Topic Oriented Open Learning (TOOL) platforms: a novel approach for open education – experiences of two initiatives

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Abstract
Independently and unknowingly of each other, in two different subject fields, open learning platforms arose, that address similar needs and have similar set-ups, and differ from existing open education formats such as Open Educational Resources (OER) repositories and MOOCs. They appear to form a specific new type of platform, that we dubbed ‘Topic Oriented Open Learning’ (TOOL) platform. They combine domain specificity, OER, and tools to facilitate the learning process. This combination is new. Existing commercial domain-specific platforms and educational felt needs inspired to the creation of these platforms. We describe these two examples and experiences with their usage and extract generic characteristics of TOOL platforms. Compared to existing approaches, TOOLs make it easier to use OER in teaching. By linking TOOLs to institutional learning management systems they engrain the usage of OER in the daily teaching routine and thus offer a unique opportunity for promoting of open education.

Keywords: OER, domain-specificity, Topic Oriented Open Learning (TOOL)

A new kid on the block: TOOL platforms
Independently and unknowingly of each other, in two different subject fields (anatomy and statistics), open learning platforms arose, that address similar needs and have similar set-ups, and differ from the presently common learning platforms. We realized they might offer a new format for open education, besides the existing Open Educational Resources (OER) repositories, Massive Open Online Courses (MOOCs) and Small Private Online Courses (SPOCs). These new types of platforms have three main characteristics: they specialize on one domain (“topic oriented”), they are open, and they support the process of learning. We therefore dubbed them Topic Oriented Open Learning (TOOL) platforms.

What formed the inspiration for these three main principles: ‘Topic Oriented’, ‘Open’ and ‘Learning’?

Topic Oriented
On the web, general and specific sites both have their place. Besides generic search engines, such as Google, there are many specific sites, to name just a few: Google maps (maps), Booking.com (hotels), second hand stuff selling sites, travel planners, GitHub (software sharing), Stack Exchange (Q&A sites), etc.
They allow performing specific tasks faster and easier than would be possible with a generic application or create possibilities that would not at all or hardly be possible with generic applications.
For instance, if one wants to have a nice weekend off in Paris one would probably not Google for dozens of hotel web sites, visit each web site separately, and note prices and location of each in a spreadsheet to finally decide on the best option. Instead one would visit a dedicated hotel website,
such as Booking.com, because such sites allow to easily search across all hotels, rank them in several ways, find them by location, compare pictures and facilities, read user reviews, and finally make a reservation. The task ‘finding and reserving a hotel’ has specific needs, such as investigating and comparing general impressions, locations, prices and facilities, etc. This would be possible with generic sites but cumbersome. Some needs, such as software sharing or exchanging questions and answers to highly specific topics would probably even be impossible to meet at all with generic applications.

Such domain-specific platforms have several or all of the following characteristics:

- **Domain-specific content/collection**
- **Domain-specific presentation of material and search possibilities** - e.g. in Booking.com: ‘find all hotels with an indoor swimming pool in Paris, ranked by price’.
- **Domain-specific tools** - e.g. in Booking.com: maps that present the hotel locations, and functionality to make reservations.

*Behind the scenes:*
- **Domain-specific intelligence** - e.g. Amazon’s: ‘maybe you’re also interested in this...’; in travel planners: the intelligence to combine and compare different transportation modes and routes.
- **Domain-specific classification and organisation**: a necessity to enable many of the previous possibilities, see the section 'Domain Model' below.

If domain-specific applications offer better solutions for many needs of daily life, why are we treating education in all domains as similar and offering only generic institutional Learning Management Systems (iLMS)? This is where the ‘Topic Oriented’ platform comes in. Just as holds for commercial goals, also education of specific topics can be better served by specific applications. TOOL platforms are based on the principles (Jarvis, 2009) of the many available domain-specific commercial platforms, but they apply those principles to facilitate learning.

**Open Education**

Governments around the globe stimulate open education (Cape Town Declaration, 2007; Paris OER Declaration 2012; Creative Commons, 2015; Ministerie van OCW, 2015; Ljubljana OER Action Plan 2017). Arguments are (Weller, 2015):

- Economic: reuse of resources will reduce costly re-creation, reduction of costs for students.
- Educational: improvement of instruction and pedagogy.
- Marketing: acquire reputation.
- Idealistic: offer equal access to knowledge for all.

In different countries, to this aim, OER repositories have been set up. For the same reasons, TOOL platforms offer their content open.

**Learning support**

Having access to resources is vital, but not enough. Learning is not only absorbing information and teaching is not only presenting information. “Learning is an active process that requires exercising and interacting with the subject matter” (Nuthall, 2000; Hattie, 2009). To that aim teachers and students
should have tools that they can easily use in their teaching and learning. This is what TOOL platforms offer in addition to pure OER.

**Two examples of TOOL platforms**

The combination of domain specificity, openness and support for learning is the hallmark of TOOL platforms. We describe two existing TOOL platforms: one for learning and teaching anatomy (AnatomyTOOL), another for learning and teaching statistics (I Hate Statistics). They were created independently but share essential characteristics.

**AnatomyTOOL (AnatomyTOOL, n.d.)**

**Domain-specific needs**

The main identified problems in anatomical education that lead to the initiative to create the platform were:

- Insufficient or too expensive access to quality controlled anatomical images. Because of the topographic nature of anatomy, imagery is very important in learning anatomy. Images can be drawings, but also images created by specific techniques such as dissection, microscopy, cross-sectioning, radiology or 3D imaging.
- Lack of quality guarantee and organisation of online anatomy learning materials.
- Lack of online tools for students and teachers to exercise anatomy, respectively create exercises and study material. Because the discipline requires becoming aware of and memorizing large amounts of details, quizzing, repetition and exercising are vital.

**Description**

AnatomyTOOL was created by the departments of Anatomy of Leiden University Medical Center and of Maastricht University, in collaboration with most other departments of Anatomy in the Netherlands and Flanders, with a grant by the Dutch Ministry of Education, Culture and Sciences. It offers anatomical content and tools. The content are documents, images (fig. 1), videos, e-learning, questions, quizzes and learning paths aimed at learning anatomy. They are reviewed. The material is presented organised and searchable in ways specific for the domain: by anatomical regions or body systems (fig. 2), by specific anatomical subjects, such as dissection, microscopy, embryology, etc. (fig. 3), or by anatomical structure. For each anatomical structure, all relevant material is presented together. The tools comprise of generic tools such as a functionality to create learning paths or quizzes, and domain-specific tools such as a virtual microscopy viewer, and cross-sectional viewers (fig. 4). Table 1 lists AnatomyTOOL’s characteristics.
**Domain-specific (‘Topic Oriented’) characteristics**

- **Domain-specific content/ collection**: items on gross anatomy, embryology, dissection, practical applications of anatomy; virtual microscopy slides and microscopy tutorials. A vast amount of synonyms.
- **Domain-specific presentation of material and search possibilities**: browsing amongst anatomical regions or body systems, searching on anatomical structures or by filtering on specific anatomical subjects (microscopy, embryology, dissection etc.). Presentation of subject matter per anatomical structure.
- **Domain-specific tools**: virtual microscopy, microscopy tutorial editor, cross-sectional viewers.
- **Domain-specific intelligence**: apply topographical and systemic relations in searches. Resolve anatomical synonyms.
- **Domain-specific classification and organisation**: all items are tagged by anatomical structure(s) and by anatomical subject(s). Relations between structures are stored and enable specific functionality (see section ‘Domain Model’).

**Open characteristics**

- All content stored in the platform has a Creative Commons license or is in the public domain.
- All content and tools can be reached without log in.

**Learning process support**

- Teachers and students can upload materials.
- Functionality to create learning paths and quizzes.

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**Table 1. Characteristics of AnatomyTOOL**

**Fig. 1. The images gallery in AnatomyTOOL**
Fig. 2. Browsing by body system to smaller parts and finally to a page specifically dedicated to an anatomical structure

Fig. 3. Domain-specific organisation
I Hate Statistics (IHS) (I Hate Statistics, n.d.)

Domain-specific needs

1. Statistics is a field where the subjects are strongly related. This requires that students master the lower-level subjects before they can move on. Online, students can practice infinitely and get personalised feedback to inform them if they are ready to move on.

2. Statistics is a field that requires a lot of practice. The concepts are often quite abstract. This drives the need for repetition and revisiting the material.

Description

Many students consider statistics as one of the most difficult and abstract courses. In some studies, fear of statistics and maths is a well-known issue. The author that founded I Hate Statistics had friends who stated: “I just really hate statistics!” This formed the drive to find a method to help students get rid of this fear for statistics.
In I Hate Statistics, teachers can create a tailored curriculum, by selecting the subjects that match their course. I Hate Statistics offers more than 3000 practice questions and over 100 lessons on statistics, ranging from measurement levels to ANOVAs and regression. Students can do an intake-test, based on which the platform generates an advice on which areas to focus. The student can then practice, obtain direct feedback and review lessons if needed. Teachers can also easily add or change the materials, using an intuitive editor. Finally, teachers can obtain insights about their class, for example, which subjects students find most difficult to grasp. Table 2 lists IHS’s characteristics.

**Domain-specific (‘Topic Oriented’) characteristics**

- *Domain-specific presentation of material and search possibilities:* tailored lesson map, entry knowledge diagnosis using IHS’s domain-model (fig. 5) (see section ‘Domain Model’).
- *Domain-specific tools:* interactive graphs: e.g. visually judge the area under distributions, simulations: do your own election polls and observe characteristics (fig. 6), statistical tables, symbolic equation checker.
- *Domain-specific intelligence:* quiz generation based on learning goals.
- *Domain-specific classification and organisation:* all items are tagged by learning goals. Relations between learning goals are stored and enable specific functionality (see section ‘Domain Model’ and fig. 5 and 7).

**Open characteristics**

- By the end of 2017, all lessons will be freely available without needing to log in. Exercises for now are behind the pay-wall. Hopefully they can be opened soon as well. (see gradual openness in IHS governance section)

**Learning process support**

- Intake-test generator, content editor for teachers, curriculum editor (fig. 8).

Table 2. Characteristics of I Hate Statistics
Fig. 5. Domain-specific organisation: domain-model view used for student feedback.

Fig. 6. Domain-specific tool: interactive simulation to help students understand sampling variation in election polls.
Fig. 7. Visual representation of part of the domain-model that underlies I Hate Statistics

Fig. 8. Teachers can create tailored curricula by selecting relevant lessons from IHS.
Results and experiences

AnatomyTOOL

AnatomyTOOL was released recently, so large scale experiences were not yet available at the time of writing. However, a survey amongst anatomists and students showed that the functionalities offered by AnatomyTOOL are well in line with perceived needs (Author 1, 2017). Initial experiences in the testing phase from usage by the developing anatomists showed that the platform proved useful for multiple situations: ad hoc finding of teaching material (for instance in response to student questions), offering organised material in learning paths to students, creating assignments. Also the exchange of teaching materials between institutions and reviewing them was found to lead to improved materials, and awareness of teaching material created by other institutions useful for the own teaching.

I Hate Statistics (IHS)

IHS has been operational now for three years. Over the years, the available subjects and functionalities have increased, and with that, its usage and the evaluation results of students and teachers.

Usage: overall, IHS is being used intensively, although this differs per supported course. In one course, the teacher first used a different learning program and out of 350 students, only 12 used it. The next year they switched to IHS. Then, 350 out of the 350 students used it and together they answered over 137,000 questions (!), an average of about 400 questions per student.

Student and teacher evaluations: in many courses which IHS supports, the majority of students (depending on the course between 80% - 100% of students) recommend to use the system in the next course and indicate they find the addition of an online practice tool is beneficial. An example of such a comment: “I find it to be very useful! If I find any chapters particularly confusing, I can better understand them through these exercises. Eventually building up my skill set to execute exam questions.”

We have learned that the most important factor for student satisfaction and usage is the involvement of the teacher and the integration of IHS into the course. In highly integrated courses, both usage and evaluation results are highest.

Specific features of TOOLs

What is characteristic of a TOOL platform? Domain-specificity, openness and learning tools by themselves are not unique; their combination might be regarded characteristic though. Further characteristic aspects are: niche concentration and specialisation, a domain model and domain-specific tools.

Niche concentration and specialisation

Probably the most critical advantage of a TOOL platform in comparison to generic platforms is that it can concentrate and specialize on a niche. This has several advantages.

Critical mass of content coverage can be reached easier
To be useful for a user, a content collection should provide a successful result for most searches. This requires a critical mass of content coverage (extent, depth). Because of the limited subject extent in a TOOL platform, such a critical mass and hence a full working solution (Moore, 1991) can be reached easier. For instance, IHS, by focussing on one domain - statistics - was able to develop the over 3000 exercises that were needed to cover most basic statistics topics.

A positive effect on governance
A platform with OERs requires efforts for contributing and quality control and financial means for hosting and maintenance. Teachers in a domain and their associations will probably be more willing to contribute those to a platform in their own domain, because it interests them and there is more chance that they will benefit from it themselves. The feeling of 'ownership' will be larger. Also, the chances of collaboration are larger. For instance for AnatomyTOOL, several anatomical departments contribute materials and financial support.

Domain-model
In order for a teacher, student or algorithm to find relevant OERs, those resources must be categorized or tagged in some way. There are many different categorizations that are useful for finding OERs, for example: the language(s) in which the OERs are available or what type of resource it is (video, paper, classroom activity). One might need multiple of these filters in order to find relevant materials.

We posit that in order for OERs to be reused by teachers, one essential classification needs to be topic-oriented and fine-grained. This classification consists of relations between all of the topics in that specific field. This was described in the first sections as a 'domain-specific classification and organisation'. This fine-grained network of relevant topics and their relations has been termed a domain-model (Sottilare, 2016)

Many OER platforms classify OERs according to a high-level field, for example maths, art, history or chemistry. This is useful for initial exploration. However, when preparing for a class, a teacher needs access to a much more fine-grained classification, for example: within statistics, resources on the conceptual understanding of sampling variation. This requires a domain-model. Creating a domain-model is labour-intensive and requires a deep understanding of a particular field. It requires specialisation. A fine-grained, intuitive, comprehensive and useful domain-model is a unique feature of a TOOL. It allows teachers to find and select exactly the resources they need and allows the platform to suggest related resources.

AnatomyTOOL and I Hate Statistics both contain a domain-model. Although both are different in nature, reflecting the different requirements of their field, both are designed for the needs of learning:

- **AnatomyTOOL's domain model** contains relations between anatomical structures: topographical relations (e.g. the nostrils are part of the nose, which is part of the face, which is in the head region), body systems relations (e.g. the nostrils belong to the respiratory system), functional relations (e.g. this muscle is attached to that bone, this blood vessel supplies that structure), etc. In the practical application of anatomy in medicine, and hence in learning anatomy, these different types of relations are all relevant at times.
• AnatomyTOOL’s domain model allows searching for items independent of the entry, e.g. images or questions about the nostrils will be found in searches on the nose, the face, the head or the respiratory system. Also it allows to browse from larger entities to smaller parts (fig. 2) and to create listings of relations, which are helpful in learning.

• *I Hate Statistics’ domain model contains relations between learning goals*. For example: “a student is able to indicate whether a description is about a population or a sample.” This learning goal has two different relations:
  1. hierarchical: for instance indicating that the difference between population and samples is part of inferential statistics.
  2. prerequisites: in order to be able to make the distinction, one first has to know what “population” and “sample” mean.

• This domain-model allows I Hate Statistics to select the right exercises and allows the program to provide reports about the mastery of learning goals, such as which subjects students seem to have most difficulties with.

**Domain-specific tools**

Specific domains require specific tools, which probably will not be present in generic platforms. For instance, AnatomyTOOL has virtual microscopy and body cross-sectional viewers. IHS has interactive graphs, statistical simulations and tables, and a symbolic equation checker. We can imagine such specific tools in several domains, for instance in chemistry and physics: digital labs, in geography: map-based tools, in history: timeline-based tools, in languages: grammar or pronunciation exercising tools, etc.

**Discussion**

*Comparison with other platforms*

Several platform types exist that have some of the characteristics of TOOLs. Both the common Learning Management Systems\(^1\) and specific learning tool platforms\(^2\) offer learning tools (‘L’). OER platforms\(^3\) offer open learning content (‘O’), some also contain learning tools (‘OL’), or are domain specific\(^4\) (‘TO’). MOOCs\(^5\) and SPOCs have varying degrees of openness and offer learning tools (‘(O)L’). Finally, domain-specific learning platforms\(^6\) exist commercially already, but not yet on an open basis (‘TL’). The combination: domain specificity, openness and learning tools (‘TOOL’) is new though as far as we know.

Why not just use the Institutional LMS?

Most educational institutions nowadays use institutional Learning Management Systems (iLMS). These focus on organising the educational process within the institution, by offering facilities for group management and for posting of information per module. They are organised in student groups and modules. Also they have generic educational functionality, such as tests, gradebooks, etc. But they do not cater for needs of specific disciplines. No ready-to-use materials are available. Material about a
specific domain is scattered around different modules. There is no way to search for topic specific content across the platform; also it is cumbersome to access material in different modules. Moreover, by their nature, they do not allow sharing of educational materials or collaboration between colleagues within a discipline across institutions. Specifically for open education, such sharing is desirable.

iLMS are perfect for material and data that are institution specific – student names and data, rosters, specific local curriculum material (module programs etc.), but they offer little support to the teaching and learning of domain-specific subject matter.

What's withholding the use of OERs?
OER Platforms offer valuable material but their usage in daily life education has remained limited so far. The most often mentioned reasons are (Allen & Seaman, 2014; Annand, 2017; Hassal & Lewis 2017; Kortemeyer, 2013; Mtebe, 2014; Schuwer, 2015; Schuwer, 2016):

- Unawareness of OER
- Difficulty or time cost to find the suitable resource
- Doubt about permissions and copyrights
- Lack of incentives for faculty, lack of institutional support

A key issue may be the misalignment between interests of students, faculty and institutions (Annand, 2017): students benefit from OER, but faculty decide about the used resources and faculty benefit from using commercial textbooks: faculty have free access to them, using them saves faculty searching and publishers offer complementary tools that make teaching easier.

What about MOOCs?
The Massive Open Online Courses (MOOCs) gave a world-wide boost to Open Education by offering open accessible courses. However, the courses are usually large monoliths and they are only partially open; reuse of the materials is often not allowed or is difficult, and access may be limited to specific time-slots. Furthermore, random teachers can usually not create learning materials on the MOOC platforms, nor do MOOCs offer specific tools for teaching. Hence, they are only of limited value for on-campus usage.

The whole job of using OER should be easier
As mentioned above, faculty do not benefit from using OER: it takes time to search them and they do not offer the complementary tools of commercial textbooks that make teaching easier. ‘Openness’ is not in itself a value to most people. To promote open education the job of using OER - finding them, judging whether they are useful, adapting them, etc. - should be easier. We posit that TOOL platforms can be useful for this: their domain specificity with its concentration of content and their organisation, presentation and search possibilities tailored to the specific subject ease finding resources. Their tools assist in the teaching task.
**TOOLs within generic OER platforms?**

One might critically ask: why not use generic OER platforms to develop topic-oriented material? That is a good question and there are no principal reasons why a topic-oriented community could not organise itself around a generic OER platform.

However, if the nature of the topic requires specialised tools (i.e.: mapping, simulations) and a specialised domain model, then in essence what is happening is the creation of a TOOL within the infrastructure of a generic OER platform. This is definitely a possibility, but in that case, the point remains: in order to drive OER adoption, we must focus on providing a full working solution for a particular topic-oriented niche (Moore, 1991)

**OERs need to become more modular**

We see modularity as an important aspect for the successful adoption of OER. In many OER platforms, it is possible to upload or share entire chapters that are only classifiable on the main topic they address. Often, that is too broad for practitioners to use in a workshop or activity.

If we want OERs to be adopted, teachers need to be able to find the exact relevant piece of material quickly. This requires learning materials to be structured in much smaller modules and a classification that is able to tag and retrieve these modules quickly. TOOLs support this.

**OERs need to be editable**

Resources need to be editable as teachers find it important that they can control and adapt the resources they use in their teaching.

For paper-based resources, this was relatively straightforward; simply select questions manually and perhaps add some comments. However, digital resources hamper this behaviour: online programs often dynamically select exercises, making it more difficult for teachers to assign specific exercises.

Secondly, digital resources are harder to edit as their offering is embedded in code instead of on paper.

In order to edit learning resources 1) the licenses need to allow this and 2) for online resources, infrastructure that enables this needs to be available. This combination of open content and tools is exactly what TOOLs offer. Providing options for teachers to easily edit available resources might prove to be an essential step towards OER reuse.

**TOOL platforms: back to discipline-based teaching?**

The usage of TOOL platforms need not mean a return to pure discipline oriented teaching and learning. TOOL platforms themselves can offer integrated and applied subject matter. Also, integrated TOOL platforms could arise, that refer to the basic subjects TOOL platforms where necessary. For instance, in the medical discipline, there could be TOOL platforms for cardiology, radiology or surgery, which refer to an anatomical TOOL platform for the basic anatomy.

**Governance of TOOLs**

Governance of open educational initiatives is always a challenge. The two main challenges are: 1) quality control and maintenance of the content, and 2) financial maintenance. Anderson (2009) and Stacey and Hinchliff (2017) describe a number of ways to generate revenues with open or free
activities, such as: freemium, donations, charging for custom services or physical copies, etc. For each project the possibilities will be different, so solutions are project specific. For the two discussed TOOL projects, the governance is presently arranged as follows:

**AnatomyTOOL:**
- **Quality control and maintenance of subject matter:** A peer review process to ensure quality is built into the workflow with incentives and sanctions. Because of the lack of central editing staff, the tasks are laid with the faculty, but the review requirements are kept light to not overload the relatively small group of anatomists that create and review these materials. The reviews serve mainly as a basic quality check.
- **Financial maintenance:** to finance basic hosting and maintenance the platform presently is still dependent on financial support agreed to by the anatomical departments of the Netherlands and Flanders. It is hoped that in future additional revenues can be generated by commercial usage of non-commercial licensed images and by offering institution specific services (freemium). Major extensions still require obtaining additional grants.

**IHS:**
- **Quality control and maintenance of subject matter:** IHS mainly employs central curation, as well as additional forms of community curation. Central curation: It is IHS’s responsibility to ensure high quality materials. IHS’s team checks all exercises and lessons. In addition, two forms of community curation exist: 1) teachers who use the platform check whether the material is up to their standards. Inconsistencies get flagged quickly. 2) every student sees a button: “mistake spotted” and can easily submit what they see as erroneous.
- **Financial maintenance:** IHS operates under a freemium model. In this model the content is free for everyone. Universities pay for services that are beneficial when integrating the online functionality of IHS in their courses. Services include: telephone support, service level agreements, white-label offerings, learning analytics that enable teachers to see which subjects students are struggling with. IHS is gradually increasing its openness, making more content open and freely available as more universities join. The balancing between premium and open/free has allowed IHS to grow to a full-time team of 3 people and some freelancers in about three years, without requiring additional grants.

**A TOOL platform for your domain**
AnatomyTOOL offers its code as open source, to allow other disciplines to build similar TOOL platforms. Its basis is the open source software content management system (CMS) Drupal\(^7\), topped with the open source LMS Opigno\(^8\). TOOL platforms, by virtue of their domain specificity, require modification per discipline to cater for discipline-specific needs. This can nearly only be achieved at a reasonable speed and cost by using open source code as basis, as with commercial learning platforms one is at the mercy of the platform vendor, desired modifications will only be implemented if they are of enough commercial interest for the vendor to spend development resources on.

**The future: an integrated mixture of iLMSs and TOOLs**
There is a trend for integration between platforms. Ideally, institutional matters, such as registration and management of student information, institution-specific modules, groups, and student results
(gradebooks) should be processed in the iLMS. The subject matter itself however can better be concentrated in platforms specifically dedicated to the subject: domain-specific platforms. There should be easy plug-and-play of TOOLs into LMS’s as with other LMS plugins (e.g. plagiary checkers). We envision that students, from the iLMS, will be referred to the relevant TOOL platform for specific assignments or study topics. In that TOOL platform, they study the subject matter and possibly perform assignments or quizzes. Results will be transferred back to the iLMS for storage in its portfolio or gradebook. The TOOL platform only receives an anonymised student code, so privacy sensitive material is not present in the TOOL platform but remains in the iLMS.

Because of the tight linking of LMSs and TOOL platforms plus the offering of useful content and tools in the TOOL platform we expect the visibility and usage of the open educational material to become engrained in the usual teaching routine.

**Conclusion**

TOOL platforms offer a new approach to promote open education because they offer the openness and reusability of OER, plus possibilities to support the teaching process, and they are catered to a specific topic. These additional characteristics to plain OER make it easier for faculty to use OER and put the ownership and quality control of the subject matter in hands of those for whom it matters most: the subject experts and teachers. By offering TOOLs as plug-ins in institutional LMSs they can engrain the usage of OER in the daily teaching routine and thus offer a unique opportunity for promoting of open education.
Notes

1. Learning Management Systems: e.g. Blackboard, Moodle and many others
2. Online learning tools: e.g. Socrative, Kahoot, Cerego
3. OER repositories: e.g. Merlot, Wikiwijs
4. Domain-specific OER repositories: e.g. HEAL, MedEdportal, Radiopaedia, Computer Science Open Educational Resources
5. MOOC platforms: e.g. Coursera, EdX, Khan Academy, etc.
6. Commercial domain-specific learning platforms: e.g. Kenhub, AnatomyZone, etc.

References


