OPEN LEARNING CONTENT MANAGEMENT SYSTEM: ATTRACTING YOUNG PEOPLE TO STEM AND FOSTERING SENSE OF COMMUNITY

Mirosław Brzozowy[1], Jacek Bzdak[1], Katarzyna Hołownicka[1], Przemysław Duda[1]
Christina Troumpetari[2] , Nick Vovk [3,]

[1]Warsaw University of Technology, Warsaw, Poland
[2]Eugenides Foundation, Athens, Greece
[3]Institute for Developmental and Strategic Analysis, Ljubljana, Slovenia

The Open Learning Content Management System (OLCMS) presented in this paper is one of the tools currently being developed by STEM4youth project (www.STEM4youth.eu), funded under the Horizon 2020 programme scheme. The project aims to make STEM education more attractive for youth (predominately for secondary pupils as well as pedagogues and science promoters) with a synergy of various educational tools and methodologies and an open multidisciplinary, multilingual content. To this end, the project aims at creating an OLCMS platform which will provide the end users with an advanced search engine, learning, and content management features rarely offered by the majority of other similar cost-free tools. These features will allow the pedagogues or science promoters to customise the course creation, localise, edit or modify the content available at the platform as well as upload external content to the platform to share with others. We believe such a platform design will magnify the impact, reach wider audiences, and significantly reduce the costs of educational content development. Finally, due to the platform's social features (such as user ratings, forum, social media links, etc.), pupils and pedagogues will be able to foster local, national, and international (virtual) communities based on shared interests in STEM-related topics.

Keywords: STEM, open education content, content management system

INTRODUCTION

The STEM skills gap in EMEA countries is widening compared to other regions across the globe (Joyce & Dzoga, 2011). To shift this situation, upcoming didactic methodologies ought to be more considerate of the ties modern youth holds with Information and Communication Technologies (ICT), such as computer games or mobile applications. For them, learning aspects such as aesthetics or (social) amelioration are becoming increasingly more pertinent at the same time as traditional learning materials fail to address them. Moreover, despite there being an abundance of educational content openly available on the Internet today, finding relevant high-quality content, either to pedagogues or pupils, persists to be a strain. Furthermore, the latter two generally remain as passive consumers of prefabricated content without their own creative or collaborative contributions – attributing to a lack of the proliferation of value-added content (i.e. content that contains results derived from learning processes such as enriched material, novel methods, good praxes, etc.) (Massive Open Online Courses, 2013; OLCOS Roadmap, 2012).

In lieu of this, the STEM4youth project sets out on a fresh path towards the popularisation of STEM (in)formal education among the modern youth. Firstly, this encapsulates the development of a series of challenges in six STEM disciplines (mathematics, physics, chemistry, astronomy, engineering, and medicine) for the project's core interest groups (pedagogues, pupils, and science promoters); and secondly, an online platform to help with the promotion and re-usability of these contents on the international level. The OLCMS's *raison d'être* is providing the aforementioned end users with advanced system features rarely seen in other learning content providers (full-text search, manual course composition, content updating, multi-annual support, social and communal features, etc.).

METHODS

General Platform Design Approach

The OLCMS platform's conception and design were guided by unstructured interviews with the interest groups (pupils aged 12-19, high-school pedagogues, and science promoters) as well as a Delphi Survey with domain experts on their longitudinal experience with STEM education. In addition, the project's research teams conducted analyses of secondary sources, extensive desk reviews, and market research of competitive technology-enhanced off-the-shelf open-source reusable and adaptable learning packages:

- *MOOC (Massive Open Online Courses)* are growing in popularity and have high-quality content, however, are mostly provided in English and focused primarily on graduate students (fewer than 10 percent of high-school pupils are MOOC users) (MOOCs at the University of Edinburgh, 2017);
- *LMS (Learning Management Systems)* allow for the creation of content and include certain knowledge attainment evaluations but felt short of several requirements identified by the preliminary research;
- *EU-funded systems* serving as media repositories but with a lack of their own content as well as usually not being open-sourced;
- *Other systems* that fulfil the majority of functional requirements but were rejected due to technical reasons as reported in (Bzdak, Kowalski, Kubicki, et al., 2016).

OLCMS Assumptions and Requirements

Given that the research failed to yield an open platform befitting the surfaced requirements, the project's partners ventured to develop a new system, based on the leading and widely accepted open-sourced technologies. Our OLCMS system will hence feature a combination of learning management and content management systems, such as (but not limited to):

- Relieving the entry point of potential access barriers – login process heavily simplified;
- Features of adaptive learning – individually tailored learning processes (Russel, 1997);
- Responsive web design – serviceable on a variety of (mobile and desktop) devices and operational systems (including handhelds);
- Editable, combinable, and customizable content answering to different end users' needs;
- All material accessible via HTTP and downloadable for offline usage;
- Multilingual content and portal (Czech, English, Italian, Greek, Polish, Slovenian, Spanish).

1	Project logo	8	Module domains	15	Download documents
2	OLCMS index service	9	Authoring organization	16	STEM supply and demand
3	Links to social media / website	10	Module logo	17	Quiz / evaluation form
4	Module name	11	Inclusion of RRI principles	18	Informational guide
5	Module ratings	12	Material and shops	19	Module assembly line
6	Short module description	13	Module video / simulation	20	Forum
7	User tags	14	Tools and methodologies	21	See similar others

Scheme 1: Tentative OLCMS portal home page (*left*) and 'Assembly line' for course creation (*right*)

Content Re-usability and Composability

Our OLCMS platform will allow collaborative content creation and editing options, similarly as, for example, Wikipedia. The speculative predominant content changes are likely to occur in matters of translation and content adoption to specific audiences; however, to avoid potential legal and ethical

liabilities any updates or uploads will be screened by moderators prior to publishing. Furthermore, as seen in Scheme 1 (*right*), our platform will provide a compositional feature in which different content items (such as text, video, simulation, educational game, quiz, online experiment, etc.) will have the option of assortment, spanning hence in duration, interactivity, and difficulty. While the latter was designed primarily for pedagogues, pupils, on the other hand, will be able to rely on the extensive content search engine as well as vibrant communal features (e.g. user ratings, forum, social media links, etc.).

RESULTS AND CONCLUSIONS

Market Demands for Educational Content

Despite it being too early at this stage to provide statistically significant empirical results on the OLCMS's functionality, the STEM4youth research teams observed a high demand for educational content in the EU region. Taking into account, for one, a similar project ('e-Physics'), which made an interactive physics textbook (containing many similar multimedia features: videos, simulations, online experiments, etc.) openly available to Polish high school pupils in 2015 has since received on average over 45 thousand unique users per month – making the projections for our own OLCMS indisputably clear.
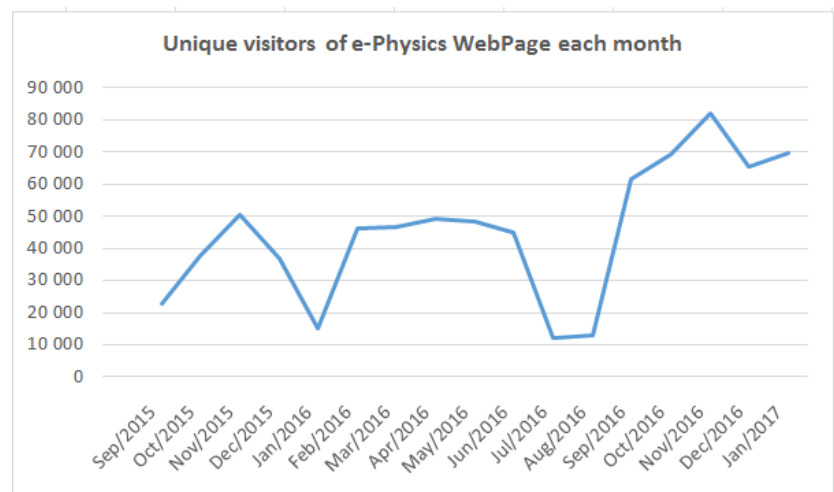
Graph 1: Number of unique visitors of e-Physics over time

Final Conclusions

Over the last few years the promotion of STEM education has seen a recognizable trend in many European countries, consequently contributing to an enlarged demand for educational content, online-learning systems, and content repositories. Since our research highlighted limited features on the current market for the latter, our proposed OLCMS platform seems well-suited to answer to such needs. In the framework of the ESEFA17 conference, we will provide the preliminary OLCMS usage characteristics, end user feedbacks, a further elaboration of the results as well as present the platform in its entirety.

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