MASSIVE DEVELOPMENT OF ONLINE LEARNING MATERIALS

T. Zeman[1]
Czech Technical University in Prague
Praha, Czech Republic
ORCID 0000-0002-2953-4925

J. Hrad
Czech Technical University in Prague
Praha, Czech Republic
ORCID 0000-0002-4026-0080

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ABSTRACT

We participated in collaborative development of more than six hundred comprehensive online teaching materials for higher professional schools in the Czech Republic. The paper focuses on explaining the procedures and methods that we used to make the development process as efficient as possible, which was necessary with respect to the quantity of the materials and the limited time. Managing the logistics was the key, as several hundred people took part in the project. We are also describing, from the edagogical point of view, the OER structure, its division into educational blocks, and types of educational objects.

[1] *Corresponding Author*
T. Zeman
zeman@fel.cvut.cz

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1 INTRODUCTION

1.1 The Project in a Nutshell

Our department had the opportunity to collaborate on three major nationwide projects that focused on innovation in higher professional education. Within this project, we were in charge of the complete provision of the technical and logistical background for the development of so-called Open Educational Resources (hereinafter referred to as OER). The assignment was – in addition to ensuring high professional quality, which was based on the selection of authors and other creative staff – to guarantee smooth progress of this demanding operation (orchestrating the work of more than 600 people to develop more than 600 OERs) as well as high quality of the ouputs (in terms of graphics, form and structure). It is also very important that all ideas, guidelines and recommendations for the authors (as well as for other creative) staff had to be available before the start of their work; that is, at a very early stage of the project, when it was not yet possible to imagine all the situations that might arise. The completed OER set is available in the library [1].

1.2 Context and Motivation

The project activities builds on our long-term (since the 1990s) efforts in the field of modern teaching methods, modern education and innovative work in the field of pedagogy and didactics.

As for the high-volume development of teaching materials, their largest numbers can be observed in relation to various MOOC platforms, such as edX, Coursera, FutureLearn and many others. However, such teaching materials are comprehensive courses, while the discussed project aims to create supplementary teaching materials, usually for blended learning. What they have in common with the courses provided on the MOOC platform is their openness, i.e. unlimited free access, as the licenses from the Creative Commons family apply to the newly developed OERs.

Large-scale production of online materials is more common in the commercial environment, often without the possibility of general access to the outputs. In this sense, our open-source project is unique in a way.

The motivation for the preparation of a large number of teaching materials was the idea of creating a universal environment (bookstore) that would accommodate a large amount of them, will therefore be frequently visited, which will put further pressure to expand the number available of teaching materials. At the same time, our major advantage was the massive financial injection for the creation of the basic set of learning packages.

2 PEDAGOGICAL POINT OF VIEW

Having the intention to create a huge library of teaching materials, we needed to prepare a solid pedagogical and didactic concept of the individual OERs and the library as a whole. This concept is based on defined sets of mandatory and optional elements, which are available to authors and other creative workers, and which can/must be (according to the given rules) integrated into larger units.

2.1 Structure

The highest-level hierarchical element is the storage organized in a clear way as an electronic bookstore. There we can find the individual topics (inaccurately: “books”) which, after clicking on their “envelope”, offer basic metadata about the topic, namely: title, list of authors, annotation, license, year of origin, price, language, methodology for use, and feedback (rating, errata reporting). It is then possible to open a page with further details about the OER, such as objectives, keywords, required level of study effort, references and recommended resources.

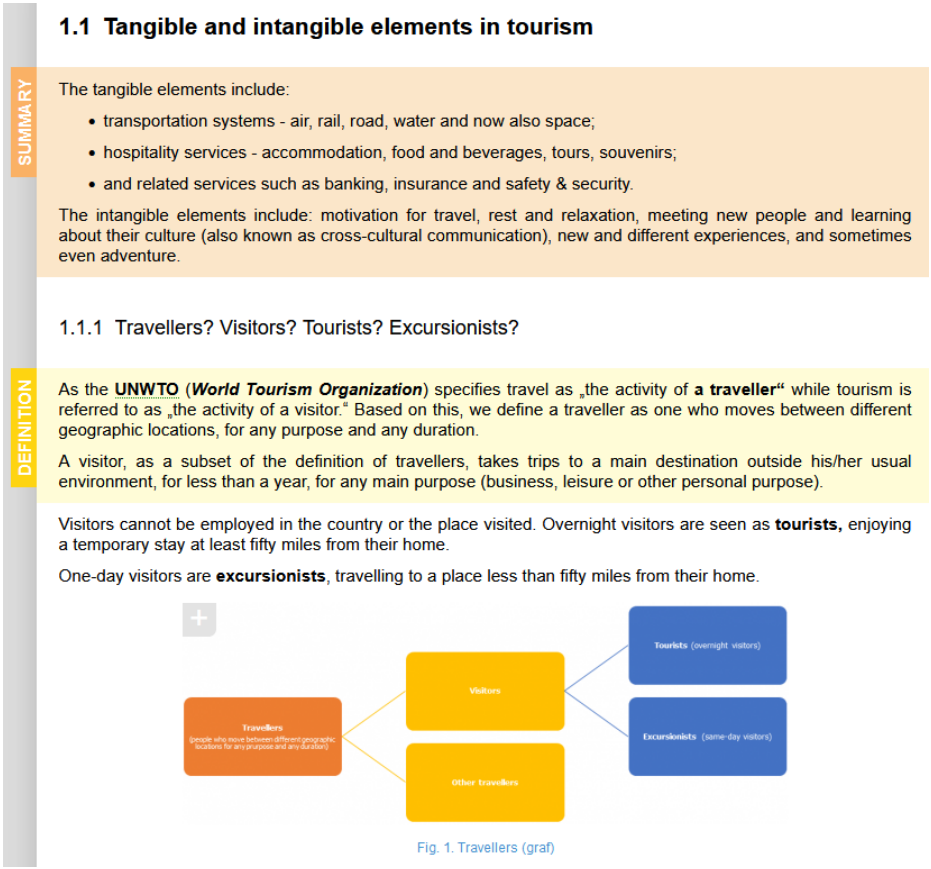

Fig. 1. Educational blocks

Subsequently, it is possible to explore the actual educational content. We have defined the following standard educational parts (functional blocks):

1) *Basic text* – not marked in any special way; used for common learning content.
2) *Definition* – serves to clearly separate definitions of basic terms.
3) *Note* – educational block suitable for providing additional explanations.
4) *Example* – in this block it is appropriate to enter the assignment of solved and unsolved examples or tasks (e.g. calculations) or questions.
5) *Solution of an example* – a special block where the solution of a task or example according to the previous point can be stated; the special nature of this block consists in the fact that it is hidden by default, and revealed only after clicking on it (which displays the correct solution of the task or example).
6) *Advantages* – simply to highlight advantages of what is described in the text.

7) The block of *disadvantages* is defined in a similar way.
8) *Summary* – suitable for placement at the end of a section (chapter), where it can summarize the most important findings.
9) *Interesting* – additional facts, trivia or even jokes can be contained there.

The educational blocks are highlighted in color in the final version of the teaching material, thus helping to make the content clearer, as can be seen from Fig 1.

2.2 Educational Objects

The educational objects belong – similarly as educational blocks – to the basic parts of the OER structure. They can be used, in principle, in any part of an OER, either within the *Basic text* educational block (most often) or within other types of blocks. We defined the following basic learning objects:

1) *Text, equations, formulas* – common content of a "book" publication. From a formal point of view, it is necessary to follow the set format, specifically the consistent use of styles. This will help to seamlessly convert the learning material into HTML (a format that is optimal for displaying on the Internet); it also makes the learning material significantly clearer and unifies the form of different learning materials by different authors, which means significant added value for students.
2) *Figures, tables, graphs* – again it is a common "book" format, which is suitably transformed into HTML. Even in this case, it is mandatory to use a unified format so that the results are formally and graphically identical in all OERs.
3) *Videos, animations, sounds* – effective inclusion of multimedia elements is only possible with electronic materials, so this is an added value of online courses. Multimedia elements are one of the essential attributes that distinguish "book" publications from e-learning teaching materials. For technical reasons (storage reliability, bitrate), the multimedia elements are stored on the YouTube platform. In the teaching materials, the authors can use either their own multimedia elements, or elements by other authors (typically videos) placed online. In such a case, however, OER would often not be able to have a free Creative Commons license; therefore, such elements have a warning notice and the element used (video, image, etc.) is not a part of the material – only a link is available.
4) *Tests* – it is appropriate to include a comprehensive part of the explanation at the end. Both *1 of n* and *m of n* types of tests are available. It is possible to assign an explanatory or additional comment (feedback) to each answer (whether it is correct or not). The evaluation of the correctness of the answers typically takes place at the moment chosen by the user (student).
5) *Interactive elements* – we consider them to be one of the most important parts of OER. These are various interactive tasks that can only be included in electronic learning materials. There are 13 template-based types of interactive elements (online tasks such as text with drag and drop / delete / delete words, matching, sorting, grouping, flashcards, crossword puzzles, interactive videos); examples in the Czech language are available in [2]. It is also possible to create tailored ones, which is, of course, demanding and expensive. See an example in Fig. 2.

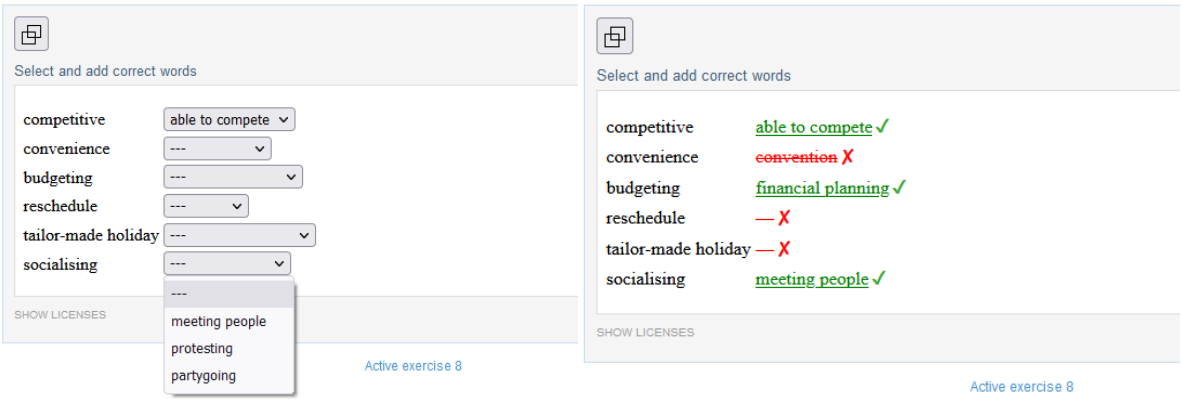

Fig. 2. Example of an interactive element in the text (the first image shows an assignment; the second one shows a solved and evaluated task)

The use of a variety of learning objects in an OER will ensure that the material is varied, interesting and readable – from a pedagogical point of view, there is nothing worse than boring textbooks that contain only long paragraphs of text; and from the point of view of modern teaching resources located in the virtual world, there is nothing worse than teaching materials without interactivity.

2.3 Variety of Topics

Thematically, the individual OERs touch a number of fields, divided by the following professional areas: Technical, Agricultural, Economic, Medical, Pedagogical, and Social.

3 LOGISTIC SCHEME

The OER library currently contains 662 teaching materials. More than 600 people from various parts of the Czech Republic took part in their development. The production process of each OER involved over 15 major steps (including corrections and reviews). It was necessary to guarantee the high quality of individual OERs and the purity of the content from the point of view of copyright (preservation of the Creative Commons licensing model [4]). The related procedures are outlined in [3]; Therefore, we present only the basic ideas here:

1) *Competent worker* – each creative worker underwent basic training (face-to-face or online), had a complete set of supporting online materials and the option of telephone/e-mail support.
2) *Robust workflow* – defined flowchart for creating OERs with 15 essential steps, relative timeline and many feedbacks for outputs quality control.
3) *Sophisticated task manager* – the managementof the development process was supported by a semi-automatic web tool, which monitored the production of the individual OERs step by step (entering and submitting partial tasks), pointed out problems (especially work delays), saved all outputs (including partial ones), monitored and archived time stamps of work and individual actions. To give an idea of the scope: during the three-and-a-half-year project, a total of 666 people registered in the task list and 7231 sub-tasks were assigned.

4 EXPERIENCE FROM PRACTICAL TESTING

The OER library is currently a widely used tool to support teaching at many schools. Although the individual OERs were originally intended for a specific segment of higher professional education, we know that the individual teaching materials are used for both secondary and higher (bachelor and Master) education. Every month, several thousand users visit the library.

4.1 Quantity data

The data obtained from the production server show a relatively strong use of the individual OERs. The server has been in operation since February 2020 when we stored the first OER on it; we had been gradually supplementing other ones until approximately October 2021 when the above-mentioned number of more than 600 OERs was reached. Thus, as of September 2022, the serverhas been in full operation for 12 months.

For technical reasons, out of those more than 600 OERs, 427 are included in the evaluation. A total of 143,913 users (from unique IP addresses) have viewed individual OERs during the monitored period (by July 7, 2022). The highest view count of a single OER was 3792 users, while the average one was 337 users per OER. By sector, the most users (70,205) have viewed medical educational materials; technical and agricultural materials have been viewed by 43,669 users, and economics materials by 30,039 users.

It should be noted that the actual numbers are likely to be even higher, as the production server, including all OERs, has its clone operated by one of the project partners (which is allowed by the licensing policy); however, we do not have their data available.

4.2 Quality data

Each OER allows feedback from students to be passed to its authors via the system administrator. The system also includes the “stars” rating of the OERs. We assumed that approximately one tenth of users would provide their comments, point out possible errors or recommend various improvements or additions. This assumption did not prove realistic: we only have a minimum of data from the electronic feedback channel, namely the “stars” rating. Thus, only 70 OERs were rated by users with an average rating of 3.73 stars (out of 5).

That’s why we decided to expand the feedback tool and explicitly ask the visitors to use it. We believe this will make it possible to obtain relevant data and subsequently increase the quality of the OERs.

Therefore we almost do not have electronic feedback from users; on the contrary, we have enough feedback based on direct contacts of the creative team and teachers who work with the OERs in their classes. This feedback is valuable, but since it is based on personal contacts, its extent is obviously limited.

5 SUMMARY

In the years 2017–2021, a remarkable online educational support was created, which is available on the web as an online bookstore with 662 titles. All of them are available free of charge, exclusively under open CC CC or CC BY-SA licenses.

We gradually started publishing the first teaching materials from this series in February 2020. This date coincided with the beginning of the COVID pandemic in Europe. We were therefore able to offer online teaching materials to secondary and higher education teachers, which they greatly appreciated; there was pressure to complete the materials faster and use them as soon as possible during lock-downs.

Although the project formally ended in 2021, teaching materials are still widely used and the system is still supported, which will be continued in the future. Currently, models of economic sustainability are being sought so that the e-bookstore and its titles can be developed, in addition to simple maintenance.

We also appreciate the success we achieved in the eLearning 2021 competition: the portal for electronic resources vovcr.cz was awarded the 2nd prize.

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