure and services should support the actors in making the choices. It is important to distinguish different types of activities that form the basis of the categorization. They are the media choices the teacher has to make in addition to taking into account other considerations described earlier with the ADDIE model. What is the optimal media choice in different situations while there are many alternatives? To simplify the amount of alternatives I suggest two dimensions: activity and network.

For the network choice, I suggest categories ***offline, distributed, and online***. Using these terms limits the focus on using the computer network for the activity. In addition, it does not directly contain any aspects, which would tie the categories to any specific technology.

My suggestion for a simple **activity categorization** that would distinguish the course modes from each other is ***course information - material delivery - interaction and collaborative work***. The earlier ver-

sions of these categories of the activity dimension were presented in chapter 2.9 (in Table 2-4 Key indicators' shares (%) by groups).

Dede (1996) used the terms *direct interchange* for offline activities and *virtual interaction* for online interaction. Using the terms offline, distributed and online allows for flexibility in discussing about different media and formats. For example, in all three classes ICT may be used. Using these categories, terms as distance learning and face-to-face activity do not have to be determined. If used, they may change their nature too. Using my categorization, we avoid connecting the term face-to-face with the classroom. Consequently, one may have both in all categories, for example face-to-face conversation in videoconferencing. The same applies to distance learning with handwritten letters etc. In offline-mode, the delivery channel of any individual activity or learning module is not the network, on the other hand, in online-mode all activity is online. The distributed-mode contains both online and offline methods.

In addition, we do not have to discuss different dynamics and learning methods in defining the categories. Having just three categories in a single dimension is not enough to distinguish between various levels of learning experiences. Therefore, the activity dimension allows more elaborate descriptions of the levels of distributed learning. Distributed learning is just not just about using technology; it is also about defining what kind of activity (for example content creation) may be distributed to different actors.

The exemplars are generated using a two-dimensional matrix for presenting different types of choices in course design. Combining the two dimensions (network usage and activity type) produces a matrix for media choices. The matrix presents the alternatives, from which distributed learning as a mixed approach allows us to choose in designing the learning environment.

Activity / network	**Offline**			**Distributed**			**Online**		
Information				1				2	3
Material	1				2				3
Interaction	1				2				3

Table 7-1 Matrix for defining dimensions of distributed learning

Choosing the right solution mix for a practical purpose is the key issue in instructional design. The question is not with which technology we operate with, but what we want to achieve and what options we have in a given situation. Any technology can transfer knowledge and communication. Of course, the chosen technology determines the pace, mode and form of exchange (and information), but the technology choice should be appropriate

for the context. Other dimensions we may have to operate with in choosing the technology are access, location and time.

The following exemplars are examples of the final categories of distributed learning emerged from this study. Choices on courses 1, 2 and 3 are indicated by respective numbers in the matrix. The following three fictive exemplars describe situations where

- Course 1 is partly distributed but mostly offline,
- Course 2 is mostly distributed and partly online, and
- Course 3 is fully online.

The descriptions of the exemplars are minimal representations of possible outcomes from using the artifact in course design. Richer descriptions could include detailed explanations of the aspects that form the instructional design process with the consultative approach.

7.2.1 Course Information

The exemplar presents a setting where only the course information is in a distributed mode, everything else, i.e. material delivery and interaction, is offline. The case might be that the teacher is not technology-savvy or that he sees that the pedagogical goals or learning context demand mostly offline activities.

The teacher has provided the course information online on the course web site or in another system such as the university's electronic study guide. The other pre-course activities such as registration may be obligatorily handled in an online system; this may not be the choice of the teacher. The course announcements, such as changes on the course schedule may be on the web site or delivered via email. The teacher provides all additional information in class, face-to-face with the students. Online services are in this case used only from informing viewpoint**.** The teacher's demand for using online applications comes from the organization's rules and regulations or for the reason that he/she sees some benefits in using the basic applications provided by the organization. The teacher delivers all learning materials offline and manages all interaction with the students within the classroom.

7.2.2 Material Delivery

On this course, the teacher sees the value of online information and material delivery. She produces the course information and learning material only in digital form and delivers it to the course site or other applications in use. She has delegated the printing of the handouts to the students and provides all materials online on self-service basis. The students make the decision

whether they wish to print it out. Interaction is distributed. The teacher sees most value of online services from the logistics viewpoint, but encourages the students to use discussion boards in interaction between themselves. The teacher activates students in the classroom, but uses online services as a one-way channel from the teacher to the students, and does not participate in online discussions. She regularly goes through the bulletin board before every lesson and discusses the most important matters with the students in the classroom.

7.2.3 Interaction and Collaborative Work

This course is completely online. The teacher applies online information and material delivery, but also manages all interaction online. The course information and learning material are only in a digital format and the course site's interactive systems are in use. The students use discussion forums for their collaboration and participate in the discussions that are coordinated by the teacher as learning tasks. The students use online applications in joint writing to do their exercises. The teacher encourages students to use external online applications in interaction between them, but also to critically apply online sources as learning materials.

On this course, the activity viewpoint is emphasized. Online applications are seen as adding value to the learning experience in addition to being perhaps the only way to collaborate. The teacher and a part the students may be located geographically in different places. Virtual Worlds too may be used as a meeting for the lessons.

8 Conclusions

As part of the conclusions of this research, I provide a table (based upon Sein et al., 2011) to summarize the whole research process.

The table summarizes the emergent nature of the artifact design using the terms of ADR methodology. In the last two chapters (Objectives and Solutions and From Margin towards Cultural Change), I discuss general conclusions of this work.

Stages		Artifact
Stage 1: Problem formulation		
Principle 1: Praxis-inspired research	The objective was to ease adopting and applying online teaching and learning practices; and to design the instructional design processes to support the activity.	**Recognition:** The starting point was that the programming language (html) in producing course sites was too difficult to master by the teaching faculty. On the other hand, implementing learning management systems included too high learning and procurement costs.
Principle 2: Theory ingrained artifact	The kernel theory, minimalism, is a design and learning theory, which has been used as a basis in designing the artifact.	
Stage 2: BIE		
Principle 3: Reciprocal shaping	The researcher's work is essentially collaboration with the teachers and other support units' personnel. The collaboration consisted of seminars, instructional workshops and development projects, but especially teacher consultation on a daily basis.	**Initial design:** The design process was started within a project by designing a web-template for five courses in one disciplinary area. **Initial realization:** After the project, the template was redesigned, and the artifact emerged from organizational and instructional needs through the research process.
Principle 4: Mutually influential roles	Applying constructivist principles, the working method includes taking the teachers previous knowledge as a starting point in developing the online services. Teachers and the researcher have worked as peers from different fields of expertise. The artifact development includes several collaboration efforts with other internal support units within	

	the university.	
Principle 5: Authentic and Concurrent Evaluation	The instantiations (course sites) of the artifact have been evaluated by the researcher. Other evaluative methods include teacher interviews and both student and personnel questionnaires. The practical work has been evaluated as a part of the annual performance negotiations of the support unit.	
Stage 3: Reflection and learning		
Principle 6: Guided Emergence	Flexibility and emergence were the main modes in the design process. While the template was developed, the processes around it evolved at the same time. The processes and the template – together forming the ensemble artifact – were developed sequentially in iterations, which formed the stages of the design and research processes.	**Emerging version and realization:** The artifact was originally supposed to consist of only a course template and the instructional design process surrounding its use. During the BIE, the artifact was connected to issues concerning organizational management, quality improvement in addition to internal and external constraints via strategy implementation.
Stage 4: Formalization of learning		
Principle 7: Generalized Outcomes	Design principles were formed for building an artifact, which integrates a course template to organizational processes. Design exemplars were formed as research outcomes of employing the artifact and the design principles.	**Final version:** The ensemble artifact and design principles, which emerged within the ADR process, articulate the issues that are important in similar design situations in other contexts.

Table 8-1 Summary of the ADR and research project

8.1 Objectives and Solutions

The initial goal in the design process was to build a platform for a small number of courses in 1996. Important lessons from organizing the publishing process and meeting online activities' special demands were learned. The main conclusion was that the organization and most of its members were not familiar with the concepts or practices of online work. Something had to be done in order to change the situation.

The artifact building was done in steps that emerged not only from the researcher's initiatives, such as the course template and the instructional design process, but also from internal demands for quality development and external pressures for strategic planning.

The process had both anticipated and unanticipated consequences. Practices were transformed into a strategic and organizational planning tool. Reciprocally, the tool development had an effect on practice.

The design/redesign or build/rebuild cycle is clearly visible in the design stages of the template. The reported design process's duration is extensive. The length provides an almost historical perspective to the analysis, which can be regarded as accumulating the knowledge of the problem domain's development. On the other hand, the fact that the time span spreads the design interventions to a series rather than a clearly defined single point in time may be seen as a limitation of this research. This is clearly seen in the fact that the evaluations focused individually on different parts of the artifact. In addition, the template was not accepted by the organization on any specific date. Rather, it was gradually adapted by the maintainers for their courses.

The artifact design and research processes were a continuation of the design process. During the research process the implementation stage of the school's strategy was a major intervention, which combined ideas of the template design, support processes and qualitative demands for change. These development goals were announced within the case organization and nationally. Similar to the template and the ADDIE process in terms of being an operationalization of the artifact in practice, the artifact may be seen as a tool for strategy implementation. In this respect, the artifact has not been tested. It is intentionally an outcome of the research as defined by the ADR process. Furthermore, the design principles formed during my work may give some additional insight to the past decisions, but more importantly, I wish them to work as an aid in future planning.

Generally, the type of an artifact that emerged from this research as an ensemble may be generally known within the organization, but definitely it is not supposed to be applied by every actor individually. All experts in their

fields should be able to concentrate their efforts and resources to the most appropriate and efficient use – teachers provide a learning environment to students whose task is to learn. The integrated support organization for distributed learning should provide the facilities in the manner that these goals could be realized in practice. The artifact is a tool to orchestrate the activity.

8.2 From Margin towards Cultural Change

Distributed learning contains two important aspects. Firstly, it shares the responsibility of learning between the students and the teachers. Secondly, it emphasizes that the appropriate mix of offline and online activity is important, not any specific technology. The technology empowers the users to do routine tasks efficiently, but more importantly, it enables people to do things in a new way, even though the surrounding systems and technology change more often than generic work processes and learning goals.

The pioneers employ new technology, innovate and practice new ways of communication. Marginalization ends when the penetration rate of a new technology exceeds a critical mass and the new ways become current for most. When the demand to change comes from several directions (top, down and peer), interest arises. The final decision is made by individuals based on their perceptions on utility vs. learning and other costs.

In most cases, higher education is about distributed, not distance learning. In the teaching and learning context, to complement the administrative and technological viewpoints, a mechanism, service or a unit that guides an organization through the transitions should be available. In ICT driven change processes, without special support and orchestration of the development in this area, often only administrative and technological viewpoints dominate. For the necessary conditions to meet, there is demand for a broader view and orchestration of the development.

Online services do not produce collaborative solutions by themselves. Unfortunately, teaching and learning with online tools often reflects the offline culture. This is related to the attitude that technology is “only a tool”. The utility of using any tool is evaluated from the individual’s perspective. If the individual does not apply collaborative practices, using the online tools do not enable collaboration automatically. If any change is to be expected, it is likely to be gradual and may take a considerable time. Taylor (2001, p. 1) formulates the inertia for organizational change: “Trying to change a university is like trying to move a graveyard – it is extremely complex, and you don’t get much internal support!”

Nevertheless, new generations act differently from the previous ones. Young adults of today have experienced an era of online openness, sharing, collaboration, social media, etc. However, many present teachers see value in digital information and material delivery, but not yet in online collaboration. Routine tasks such as material and announcement delivery dominate the online activity. If the older generation is to be able to educate the younger generation, the teachers should learn new ways to facilitate collaborative learning and adapt different ways of thinking. As a minimum, they should allow their students to learn the way that is most natural to them. Technology allows and enables that already.

However, developing services cannot be entirely user-based. The design process, like ADR, includes problems, goals, and actions of several actors' who may have differing preferences. In addition, the design outcome is emergent in nature and contains solutions that are constrained by organizational and external factors. To change and transform, we must take into account

- Personal attitudes and skills,
- Organizational culture,
- Disciplinary differences, and
- Constraints and development of infrastructure.

Without affecting all of these, the transformation process is only incomplete. We only employ the benefits from online services partially. We do not employ their greatest possibilities such as information sharing, connectedness and collaboration.

Through a collaborative culture, there is the potential for an organizational change too. It would be important to dispose of the "content over collaboration" approach in teaching and learning. The students should be enabled to transform from a teaching audience to a learning community. ICT should be a tool to provide connectivity between teachers and learners, not to just serve as a material delivery channel. The ICT environment of a university should be a personal learning environment for the students to use. We have to design this. Technology is an enabler for new ways of collaborative work.

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ICT enhanced instructional methods have generated demands for change in universities and other educational institutions. The change creates interests and concerns, which an organization has to attend to in order to employ learning technologies in line with its strategic goals. The purpose of this study is to present and analyze the researcher's efforts of making ICT enhanced learning understandable and commensurable to different stakeholders within Helsinki School of Economics. During the research an artifact was built. The artifact is an intervention tool, which may be used on several levels of planning and consultation. The used research methodology, action design research, results in emergent design principles from an organizational intervention. Design principles of contextualization, concordance, collaboration, and commitment emerged during the building of the artifact. They are intended to be used along with the artifact as an intervention tool within another similar organizational development context.

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