

# Implementing delivery methods by using pedagogical design patterns

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**Abstract:** The goal of e-learning technology should in our opinion be to develop systems with a wide range of variation and many opportunities for both teachers and students when it comes to delivery methods and learning styles. We argue that the focus of e-learning design has been administration, content and media, and that pedagogical methods have not been prioritized. We present our thoughts about how to implement delivery methods by systematizing them into pedagogical design patterns that are implemented as wizards. The use of pedagogical design patterns will ensure that the pedagogy, not the technology, is the main focus in the design process.

## Introduction

E-learning systems are often dedicated to one or a few delivery methods. Morrison (Morrison in Helmer 2003) in contrast says that "...the ultimate goal would be to develop systems with varied pedagogical methods where the student can choose between different methods according to the learning strategy best for him / her". Morrison claims that the expense of this goal makes it utopian. We agree on the goal and think that we need to work around the expenses. Although it is too expensive to develop this kind of system today, if we give attention to developing tools for the design process and systematically learn from earlier experiments, it might be possible to achieve the goal in the near future.

Many smaller systems developed during the last decades have given us a lot of experience of what does and doesn't work, using a wide variety of pedagogical methods. We would learn a lot from these smaller experiments and experiences if we worked in a more systematic manner. There are applications based on simulation, others on CSCL, PBL or tutorials, etc. In recent years attention has been given to standardization (such as SCORM) and Learning Content Management Systems. Paulsen defines an LCMS as follows:

"A Learning Content Management System is an environment where developers can create, store, reuse, manage and deliver learning content from a central object repository, usually a database. LCMS generally work with content that is based on a learning object model" (Paulsen 2002).

The weakness of LCMS is its pure focus on learning objects. Ideally, learning objects are learning material that can be used in a wider context. SCORM is a standardization tool regarding content; we now need a standardization regarding teaching and learning methods as well.

In some communities there is now focus on "blended learning", that combines online and offline delivery methods in learning programmes (Helmer 2003). As far as we can see, "blended learning" is enforced because of the inadequacy of the technology used in e-learning so far. One solution to the problem of inadequate technology is to work with varied online methods. It should be possible to have "blended learning" in a pure online learning environment by varying delivery methods online. Many models have also been developed on how to evaluate instructional technology, e.g. Torgersen's GPK-model (Torgersen 1998), the Revised Pedagogical Framework (Britain & Liber 2004), etc. The purpose of these models is to evaluate existing applications and to make it easier for the teacher to choose the right application for his/her students. We find this too reactive, and mean that we need to be more proactive by developing methods and tools to help instructional software designers focus on pedagogy.

The special field of pedagogy consists of many pedagogical methods. Future e-learning systems need to reflect this fact. Our attention is therefore on pedagogical methods and how to implement them into e-learning systems.

## Variation

Variation has been regarded as an important principle within teaching and learning for many years. This principle seems lost on the road to the online university. Many online teachers use a few delivery methods over and over again: This is convenient for inexperienced online teachers. Britain and Liber concluded in 1999 that the majority of VLEs (Virtual Learning Environments) were designed to support an education model based on information transmission (Britain & Liber 2004). However, a model based on information transfer alone does not take into consideration the pedagogical challenges facing teachers and students in online communities.

Teachers with classroom experience know that instruction needs to be varied to retain students' motivation for learning. Sometimes problem-based learning is the best delivery method, at other times collaborative learning, lectures (one to many) or drill exercises are effective. The best delivery method depends on many variables, including the age or culture of the students, their background and motivation, the subject, the theme, the teacher and learning environment.

## Pedagogical Methods

Online teachers have typically adopted the delivery methods of pioneer online teachers. They have also of course been dependent on and limited by the learning system used. "Many first-time users of VLEs (Virtual Learning Environments) seek to adapt the way that they work to the way that the software needs things to be done" (Britain & Liber 2004). E-learning courses for higher education usually are based on a VLE / Learning Management System (e.g. Blackboard, WebCT, Fronter). The weakness of these systems is that they give too much attention to online administration and too little attention to pedagogical concerns (Britain & Liber 2004). The LMS forces the teacher into using only a few delivery methods. Teachers are used to finding the best methods of teaching their subject, and online teachers also should have the same opportunity. Most online teachers do, however, still need systems that help them discover the different pedagogical methods to use in a computer-based learning environment.

Systems based on pedagogy do exist, but they give attention to only one or a few delivery methods. Heinich et al., when talking about learning in classrooms, say "It would be overly simplistic to believe that there is one method that is superior to all others or that serves all learning needs equally well" (Heinich et al. 2002). This is valid for e-learning as well. Heinich et al. categorized instructional methods into the following ten categories (Heinich et al. 2002):

- |                       |                         |
|-----------------------|-------------------------|
| 1. Presentation       | 6. Cooperative Learning |
| 2. Demonstration      | 7. Gaming               |
| 3. Discussion         | 8. Simulation           |
| 4. Drill-and-practice | 9. Discovery            |
| 5. Tutorial           | 10. Problem solving     |

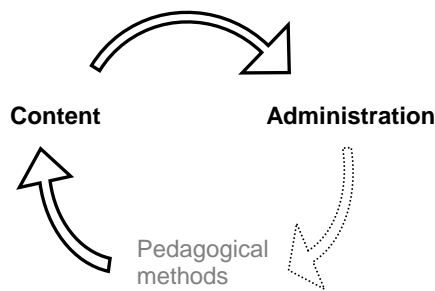
Some people will argue that several of these methods are available in e-learning systems; for example, a discussion forum is the implementation of the third category "Discussion". The weakness is, however, that most systems only give the functionality of a discussion forum, while the methodical knowledge and experience of how to use it in a learning situation is lacking. The result is that experienced online teachers gather their expertise in whole books e.g. about how to moderate an online discussion. The expertise should instead be implemented into the system. Another weakness is often a lack of communication between online teachers, up until now everybody makes the same mistakes, instead of implementing the solutions into the system and so learning from each other.

Each of the above categories has many subgroups of delivery methods. As an example we mention some subgroups of the sixth category "Cooperative learning":

- Group administration
- Genuine interdependence
- Synchronous communication
- Asynchronous communication
- "Learning Together Model" (Johnson and Johnson in Heinich et al. 1993)
- Team-Assisted Individualization (Slavin in Heinich et al. 1985)

There are reasons why there are many delivery methods available in classroom learning situations. We cite Anderson and Thalheimer: "Creating a greater number of retrieval paths (multiple delivery methods) the information will strengthen the retrieval process and increase ultimate performance..."(Anderson & Thalheimer 2003) and

therefore multiple delivery methods are important in the design of future e-learning systems. We argue that “the missing link” in e-learning systems of today is pedagogical methods.



**Figure 1:** Illustration of “the missing link” (pedagogical methods) in e-learning systems of today

### **Interactive pedagogical methods**

Information technology has advantages that paper cannot match. There exist “methodical guidelines” on paper available for teachers in different subjects, but integrating methods into information technology makes it possible to get interactive methods, where the system adapts to the choices made by the user.

The company “Groupsystems.com” now concentrates their work and systems around their trademark “Active methods”, where they integrate methods into their systems for project management. “An ActiveMethod is a sequence of steps designed to guide a group toward an outcome. Like a software wizard, an ActiveMethod guides users through a well-defined process, automatically presenting and soliciting the information appropriate for each step in a process” (Groupsystems.com 2003). Technology has been viewed as the solution in e-learning, whereas processes / methods are usually considered solutions in classroom settings. We believe the solution for e-learning might be to integrate processes (methods) into the technology.

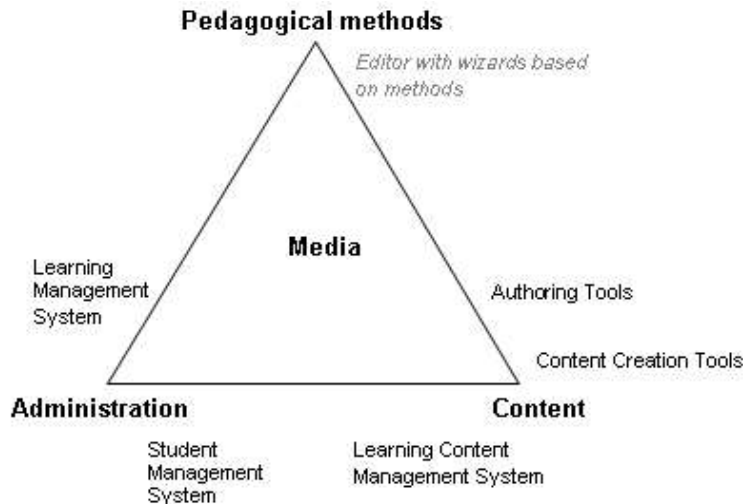
### **Design of e-learning systems**

An e-learning system should consist of more than we can see in the technology solutions we find today. Different functionality such as student and course administration, content creation etc. is already implemented and in use (e.g. LMS, LCMS and Content Creation Tools). Paulsen defines content creation tools as tools that are used to develop learning material, for instance plain text, slides, graphics, pictures, animations, simulations, assessments, audio and video. Examples of content creation tools are MS Word / PowerPoint / FrontPage, Macromedia DreamWeaver / Director (Paulsen 2002). He also defines authoring tools as “a software application, used by non-programmers, that utilizes a metaphor (book, or flowchart) to create online courses” (Hall in Paulsen 2002). The functionalities mentioned above all need to be intertwined in a joint e-learning system.

Inspired by the Assure model (Heinch et al. 2002) created for classroom instruction we present a learning system triangle (Fig. 2) where we divide the design of e-learning systems according to four different aspects:

1. Media: The channel of communication.
2. Content: Systems for content building (learning objects) based on e.g. SCORM.
3. Administration: Student / Course / Learning Management Systems.
4. Methods: Pedagogical delivery methods

We argue that three of the aspects are already implemented, but that the fourth aspect “the pedagogical methods” has not been prioritized. We believe it would be right to implement the pedagogical methods as an editor program with built-in delivery methods. The teacher fills the e-learning system with learning material based on pedagogical delivery methods by using, for example, wizards available in the editor program. Pedagogical methods such as discussion, demonstration, collaborative learning, etc. are the basis of the wizards; the editor program will help the teacher make pedagogical decisions by presenting the opportunities in the application. The teacher chooses the wizards based on pedagogical judgement and when the teacher is more comfortable with different delivery methods the editor program should allow the teacher to work more freely. It also should be possible to integrate the editor program into an e-learning system, where other parts of the system take care of student and course administration, learning object creation etc.



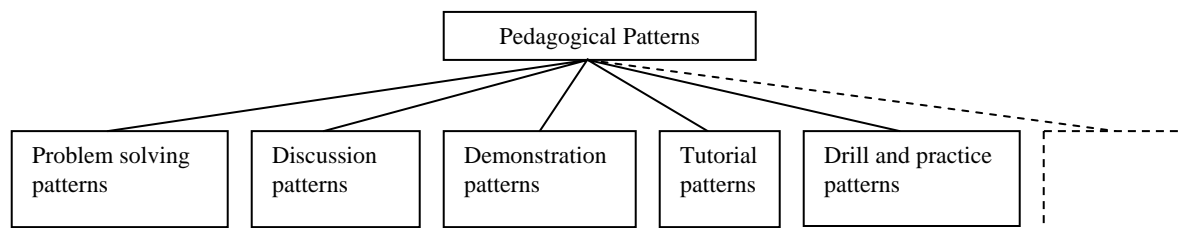
**Figure 2:** The focus of today's e-learning systems

### Design patterns as a design tool

To make the design process more effective and of course cost-effective we need to have tools to simplify the process. The tools should make it possible to develop systems with all the features and opportunities that we want, which is to include the four aspects of figure 2. Carstensen / Schmidt see flexibility as one specific challenge for CSCW-systems design; "we have to establish basic building blocks and platforms so that the actors themselves can establish a CSCW system fulfilling their needs" (Carstensen & Schmidt 2002). Design patterns can be examples of building blocks to ensure such flexibility in e-learning systems.

Frizell and Hübscher claim that design patterns can be used to effectively support novice designers of web-based courses (Frizell & Hübscher 2002). We believe design patterns could work as one kind of e-learning design tool. Design patterns are useful tools that make it easy to share the e-learning expertise learned from past mistakes since design patterns are archetypes on well-used solutions. Design patterns will build expertise of experienced online teachers into the system, and help novice online teachers learn how to work online.

C. Alexander's definition of a design pattern is that it "describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem in such a way that you can use this solution a million times over, without ever doing it the same way twice" (Alexander 1977). The patterns are systematically described using a pattern language. In this paper we are discussing *pedagogical design patterns* and believe it is useful to categorize the pedagogical patterns according to categories of pedagogical delivery methods.



**Figure 3:** Systematizing pedagogical patterns according to delivery methods

The introduction of pedagogical design patterns will lead to a systematic approach to e-learning design, where the educators do the work of collecting the design patterns and the software engineers design the technological solutions. For software designers without a pedagogical background the pedagogical design patterns will be useful and it will provide a common language for technologists and educators. Design patterns are a collection of tested pedagogical methods. Some patterns will work in several categories, e.g. a pattern of e-moderation will be useful in the categories of discussion, collaborative learning and problem solving.

## Pedagogical design patterns as wizards

The pedagogical design patterns can be implemented as interactive wizards, and design patterns will make it possible to develop learning systems where it is possible to adjust functionality in a program according to the learners' needs in the specific learning situations. Gilly Salmon has written a book about E-moderation, to help novice online teachers to make discussion groups be effective in online learning situations (Salmon 2000). Instead of reading whole books like Salmon's "E-moderation", the wizards can be helpful when you need them ("just in time" learning). The wizards are short versions of more experienced teachers' experiences.

Our work is based on the following procedure:

Delivery method → Pedagogical Design pattern → Wizard

In order to avoid creating misunderstandings because of the length restrictions on this paper, we will now describe a short scenario of how the procedure works:

The teacher uses his experience and expertise from pedagogy to create a pedagogical design pattern, using a pattern language where he needs to state a name (e.g. "E-moderation") and a category ("Pedagogical pattern – Discussion pattern"). Then he describes the problem ("A discussion forum can be difficult to get to work in an online learning environment. How can we ensure that discussion forums work well and are instructive to the students?"). He also does an analysis where he states why it is important to solve the problem and what makes this problem a hitch. He then describes known solutions: e.g. organizational moderating activities (setting the agenda, objectives, procedural rules, netiquette, encourage the participants to introduce themselves), social moderating activities (sending welcoming messages, thank you notes, prompt feedback, set a positive tone), intellectual moderating activities (asking questions, provide low-effort contributions, probing responses, refocusing discussion) (Vesseur 2004 / Salmon 2000). The pattern language also requires research questions, context, conditions, discussion, references and related patterns. The software designer can use this pattern as a starting point in the design process to create a wizard. In this way the expertise and experience of the teacher regarding methods is implemented into the system.

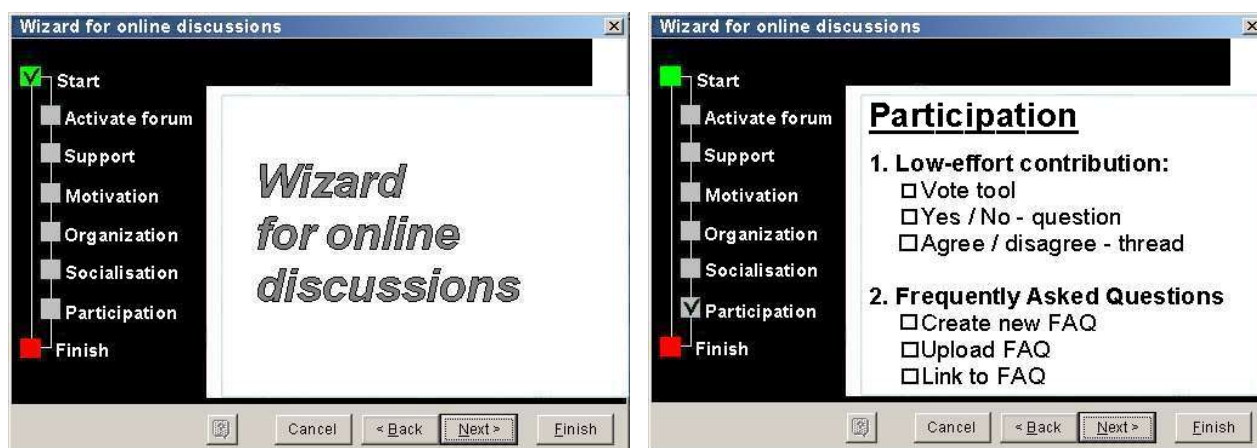


Figure 4: Two screenshots of a wizard for online discussions, based on the look of a traditional MS office wizard.

If the teacher believes that it would be effective to have a discussion to learn a specific theme, he could get the Wizard for online discussions. The first screenshot shows the first page of the wizards, with the name of the wizard, and the sequence of actions of this specific wizard. The "Cancel", "Next" and "Finish" buttons are used to navigate in the wizard. The teacher moves through the wizard's steps by clicking "Next", and reaches the 7<sup>th</sup> step "Participation" (Fig. 4). Here the teacher gets a number of choices to make. Based on the choices made, the wizard presents a discussion forum in the online learning environment, based on the teacher's pedagogical considerations.

## Advantages

Skills upgrading is dependent of individuals, which make reuse difficult. The wizards described above will assure the reuse of experience and competence, also with respect to delivery methods. The editor with built-in wizards based on pedagogical patterns will help teachers by giving them access to tried-and-tested delivery methods; novice online teachers will get to see the opportunities for online delivery methods. Students will gain access to a learning

environment where variation is implemented, making it possible for them to choose learning strategies. The learning environment will also make the students more aware how they learn best and how their learning preferences change over time. For software developers the pedagogical design patterns are useful because there are few methods and tools supporting e-learning design today, especially for developing systems based on a variety of pedagogical methods.

## Conclusions and future work

The time has definitely come to concentrate on pedagogical methods while designing e-learning systems to ensure variation for students. Morrison has described the concept of “content parity”. The same content should be made available to learners in all delivery channels, and the students can choose the combination of channels best suited for their preferences (Morrison in Helmer 2003). Morrison also argues “channel selection should be the business of instructional designers”. We therefore need learning systems that leave online teachers with the work they know best: teaching. Not administration and not technology. We believe pedagogical design patterns and wizards are the right approach to implement pedagogical methods into e-learning systems.

We will continue our work implementing delivery methods by using pedagogical design patterns and the concept of wizards, coming up with a prototype in the near future. The work will be based on patterns produced in the “E-LEN” project (a project under the Socrates Programme: <http://www2.tisip.no/E-LEN/>).

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