

Learning Content Production: A Pragmatic Approach

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Abstract: This paper offers a pragmatic approach to the production of learning content. A production-cycle for learning content consists of four activities: acquisition, structuring, representation, and management. Based on our experience in a postgraduate educational program, employing web-based courseware, we describe the challenges of and indicate solution strategies for each of these activities. Based on the generalized language XML, the development of a *dynamic* Learning Content Management System (dLCMS). The dLCMS employs a set of so-called learning objects is described. Learning objects are reusable components that can be combined in different ways to produce new courseware. Drawing on domain-specific knowledge and employing the dLCMS, we explore ways to integrate such learning objects into efficient and user-friendly educational multimedia.

Introduction

In the context of a distance-learning project called VIL (**VI**rtual **L**earning-**E**nvironment), we analyze and suggest strategies for the acquisition, structuring, representation, and management of learning content. The analyses and strategies suggested are based on our experience in defining and realizing the VIL project. The project puts to work a web-based courseware for a postgraduate educational program in Occupational Health and is a complement to classroom teaching and on-the-job training. Presently, 25-30 students visit the postgraduate course. The whole course is divided into a total of 36 modules; one module last between two and three days and covers one topic. A topic can for example be physical basics or workplace design. In average, the students see two different teachers a day. The whole postgraduate course last two years and ends with an oral examination and an individual written work.

The aim of the VIL project is: i) easy access to learning material for academic professionals from different geo-cultural parts of Switzerland (the end-users), ii) high content attainability of basic and problem-orientated knowledge, iii) flexible support of different learning strategies, iv) careful integration of a CSCW groupware for collaborative learning, Tele-Tutoring and communication between students, and v) consistent quality assessment of the distance education. Whereas we study an application for a postgraduate distance-learning program, we believe that the strategies offered in this paper have general applicability to the production of learning content.

In the VIL project, we first examined alternative ways for rapid low-cost production of new courseware and found an answer in the so-called learning objects [1] [2]. They are defined as any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning [1]. To benefits promised by the use of learning objects are: *flexibility, ease of updates, searches, content management, customization, interoperability, facilitation of competency-based learning, and increased value of content* [2]. To assure a sub-set of these benefits, such as flexibility and content management, we chose not to use a standard authoring tool. Instead, we decided to develop a proprietary *dynamic* Learning Content Management System (dLCMS), introduced towards the end of this paper.

In this paper, only one part of the realization of a web-based course is presented, namely the production of learning content. Other elements in the realization of the web-based courseware which are not discussed here are: the integration of courseware into the existing postgraduate course, the development of didactical concepts to serve specific needs, the development of a learning platform, and quality control.

The body of this paper offers a four-step production-cycle ordered by the four activities of content production. For each of these activities - acquisition, structuring, representation, and management - we describe prevalent challenges and suggest solution strategies. For the first two activities - acquisition and structuring - our work is in a more mature state than for the third activity - representation. For the fourth activity - management - our work is mainly oriented towards the practical realization of a dLMS. As our work is still an ongoing process, there is presently a shared focus on representation and management. Hence we are still not able to draw a clear line between these two activities.

Step 1: Acquisition

The postgraduate distance learning program is interdisciplinary and draws on teachers from professions such as medicine, psychology, economics, social and natural sciences, who lecture in German, French, and English language. According to their individual teaching style, they employ material reaching from paper-copies to PowerPoint presentations. In this step, a painstaking challenge was to acquire appropriate learning material from each individual teacher [3]. Based on our experience distilled the following strategy (see also Fig. 1):

1. Collect learning material by carefully instructing the teacher through the following questions: i) "What do you view as important for the students?" ii) "Which is the scope of your topic?" and iii) "To what situations does your topic apply?".
2. Roughly order the collected learning material.
3. Let the teacher review the ordered material and remove irrelevant or redundant parts. This is a collaborative process where external advice from supervisors, students, and peer teachers may be of use.
4. Categorize the learning material according to the mediation of the knowledge concerned. One category is basic knowledge the other problem-specific real world.

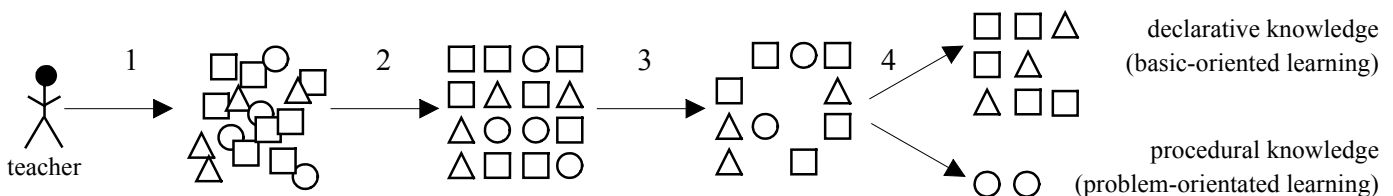


Fig. 1: The acquisition of learning content for one topic follows this strategy: 1) collect learning material, 2) give rough order, 3) carry out an extensive review and remove unnecessary parts, and 4) categorize according to the type of knowledge.

Step 2: Structuring

Our web-based courseware offers two inroads to the learning material: The first mediates basic knowledge and leads students through the courseware in a linear fashion; the second is partly based on the first one and additionally mediates problem-specific real-world knowledge. At the present stage, we limit our focus to the first, leaving the second to future work. Starting out with a pool of roughly structured, validated scripts, we aim for an optimized overall structure. We typically draw a subset of scripts (e.g. 2-5) from a pool of scripts (e.g. 10-20) and sequentially break down the subset into chapters suiting more or less all the topics in the pool. We summarize our practice in the following strategy. Fig. 2 gives an example where this strategy is applied to a subset of three scripts.

1. Divide the scripts into smaller chunks.
2. Redefine chapter classifications to suite the chunks of all scripts.
3. Choose an optimal overall form by assigning chunks into chapters and restructuring the whole scripts separate for each topic.
4. Call in the teachers to review the scripts, aiming to uphold or boost the quality and consistency of the scripts and decide which subtopics can be learning objects.

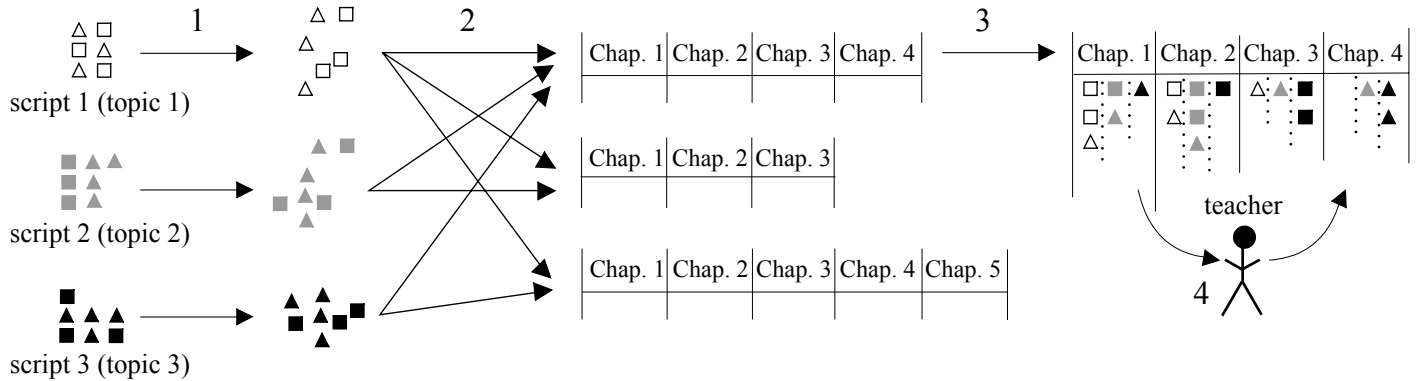


Fig. 2: Structuring a subset of scripts, here three, following this strategy: 1) divide into smaller chunks, 2) define new classifications, 3) choose a suitable form by reordering chunks and restructuring the whole script, and 4) carry out a review process, assuring that quality and consistency is upheld or boosted.

Step 3: Representation

In the third step, we choose an appropriate representation for the learning content, aiming to harvest the full potential of computer-mediated learning. Thereby, we first have to examine which combination of educational multimedia (e.g. text with graphics, text with video, audio with interactive tools, etc.) is an appropriate match for sub-topics of a given learning topic, secondly present the chosen multimedia combinations within the learning environment. As standard authoring tools provide *static* courseware, there is always one sequence of use and well-defined choices among different media and formats. However, they provide no *dynamic* features to support various learning styles. Therefore, instead of employing a standard authoring tool, we suggest the following strategy:

1. Consult a specialist in Human-Computer Interaction (HCI) to clarify which multimedia is best suited for the topic.
2. Develop a standard giving optimal results for the specific learning content in Computer-Based Training [4].
3. Realize prototypical courseware containing structured and well-represented learning material. This may give indications on usability challenges and may help to develop future courseware components like sketching, interaction, navigation, and CSCW tools.

Step 4: Management

Trans-disciplinarily educational programs have the ingrained nature of parallel and related topics, making collections of topics inherently redundant. That is, one topic may occur in several chapters. In standard authoring tools, the learning content and the environment are statically connected. Hence, for each topic, every subtopic has to be produced anew. In order to gain flexibility through the use of web-based courseware, it is essential to separate the learning environment from the learning content. Thus, several learning objects may be reused in different topics. A learning object can be a single text module or a complex multimedia lesson. However, it is important that modules are self-contained. Hence, learning objects must be modular in design, making it easy to compile new courses through the reuse of established material. To manage and easily access multiple learning objects, we currently develop a *dynamic* Learning Content Management System (dLCMS). In our effort to assure high quality and usability, the development of our dLCMS is governed by the following strategy:

1. Divide learning content into smaller modules, giving the learning objects.
2. Define an XML-based data format for the learning objects, using a so-called *content editor*.
3. Compile the learning objects into a complete web-based courseware, using a so-called *curriculum editor*.

Summary and Outlook

The reported practice of learning content production - acquisition, structuring, representation, and management - shows how we analyze problems and establish solution strategies. Some of the strategies are in a more mature state whereas others are still in progress. The underlying activity of the VIL project, the realization of a *dynamic* Learning Content Management System (dLCMS), is a significant challenge. Thereby, we intend to report on the architecture of the dLCMS, the *content editor*, and the *curriculum editor*. The design and development of dLCMS's may entail a paradigm shift in the design and use of educational courseware. Also, the reuse of learning objects will take on new importance in the production of learning content. Finally, our experience indicates that the reuse of learning objects calls for a revision of how to instruct the teachers in their preparation and delivery of learning material.

To advance the research reported on in this paper, we are currently looking for groups sharing our interest in the practice of knowledge transfer and the realization of high-quality courseware.

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