Learning Content Production: Acquisition, Structuring, Representation, and Management (paper)

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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 show the challenges of and indicate solution strategies for each of these activities. Based on the generalized language XML, the underlying activity of the project is the development of a *dynamic* Learning Content Management System (dLCMS). The dLCMS employs a set of so-called learning objects. 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, 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. 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 have general applicability to the production of learning content.

In the VIL project, we examined alternative ways for rapid low-cost production of new courseware and found an answer in the so-called learning objects [1]. These are reusable components that can be recombined in multiple ways to produce new courseware. To benefit from the full potential of learning objects, such as *reusability*, *component categorization*, and *high levels of interactivity*, we chose not to use a standard authoring tool. Instead, we decided to develop a proprietary *dynamic* Learning Content Management System (dLCMS). For each of the activities in content production – acquisition, structuring, representation, and management – we next 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 dLCMS. As our process is still an ongoing one, with a shared focus on representation and on management, we are still not able to draw a clear line between these two activities. The body of this paper offers a four-step production-cycle ordered by the activities of content production.

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, lecturing in German, French, and English language. According to their individual teaching style, they employ material reaching from paper-copies to PowerPoint presentations. In a first step, the challenge was to acquire appropriate learning material from each individual teacher [2]. Hence, we suggest 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 type of knowledge concerned (declarative and procedural) [3].

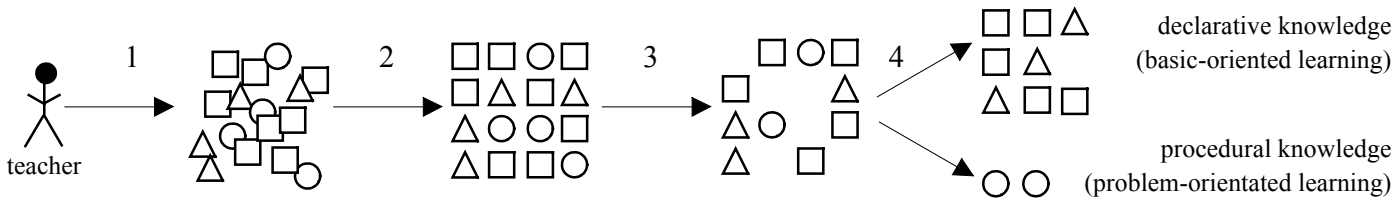

Fig. 1: The acquisition of learning content for one topic follows this strategy: 1) collect learning material, 2) give rough order, 3) carry out an extensive review and remove unnecessary parts, and 4) categorize according to the type of knowledge.

Step 2: Structuring

The 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.

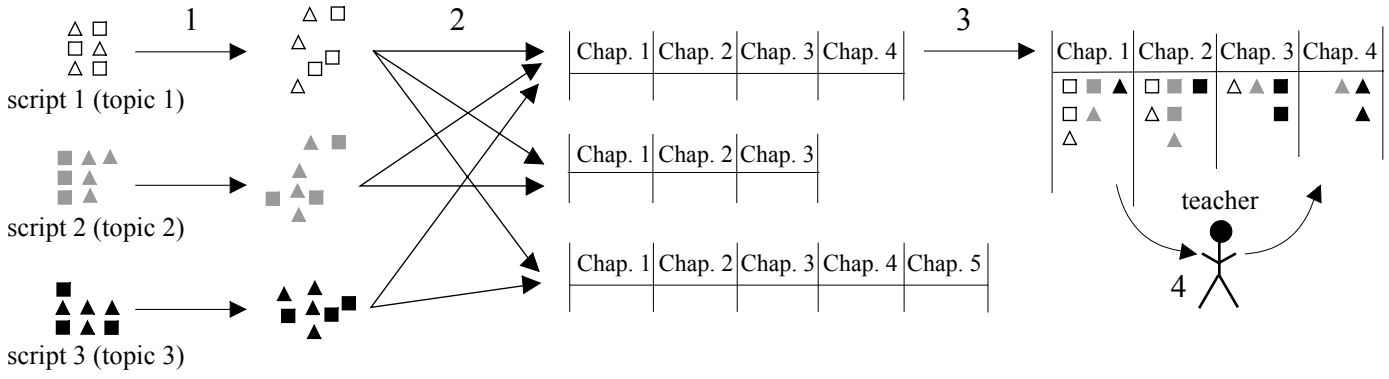

Fig. 2: Structuring a subset of scripts, here three, following this strategy: 1) divide into smaller chunks, 2) define new classifications, 3) choose a suitable form by reordering chunks and restructuring the whole script, and 4) carry out a review process, assuring that quality and consistency is upheld 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 web-based learning. Thereby, we firstly 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 didactics to clarify which multimedia combination is more suited for the given 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 subtopic may occur in several main topics. In standard authoring tools, learning content and 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. These learning objects are 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, our development 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*.

Discussion and Outlook

The reported practice of learning content production – acquisition, structuring, representation, and management – shows how we analyze and establish strategies. Some of the strategies are in a 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 the dLCMS will 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. Moreover, 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 support research, we are currently looking for groups sharing our interest in knowledge transfer and the realization of high quality courseware.

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