Development of electronic training materials at the Institute for Computer Science and Control, Hungarian Academy of Sciences

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ABSTRACT
The eLearning Department of the Institute for Computer Science and Control, Hungarian Academy of Sciences (MTA SZTAKI) has become a key player of the domestic eLearning market in recent years profiting from its multimedia technology experience in different areas of eLearning, including research, expertise, product and content development. The present document summarises the guidelines of the preparation of electronic educational curricula in accordance with the practice performed at the eLearning Department of MTA SZTAKI. We describe in details the preparation of the scripts facilitating the production of training materials. All major steps comprising these procedures are based on widely accepted international standards of eLearning.

Keywords
eLearning, content development, scripts

1. INTRODUCTION
Besides deploying eLearning systems, the staff of eLearning Department of MTA SZTAKI creates specific and generic training materials very efficiently meeting the satisfaction of the clients, due to the experience collected in the course of development projects. Our colleagues have gained their experience in the development of several thousands of multimedia elements. Target products are developed in harmonised teamwork and the results are always standardised training material packages, their local installations and configurations. All training materials comply with the international standard SCORM and consequently, all licensed and open source standard Learning Management Systems (LMSs) available on the market such as SAP, Oracle, ILIAS, IBM, Moodle can load and display them. Based on our content development experience, we perform lectures as well about the methodology of the creation of training materials.

The aim of this paper is to introduce the major steps of our systematic approach that guides the development of eLearning curricula based on the experiences of MTA SZTAKI. We have put a special emphasis on scripts during this process. The script plays a central role in the content development because it weaves the individual basic elements into a unified structure. Except for the concrete content it includes all the information (parameters, descriptions, drafts), which refers to the curriculum elements, and on the basis of which the eLearning teaching material may be organised into a conveyable form.

First, the paper introduces the process of the script preparation performed by the authors of the training material. These scripts compose the basis for the further implementation of the training material. Then, we describe the steps of the eLearning content development and indicate the practice applied at MTA SZTAKI, as well. We briefly introduce some projects where we used our eLearning experiences. We conclude the paper with a short summary.

2. SCRIPT PREPARATION
2.1. The content of the script
The content- and form-related script of the curriculum contains the following information:

- the exact table of contents,
- the ways the content is organised within the structure,
- the screen plans and descriptions belonging to the individual lessons,
- the description of the didactic elements used (images, graphs, illustrations, animations etc.),
- the detailed description of the desired interactions,
- tests, their keys (evaluation algorithms), and their relation to the curriculum.

The following parts may be included in the individual planned lessons of the curriculum:

- a brief overview of the given lesson,
- instructions and suggestions that facilitate the learning process,
- textual, theoretical parts,
- readings, notes, which include extra information pertaining to the lesson,
- multimedia elements,
    - images,
    - illustrations,
    - video recordings,
    - audio recordings,
    - other
- questions, exercises, tests,
- brief summary.

2.2. The procedure of curriculum development
During the preparation of electronic curricula a series of factors emerge which are not present in the procedure of preparing simple textual documents. Electronic curricula can include multimedia elements (voice over text, animation,

simulation exercises, etc.) which are difficult to describe in writing.

At the same time, however, electronic curricula are often produced by professionals who are not familiar with the actual content of the curricula. That is the reason why the content provider conveys the information of what should actually be included in the curriculum, which is to the curriculum developer definitely a problematic issue.

MTA SZTAKI's practice has been for quite some time now that the preparation of electronic curricula is carried out according to the following quality assurance steps:

1. As a first step, the curriculum developers demonstrate to the content providers the possibilities which may be made use of in the curriculum. This is necessary in order to create a common language and provide an overview of the range of possibilities.

2. As a second step, the so called script of the curriculum is jointly prepared. This document will be the basis for the preparation of the curriculum. The main characteristic of the script is unambiguity, therefore it must enable the curriculum developer to know exactly what and where will appear in the curriculum.

3. As a third step, the script is proof-read, both in terms of its content (professional reader) and its language appropriateness (language reader). It is important that the script be so exact as early as at this stage as to allow the readers to perfectly understand what and how will be included in the curriculum to be. The modifications of the readers are either accepted or rejected by the approving reader.

4. As a fourth step, the source materials are prepared. These include:
    a. written texts,
    b. images,
    c. studio audio recordings,
    d. videos, animations.

    Ideally, the source materials are prepared by the content provider – script writer – her/himself, or s/he at least supervises their production. That in fact helps the work of the readers greatly and there is a smaller probability of errors that are more likely to arise during the curriculum development.

5. As a fifth step, the curriculum development is carried out.

6. Finally, the complete electronic teaching material is again read and tested, to check to what extent it corresponds to the script.

As may be seen from the above procedure, the key of curriculum development is the script. The script must be very exact, as for example a narrator often has no (or not sufficient) idea what the texts s/he is reading means. Therefore s/he will be unable to rectify or complement possible inaccuracies or insufficiencies.

The present document provides help for the completion of the above procedure, and for the preparation of the key element in the procedure, the script.

2.3. Unambiguity

As we have seen in the first, introductory part of this document, the most important feature of any script is that it should be unambiguous. That is why there cannot be open questions left in it, such as: „do it this way or perhaps that way...", or „I don't know how this could be demonstrated ...", etc.

Unambiguity is also required from the readers. The reader should correct the document with the help of Word's track changes method, but in such a way that the approving reader may use the acceptance or the rejection options only, therefore comments like „I think the word ... would be better" should be avoided. Instead, the reader should explicitly state what her/his suggestion is. This speeds up work, too.

Unambiguity is further enhanced if the script is prepared according to the principles laid down in the present document. That is the script uses the terminology, templates and designations described in the present document.

Curricula should be structured according to the units determined by e-learning standards. The recommended structure of e-learning curricula is the following:

- Core material,
- Illustrational material (sound, image, moving image etc.),
- Supplementary material – teacher's notes, appendices etc.
- Assessment and evaluation material.

The fundamental, non-decomposable content components are the elements. An element is for example a definition, a formula, or an image or chart attached as an illustration.

The types of elements are the following:

- textual elements: generically speaking, the flowing text that forms the foundation of the material (theoretical, practical, revising and summarising contents)
- multimedia elements: generically speaking, images, sounds and simulation elements that illustrate or demonstrate the flowing text forming the basis of the material.
    - illustration,
    - audio element,
    - interactive element,
    - animation element,
    - simulation,
    - motion picture.
- assessment elements:
    - single choice,
    - multiple choice,
    - matching,
    - gap-fill (essay-type),
    - specific.
- teacher's note elements: collective pages supplementing the core material (e.g. dictionary, glossary etc.)

3. ELEARNING CONTENT DEVELOPMENT

The process of content preparation can be roughly divided into the following phases:

1. Course concept and script preparation;
2. Course interface functional design;

3. Media asset and interactivity preparation;
4. Course production and testing.

3.1. Course concept and script preparation

The concept specifies the topic of the course, the aims, the skills to be developed, the target group, the pedagogical approaches, etc. The platform (web and/or mobile) is also defined during this phase. The script preparation was discussed in details in the preceding section.

3.2. Course interface functional design

This component is well elaborated for the web platform but it is a real challenge if novel tools (e.g. digital TV or smart glasses with embedded microcomputer) are applied to display the content.

The layout of the course interface is also designed. Logos, background and other interface items specific to the customer are selected. Style sheets are prepared for the pages of the training material.

3.3. Media asset and interactivity preparation

The media asset and interactivity preparation often needs large amount of time. The pictures, audios and videos should be adapted to the target layout and coded according to capabilities of the student display devices by using multimedia editing tools.

If the content developer chooses to prepare the audio/video stream by himself, first he will need high quality video and audio recording equipment.

Spoken Text
The speaker is commonly a professional lecturer with a special voice with speech training. The spoken text should be preferably recorded in a professional audio studio.

Audio Recording, microphone types
Proper microphone placement is very important in obtaining good sound quality. No amount of post processing is going to rescue a poorly recorded audio. In auditoriums, we use Wireless (Radio) microphone. This device allows for the free movement of the speaker. However, speaker movements induce a strong fading signal for this microphone.

Video camera
For recording video a high quality 3CCD semi-professional or professional camera is recommended. For general use a tripod is strongly recommended. Once a video is recorded on a proper media (e.g. a Mini DV cassette), it needs to be imported to a computer for editing. Standard nonlinear video editing suites are appropriate to edit the video.

Animations
Preparing a high-quality animation is a time-consuming task and usually requires programming knowledge as well. We use Adobe Flash for preparing animation which ensures platform-independent playback.

3.4. Course production and testing

During the eLearning course production process all prepared media assets, texts and interactions are integrated to make up the complete course. The appropriate Content and Learning Management System (CMS/LMS) is selected where the content is stored. The content production includes creating evaluation tests, glossaries and helps as well. All of our training materials comply with the SCORM international standard and consequently, all the licensed and open source standard Learning Management Systems (LMSs) available on the market (such as SAP, Oracle, ILIAS, IBM, Moodle) can load and display them.

We put a great emphasis on the quality assurance (QA) of the final training materials, as well. We developed an appropriate QA module for the ILIAS open-source LMS, including the integrated evaluation of the training materials within the LMS. It can store the answers to the quality related questions simultaneously when the training material pages displayed on the screen. Furthermore, it offers an opportunity to display statistically the results in the LMS(s).

After the production and testing, the training material can be uploaded to the LMS which can be located at the customer's own site.

MTA SZTAKI has experience in preparing video-based eLearning materials as well. We prepared SZTAKI SSS® Technology (Synchron Slide and Stream) 2.0 - application for archiving presentations and conference materials, capable of displaying videos and presentations in a synchronous manner.

4. ELEARNING PROJECTS

Our clients include ministries, state institutions, banks, insurance companies, academic institutions and educational centres. The e-Learning department has been engaged with many domestic and EC-funded research projects. In this section we summarise the specific features of some selected projects.

4.1. Free-horizon image displaying device with embedded computer (FHVD)

This project is supported by a National Programme [1]. The PC glasses contain the computer in a case with a sunshield form which does not obstruct the view. There is a simplified user interface on its upper shield with four buttons for paging, searching and switching between books, films and files stored in the memory. The display units located below the eye-level present a distant and large-size virtual image in the bottom part of the field of vision. The image can be viewed by glancing downwards at a comfortable reading angle; therefore, the horizontal view has no obstacle. If a full keyboard is needed, the PC-glasses can be controlled by using the touchscreen keyboard of our own smart phone through a Bluetooth connection. Besides contents in its own memory, the PC-glasses can virtually present also the image on the display of our smart phone through a wireless connection. Therefore, we can watch various Internet contents (e-mails, news, YouTube videos, books, Wikipedia, films etc.) at a viewing angle similar to the one at the large screens of the desktop monitors instead of the tiny displays of the mobile phones.

MTA SZTAKI's main role has been developing training materials for video glasses with embedded computer. We also work on programming the control of the video display glasses using an embedded microcomputer. Our HTML5-based "Multiplatform (Web and mobile) English training material for beginners" was granted with the special award of the most innovative solution on the competition of the Excellent Hungarian Content eFestival 2012.

4.2. Innovative e-Learning Tool for Quality Training Material in VET (iQTool)

This is a result of a completed Leonardo project [2]. MTA SZTAKI's role has been open-source tool development for quality assurance. The aim of the Innovative eLearning Tool for Quality Training Material in VET (IQTool) project was to develop an open source software tool integrated in LMS(s). This tool is suitable to assess the teaching quality management of eLearning training programs and training materials for supporting the application of the quality measurement tool for institutions dealing with vocational training and which therefore can promote the establishment and development of quality culture.

The project implementation included testing of software and pilot training of the training material as well. Thus the elaborated eLearning quality tool can be applied at European level and enables the teaching of quality management. Also, the project aimed to provide the management and quality assurance of vocational training with an effective tool.

The advantage of the integration of the evaluation system and LMS is that it can store the answers related to the quality simultaneously when the training material pages are displayed on the screen. Furthermore, it offers for developers and teachers an opportunity to display statistically the results in the LMS(s) which helps to evaluate them.

The innovative content means development an up-to-date and interactive eLearning tool which helps the quality assurance of eLearning training materials development in vocational training institutions can be carried out.

4.3. eLearning Unlimited (ELU)

This reference is a completed FP6 project. The aim of the project was to develop eLearning materials for digital TV platform. MTA SZTAKI conducted user research, participated in training material development in the topic of elementary probability theory and performed pilot testing with a secondary school and conducted assessment.

4.4. Calibrating eLearning in Schools (CALIBRATE)

This project has been completed within the framework of the FP6 programme [3]. The aim of the project was collaborative use and exchange of learning objects/resources in schools. CALIBRATE brought together eight Ministries of Education, (including six MoEs from new member states), leading research institutions, validation experts, technology providers and SMEs to carry out a multi-level project designed to support the collaborative use and exchange of learning objects/resources in schools. The CALIBRATE Learning Resource Exchange (based on an advanced Brokerage System architecture) developed in the project aimed to provide a strategic level of integration at an infrastructure level that can act as a catalyst for the development of learning content repositories particularly in some new member states where the development of national repositories is still at an early stage.

5. CONCLUSIONS

In this paper we provided a brief overview on the eLearning training material development process based on the experiences of the eLearning Department of MTA SZTAKI. We demonstrated that the use of well-prepared scripts can facilitate the training material development as well as greatly reduce the development time and costs.

Creating standard training materials makes it possible to use the same content package from different LMSs. Besides the desktop computers, there exists a need to display the training materials on other platforms (smart phones, tablets, PC glasses, digital TV) and this need is covered in our training material projects as well.

Video based training materials have an increasing representation among the training materials. Therefore, we developed a technology for synchronised playback of the video stream of the presentation and the slides (SSS).

For more information please contact the colleagues of the eLearning department [4].

REFERENCES

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