

## Using a Flexible Online Tutorial to Individualize Learning Activities

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**Abstract**—Teaching highly abstract topics like system modeling demands sophisticated teaching methods. They should enable different learning paths and take into account different learning styles. FOTO is a flexible online tutorial introducing basics of object oriented modeling. Its didactic concept defines three levels of representation supporting highly individualized learning.

*electronic teaching, didactics, flexible online tutorial*

### 1. INTRODUCTION

The constructivist learning theory explains learning as a highly individual process. It is central that knowledge as a process and product is constructed individually and must be embedded in an active process [1]. Therefore, classes should offer a variety of learning activities and should provide alternative learning paths. Electronic teaching is one possibility to facilitate individual learning activities in classes. Flexible online tutorials allow students to individualize their learning activities. They are learner-centered, placing interaction between the learner and the system in the foreground [2].

At Fachhochschule Zentralschweiz we developed a flexible online tutorial introducing basics of object oriented modeling (FOTO) [3] that is specifically suited to individualize learning activities. In section 2 the didactic concept of the tutorial is introduced. Section 3 describes the three learning levels providing learning content. In section 4 the different aspects of individualization are presented. Central requirements concerning learning content as well as the learning management system are discussed in section 5.

### 2. DIDACTIC CONCEPT TO INDIVIDUALIZE LEARNING

The individualization of learning has different aspects, especially:

- the *learning content* is presented with respect to individual preferences,
- the *learning path* is individualized,
- learning comprises different, learner-centered *activities*,
- *additional* information and activities are included based on individual interests and preferences.

These forms of individualization cannot be supported by linear representations of learning content. Activities are best supported by interactive learning materials. We have developed a didactic concept supporting both: a non-linear representation of learning content as well as interactivity.

The learning content is presented on different *levels*. This didactic idea has formerly been presented in an e-learning course offering the whole learning content on four levels [4].

Our didactic concept has been inspired by this idea and defines *three* levels of representation:

- The *introductory level* presents the learning content by developing a story related to real-world problems. Students learn all relevant concepts and terms intuitively as these are embedded in concrete situations they have to observe and to deal with.
- The *information level* presents most concepts and terms in structured, technical and exact form. Learning is also supported by the graphical representation of models and structures.
- The *exercise level* offers many interactive tasks to repeat and consolidate the learning content.

The main characteristics of the three levels are summarized in table I.

Different forms of interactivity are available within the tutorial. They comprise multiple choice exercises, drag-and-drop exercises, animations and user-controlled simulations.

The learning content is divided into small *learning units*. The units are the same on all learning levels. A selected unit is required to be worked through completely. All relevant learning content is presented at the introductory level. Most content is also available at the information and exercise levels. The information level may present *additional* learning content of minor relevance.

The tutorial covers a specific topic and is used in blended learning situations. Every student works through the introductory level. The teacher determines which learning units have to be worked through additionally on other levels. Students are free to go through all other units/levels, too.

### 3. THE THREE LEARNING LEVELS IN FOTO

We have implemented the didactic concept in the tutorial FOTO (“F”lexible “O”nline “T”utorial introducing basics of “O”bject oriented modeling).

Fig 1. shows a screenshot of FOTO. Navigation bars for learning units and levels are located at the left and the bottom. The gray area at the center is used for drawings, diagrams and interactive elements. The column at the right contains a story or explanatory text. Instructions for learning activities are also given here.

TABLE I. CHARACTERISTICS OF THE LEARNING LEVELS

	<b>introductory level</b>	<b>information level</b>	<b>exercise level</b>
story	important	none	none
information complexity	low	high	low
interactivity	high	middle	high
knowledge consolidation	middle	middle	high

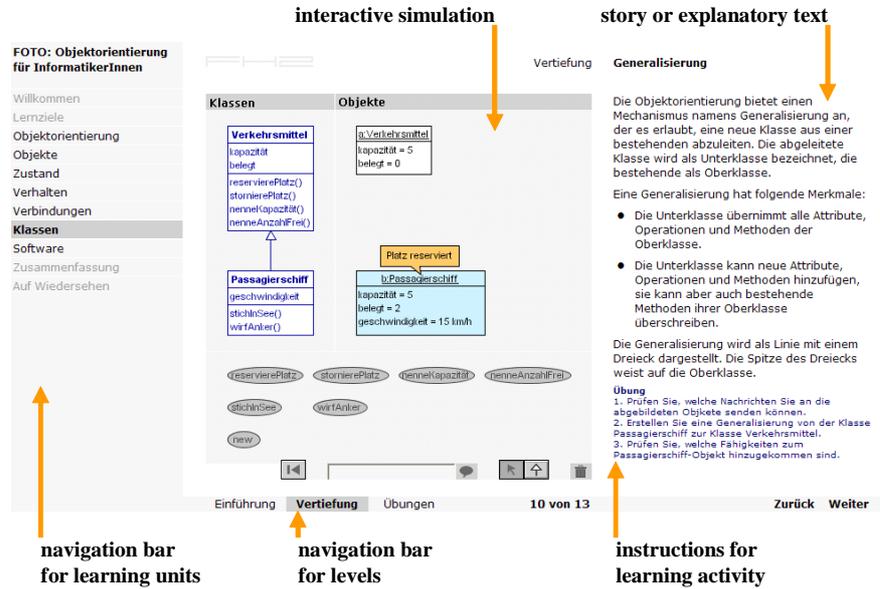


Figure 1. Learning activities in FOTO

### 3.1. The Introductory Level

The introductory level of FOTO embeds the learning content into a story: A travel agency has decided to develop new software for their sales staff. The learner observes the first project meeting. During the meeting, key concepts of object oriented modeling are discussed.

Learners are advised to work through the units of the introductory level sequentially. This is because the story line runs through all learning units. Also each unit introduces a new aspect of object oriented modeling, and puts it in context with topics covered in prior units.

Interactive learning activities support the learning process. In the first few units, the activities consist of drag and drop exercises. In subsequent units, where the complexity of the concepts is higher, the activities focus on simulations. Thus, the learner can freely experiment with the concepts.

### 3.2. The Information Level

The information level of FOTO describes the concepts of object oriented modeling in more detail than the introductory level. The language is more technical and neutral.

The learning units do not impose a particular sequence on the learner. Learners who already have some knowledge of object oriented concepts can browse the learning units of the information level freely.

Diagrams are used to visualize concepts. The Unified Modeling Language (UML) has been used to design these diagrams. Thus, students learn also some basics of UML.

This level has less learning activities than other levels. For advanced concepts, such as interdependencies between structural and behavioral aspects of models, simulations are used. In some of the simulations, the learner can alter the structure of a model, and observe the changes in its behavior.

### 3.3. The Exercise Level

The exercise level of FOTO consists of multiple choice questions. Learners can use this level to consolidate their knowledge about object oriented concepts. The computer generates feedback for the exercises. The feedback includes hints, telling which unit of the tutorial needs to be revisited by the learner.

The tutorial also provides a case study, which can be downloaded and solved using pencil and paper. In the case study, the learner is required to analyze and to draw object models by herself.

## 4. INDIVIDUALIZING THE LEARNING ACTIVITIES

In section 2 we listed four different aspects of individualization. All these aspects are supported by the flexible online tutorial.

### Presentation of Learning Content

Different learning types need different forms of representation of learning content. The introductory and the information level offer learning content presented in different abstraction levels. Also the exercise level offers such content. Therefore, students have a (limited) choice in the way the learning content is presented. Especially, students can individually choose to study the same content in different forms to better support their own learning.

### Learning Path

Students can browse learning units at will through the tutorial. They can change the sequence of units, they can repeat units, and they can choose the way a unit is presented by choosing the level. Therefore, students can flexibly compose their preferred learning path.

### Activities

The tutorial contains many interactive parts. The interaction is individually between students and the system. The activities also comprise the use of complex simulations to understand the underlying concepts. They allow students to manipulate the described system in different ways to observe and study the effects of those manipulations. Students can work as long as necessary with the simulations and try out individual ideas.

### Additional Information

Interested students can work through additional units, try out additional simulations, and test themselves with additional exercises. These activities are especially important to support better students.

## 5. REQUIREMENTS FOR THE IMPLEMENTATION OF THE CONCEPT

The didactic concept in section 2 can only be implemented if certain conditions are fulfilled. These comprise requirements related to the learning content and the learning management system.

The *learning content* can be divided into small chapters that are presented within learning units. If those units are too large, the individualization of the learning path cannot be optimally supported. The learning content can be divided into two groups: mandatory and optional content. Mandatory learning content will be presented on the introductory level as well as on the other levels. Optional learning content will be presented on the information level and possibly the exercise level, only. This allows for the support of better students who individually want to receive more information.

The students profit very well from a tutorial if it is used in a blended learning situation, where a complex case is discussed after the e-learning sessions to enable the transfer of the new knowledge to situations out of the context of the online tutorial.

Developing an online tutorial is expensive. When we designed FOTO, we wanted to ensure, that it runs on a number of *learning management systems*. Also, teachers should be able to adapt and extend it, even when they do not have access to the same authoring tools, which we used to create FOTO.

SCORM 1.2 supports this to some extent. SCORM is a relatively young standard for learning content and learning management systems [5]. One of the problems of SCORM 1.2 is its limited support for navigational elements. SCORM only supports the organization of learning content in form of trees. Therefore, the didactic concept presented in section 2 cannot be realized with SCORM as it requires learning content to be linked in multiple ways.

To overcome this problem, we have realized a lightweight learning management system named TinyLMS [6]. TinyLMS can be used as a thin layer between SCORM compliant learning content and learning management systems. It adds the additional navigation elements required for switching between levels and learning units. TinyLMS is compatible with any SCORM compliant learning management system; it requires only an authoring tool that can divide learning content up into small reusable units. In SCORM these units are referred to as sharable content objects (SCO).

## 6. CONCLUSIONS

In this paper a didactic concept for flexible online tutorials is presented. It supports different forms of individualization. A tutorial introducing the basics of object oriented modeling has been implemented based on this didactic concept. The students using this tutorial have heterogeneous previous knowledge. The content of the tutorial is relevant but also complex. To optimize the learning process, it was important to offer students a possibility to individualize their learning activities. First experiences with students have shown that the presented didactic concept and our implementation allow for this individualization.

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