

Eduportfolio: Complex Platform for Curriculum Management and Mapping

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Abstract: A lot of curriculum designers, teachers and faculty managers are involved in a curriculum development at higher education institutions. It is necessary to optimise this complicated process of curriculum optimisation and mapping using modern technologies and tools. Therefore, the EDUportfolio platform, which allows users to comfortably and safely create individual building blocks of the curriculum, is created in accordance with valid international standards. Our paper presents the origin platform from methodological and technical perspective. EDUportfolio offers a content creation module, a content browsing module as well as a reporting module that provides complex overview on created building blocks.

1 INTRODUCTION

The complex use of a wide range of technologies in learning has attracted much attention from researchers and educators in the past decade (Hwang and Wu 2014). Unfortunately, not all innovative approaches for education improvement are really effective and usable in practice. The final impact on students' learning performance is sometimes unclear due to many various factors (i.e. low experience in modern information and communication technologies (ICT), missing enthusiasm, lack of time and human resources, insufficient software and hardware equipment).

Generally speaking, technology-enhanced learning (TEL) describes the application of ICT to teaching and learning processes; TEL is even frequently considered synonymous with equipment and infrastructure (Kirkwood and Price 2014). In terms of curriculum management, TEL plays a very important role in each particular step toward a fully described and mapped education. Curriculum development is the very first and probably the most important step to get a well-balanced curriculum. Adopting a systematic approach for curriculum development represents the only way to build a database which can be subsequently used to make any further minor or major changes and to redesign various study programmes. Data describing a

complete set of mandatory and optional courses should be available in a parametric form, ideally at the same level of granularity and containing a unified terminology. This might seem to be a complicated and almost unachievable issue; with a proper use of ICT, however, this challenge can be readily addressed. It was our motivation behind an effort to design and to implement a robust and modular system which would be helpful in the time-consuming process of courses specification. Moreover, its compliance with proven international technical and methodological standards and recommendations is highly appreciated with regard to future unification, innovation and transformation. It is essential to learn from the past and to follow advantages of existing qualifications framework used globally in the sector of tertiary education.

This paper introduces EDUportfolio, a new online system for easy curriculum development, management and mapping, which makes understanding of various curriculum information produced and guaranteed by responsible teachers clear and simpler. This platform defines various curriculum building blocks including textual attributes, which are fully in compliance with international standards, and provides an effective way to describe individual study programmes, courses and learning units. Using a set of mandatory parameters, each curriculum designer is able to specify his/her lecture or seminar in terms of title, authoring team,

affiliation, annotation, keywords and, most importantly, learning outcomes together with the required assessment form. The user-friendly graphical interface contains several modules for creating, browsing, reporting and exporting a given curriculum. The EDUportfolio platform is designed as a general tool supporting outcome-based as well as module-based education, making it possible to describe any study programme. Design, development and implementation have been coordinated by the Faculty of Medicine of the Masaryk University, where a pilot run of outcome-based curriculum of General Medicine study programme has been successfully carried out.

2 METHODS

From the perspective of each institution of higher education, a comprehensive collection of requirements on its students (often called competencies or learning outcomes) after the end of learning period – typically just before their graduation – is needed. The main emphasis is focused on the final product, i.e. what sort of graduates shall be produced, rather than on the educational process itself (Harden 1999). EDUportfolio supports various kinds of curricula; one of them – an outcome-based paradigm followed by the Bloom's taxonomy as a pilot experience from Masaryk University – is briefly described below. There has been limited discussion on original information technologies supporting outcome-based ideas. There are only a few available and published solutions, which have been developed for making educational outcome-based data accessible to the target group – students and teachers (Komenda, 2015). Based on the comparison of various curriculum management systems (Vaitis *et al.*, 2017), which support the complex delivery and audit of miscellaneous study programmes, a final set of requirements and core features of EDUportfolio were defined. EDUportfolio is a kind of standard compliant system, which covers a complex process of curriculum building, browsing and interactive visualisation.

2.1 Bologna Process

This approach is also in accordance with the European strategy for higher education. One of the major changes was introduced by the Bologna Process, which has created the European Higher

Education Area (EHEA). This comprehensive reform started in 1999, where the Bologna Declaration was signed by education ministers from 29 European countries and important goals were defined. The first objective was to provide an easily readable and comparable system of degrees and divide the study into two-cycle of degrees (undergraduate and graduate degree). Another important goal was focused on the establishment of a Europe-wide system of credits (ECTS – European Credit Transfer System), which was created to encourage student mobility (Hansmann *et al.* 2017). Nowadays, the Bologna Process has 48 participating countries. Every two years, there is a meeting of education ministers where the original agreement is discussed and might be revised as needed (Collins and Hewer 2014)¹. EDUportfolio, which is presented in this paper as a system for easy curriculum development, management and mapping, has been developed according to objectives defined by the Bologna Process; furthermore, it also reflects and respects the goals of European reforming activities.

2.2 Bloom's Taxonomy

This Bloom's taxonomy is a theory of educational goals defined by Benjamin Bloom, an American psychologist. It is one of the most important pedagogical theories influencing the concept of teaching planning and curriculum development. Benjamin S. Bloom was the head of a group of educational psychologists which, in 1956, published a study called „Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook I: Cognitive Domain“ (Krathwohl 2002). The original publications contain carefully developed definitions for each of the six categories in the cognitive domain. These cognitive skills range from simple levels to more complex ones. The categories are: (1) knowledge, (2) comprehension, (3) application, (4) analysis, (5) synthesis and (6) evaluation. Individual levels are linked to each other; it is therefore necessary to master a simpler category before continuing with a next one, which requires deeper learning and is more complex (Krathwohl 2002, Adams 2015). The Bloom's taxonomy can be used by professionals to write learning outcomes that describe skills and abilities; these competencies are subsequently required from learners to master and to demonstrate. Among others, the so-called action verbs are very useful; there are lists of action verbs (Adams 2015) that are appropriate for learning

¹ <http://www.ehea.info/pid34250/members.html>

outcomes at each level of the Bloom’s taxonomy. Lists of these action verbs are widely available on the Internet.

EDUportfolio supports an outcome-based curriculum which represents a measurable description of what students are able to demonstrate in terms of knowledge, skills and values. A learning outcome always consists of a noun, a verb and a sentence (see Figure 1). There are three categories of learning outcomes supported by EDUportfolio that reflect the level in which learning outcomes are defined based on the MedBiquitous Competency Framework²: (1) the programme level (e.g. “this particular programme instils the following competencies...”), (2) the sequence-block level (e.g. “by the end of this particular course, you will be able to...”), and (3) the event level (e.g. “by the end of this particular lecture/seminar, you will be able to...”).

2.3 Pilot Usage in Partner’s Universities

After the implementation of the core functionalities of EDUportfolio was deployed in the pilot version to the public servers. There is accessible to our key partners of a the BCIME project (Building Curriculum Infrastructure in Medical Education) from Central and Eastern European region (Germany, Poland, Slovakia, Czech Republic and Romania). Each of involved academic institutions support different way of delivery and audit of medical and healthcare study programmes. During three years, partners plan to map and optimise one common preclinical study discipline together with five different medical disciplines to prove modernizing effects as well as practical application of the EDUportfolio platform. Because of the opened and modular architecture of the platform’s framework, the duplicities in curricula can be detected and minimized

wherever needed and the missing components and learning units can be easily identified. In this pilot approach users are able to see initial curriculum description based on the real content of the General Medicine study programme created by Masaryk University.

2.4 Medical Curriculum Guidebook

One of valuable outputs of the project from the methodological perspective is Medical curriculum guidebook³. This online handbook describes the crucial steps in the curriculum development process. It also explains basic vocabulary connected to the description of the curriculum according to the MedBiquitous standards. Thanks to this material is curriculum developer able to obtain knowledge necessary for work with the platform and create meaningful content.

2.5 Technological Background

The platform has been built using standard web technologies on which some of our previous web portals had been built (e.g. the MEDCIN platform and the CCCN Pilot Model Dataviewer) (Komenda et al. 2015, Dušek et al. 2017, Ščavnický et al. 2018). The main difference is that in this project we use the latest (December 2018) Symphony framework in version 4.2 created by SensioLabs⁴.

2.5.1 Roles of Users

The user role is an important attribute of each authenticated user in the platform. Immediately after the authentication process, the authorisation process takes place and at least one user role is assigned to the user. Assignment depends on enrolment within the university environment. In some cases, roles are

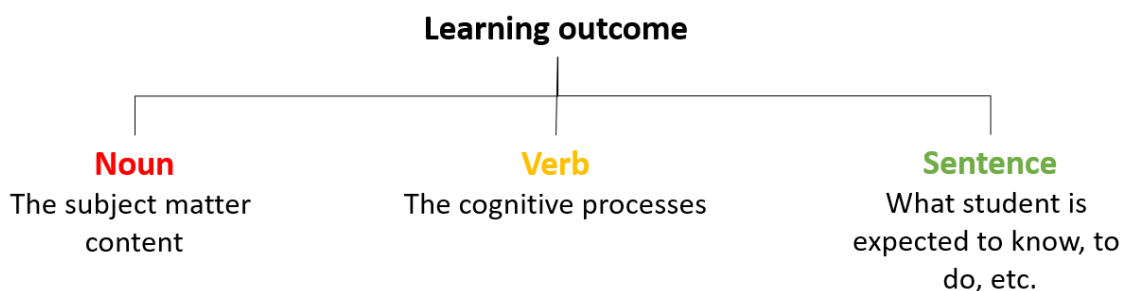


Figure 1: An example of learning outcome definition (e. g. Student describes the anatomy of human body).

² https://medbiquitous.org/curriculum_inventory

³ <https://eduportfolio.iba.muni.cz/about-project/>

⁴ <https://sensiolabs.com/>

assigned automatically (for instance students' roles), whereas other roles must be explicitly assigned based on university management decisions (such as the role of content guarantee). The set of user roles can be expanded as needed. In the case of new specialised modules, functionality can be accessed either to existing user roles or to newly created roles. There are currently four user roles in EDUportfolio:

- **Administrator:** Users in this role are tasked with managing users (creating accounts, activating accounts, assigning roles based on management decisions, and eventually deleting inactive users), and managing high-level building blocks of curriculum – study programmes, medical disciplines and courses. Continuous checking of platform run and work with the reporting module can be a secondary activity.
- **Teacher:** Teachers can examine the curriculum in the system. Structure of courses, teaching units, and other building blocks helps them in the overall orientation in teaching and in the identification of its shortcomings.
- **Curriculum Designer:** A user with this role can create and modify building blocks at the lowest level – learning units and learning outcomes (competencies). Learning units and learning outcomes are the most numerous groups of building elements and a wider group of workers at the university / faculty is traditionally involved in the process of their creation. They can then look at teaching units created by other teachers and use somebody else's learning outcomes in their units.
- **Student:** Students represent the last and the largest group of users. Using a curriculum browser, they are able to view details of learning units that were created by their teachers. Information about the student's grade is contained in the system and, based on the recommended passage through studies, students will be advised about content that is relevant to them. The student's identity is obtained from the Masaryk University Information System⁵, which serves as a verification authority

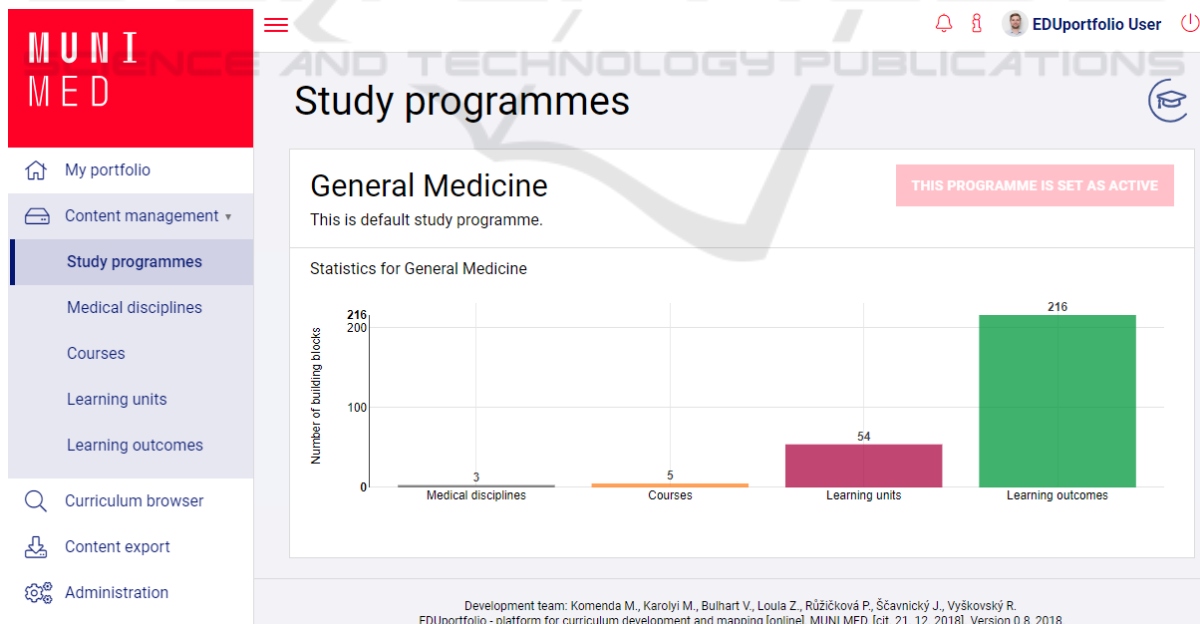


Figure 2: Overview of the General Medicine study programme.

⁵ <https://is.muni.cz/>

3 RESULTS

The EDUportfolio platform serves as a robust tool for easy curriculum development and management for higher education institutions, which consists of several modules. Each of them combines functionality related to similar issues (content development, content browsing, reporting, etc.). At the same time, the modules are accessed or slightly modified depending on the logged user's role in the system. The platform offers the ability to assign multiple roles to one user. In any case, the user is only allowed to use those modules that are appropriate to his/her assigned roles. The platform has three core modules: (i) a curriculum development module for the creation of all building blocks, (ii) a curriculum browsing module for viewing already created learning units and their environment, and (iii) a curriculum reporting module, which shows aggregated statistics about designed teaching.

3.1 Curriculum Development Module

This module allows users with the roles of teacher-designer or administrator to view and edit the content of the curriculum. Views for the modification of all building blocks of the curriculum are available: study programmes, medical disciplines, courses, learning units and learning outcomes. Using interactive web forms (see Figure 3), users conveniently fill all the necessary information for individual blocks and link them together. For some blocks, it is possible to determine whether the block is already finished or whether it is only a draft. Visualisation by a bar chart provides an overview of the entire study programme (see Figure 2), making it possible to see its size determined by the number of linked building blocks.

3.2 Curriculum Browsing Module

As a basic functionality, a search module above an existing curriculum is available to all logged-in users. After entering a phrase, the user can find relevant results in the form of details of corresponding teaching units. The search engine uses power of Majka and morphological analysis described in our previous paper (Károlyi, Ščavnický and Komenda, 2018). A set of interactive filters (see Figure 4) allows the user to select the results more accurately.

The results are returned according to the relevance of a given search phrase from the most to the least appropriate. The search itself uses several attributes of the learning unit itself, as well as other building blocks to which it is linked. In the future, support for recommending relevant content is also planned, based on user-specific information.

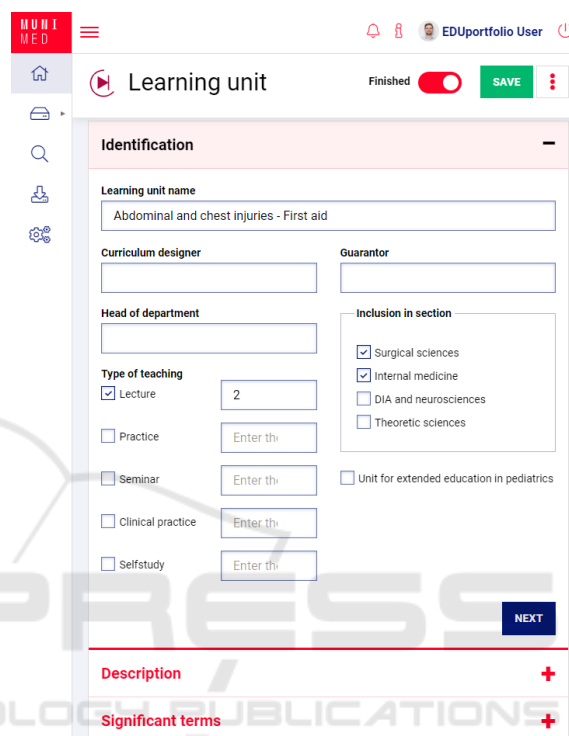


Figure 3: Editing form for a learning unit (view for mobile devices).

3.3 Curriculum Reporting Module

Curriculum reporting is a standalone module that allows users to examine aggregated statistics about teaching. This module consists of two interactive parts: (i) a filter panel and (ii) a visualisation window. Visualisation via bar chart (see Figure 5) represents Overview of learning outcomes' assessment forms for specific data. The filter panel allows users to filter input data based on the chosen study programme, section, semester and decide whether to show or hide categories with no values. It is also possible to reset all previously set filters using the "reset filters" button. The visualisation itself is a horizontal multibar chart that is built using the nvd3 JavaScript library for interactive web visualisations

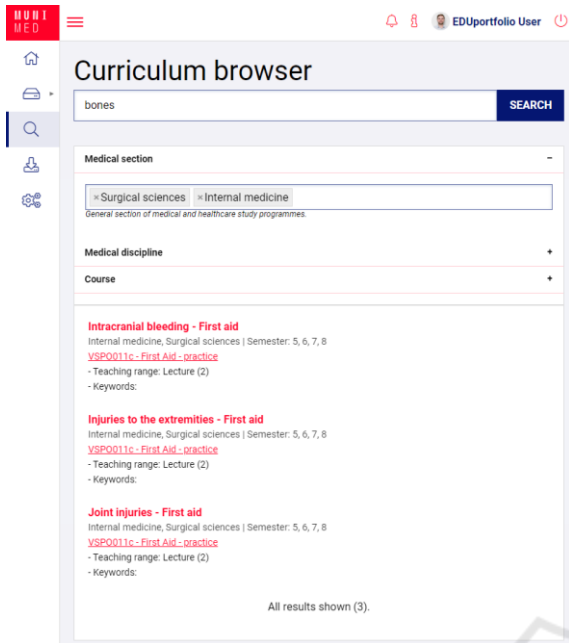


Figure 4: Results of the curriculum browser after entering the search phrase “bones”.

This chart allows users to change between grouped or stacked type of bars. Moreover, users can switch on/off particular series using an interactive legend to the chart. The x-axis represents the number of unique learning outcomes, while the y-axis represents each category of assessment form. The legend determines the number of series, which are distinguished by different colours. Each bar then corresponds to a series with a colour specified in the

legend. Tooltips with additional information appear upon hovering over the bars. The chart in Figure 5 may be interpreted as follows. In the General Medicine study programme, there are no learning outcomes at the course level in any assessment form. However, at the learning unit level, the most frequent assessment forms are the Combined form (continuing test, practical exam, final exam), the Oral discussion-based exam, the Final exam – oral and the Practical exam (demonstration of skills).

3.4 Conclusions

For students, EDUportfolio provides a summary in terms of knowledge to be obtained over the study and topics to be covered repeatedly. Curriculum designers, teachers and guarantors can clearly describe their lessons and browse curriculum data of all available courses. Faculty management obtains an online transparent overview of curriculum together with clear information about overlapping areas. In general, EDUportfolio serves as a decision support system for standard-compliant curriculum development, innovation and redesign.

We got rich feedback based on the pilot usage of EDUportfolio by partner universities. Curriculum designers, teachers and faculty management tried to get oriented in the presented graphical user interface and give us tips for the improvement. Many of them was approved and implemented to the platform.

Currently we plan to release the EDUportfolio platform for the wider audience and continue in development of enhancing features.

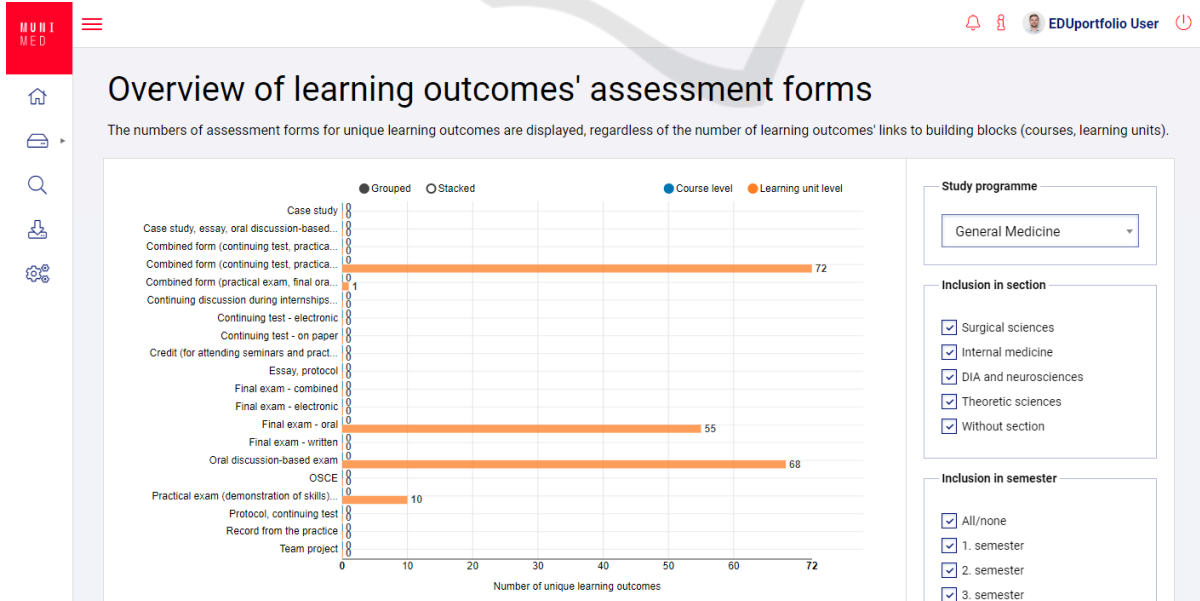


Figure 5: Overview of assessment forms of learning outcomes: Interactive report.

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