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A proposal of a multidimensional model for the assessment of OER quality standards

***Abstract:** The increase in digital Open Educational Resources (OER) repositories as support to formal, informal and lifelong learning emphasises the relevance and topicality of the OER quality issue. The aim of the paper is to propose a multidimensional model for evaluating OER quality standards in Serbia as support to the development of quality digital content for online and distance learning. The analysis of national and international policies and practices supporting the implementation of quality OER was followed by the analyses of relevant literature on OER evaluation and of the relationship between quality standards of printed textbooks, e-supplements, digital textbooks and OER. Using the method of modelling and case studies, we came up with a proposal for a multidimensional model for evaluating quality standards. These standards should be formulated in a way that clearly represents the quality threshold that every OER must “cross”, without compromising on educational materials that can be harmful to students’ learning and development. Such quality standards, as the proposed multidimensional model and evaluation instrument, should provide a framework, but also leave enough freedom for authors to design creative didactic-methodological-technological solutions that will facilitate and improve the teaching and learning process.*

***Keywords:** Open Educational Resources (OER), quality standards, multidimensional model, education, learning.*

Introduction

Information and communication technologies (ICT) represent a great potential for effective, equitable and inclusive access to *Open Educational Resources* (OER) and their use, adaptation and sharing. They can make OER available for everyone, anytime and anywhere, including people with disabilities and individuals from marginalised or disadvantaged groups. They can also help meet the needs of individual students and effectively promote gender equality, encourage innovative pedagogical, didactic and methodological approaches, and support lifelong learning.

Open Educational Resources are available to everyone – teachers, preschool teachers, students, government bodies, parents, education service providers and institutions, education support staff, teacher trainers, education policy makers, cultural institutions (such as libraries, archives and museums) and their users, ICT infrastructure providers, researchers, institutes, civil society organisations (including professional and student associations), publishers, public and private sectors, intergovernmental organisations, copyright holders and authors, media and broadcasting groups and funding bodies.

Additionally, OER can be integrated into the teaching and learning process within all the three models of educational work organisation which integrate digital technologies into the teaching and learning process: direct work at school with occasional use of digital technology in class; online teaching that is completely conducted via the Internet (most commonly by applying a learning management system); and hybrid teaching that combines face-to-face and online teaching. Therefore, OER should be viewed as collections of alternative sources of educational materials integrated as needed into a planned, continuous and integrated set of educational activities within the framework of all the three models.

The main feature of the OER ecosystem is promoting society's determination to consider knowledge as a public good and encouraging organisations and individuals to publish it. Although the OER concept is not new, there is a clear need for innovative forms of support for OER creation and for the development of an empirical database on the effectiveness of OER. In all of this, the key question is how to ensure the quality of OER, i.e. what are the areas of standards and indicators that can ensure the quality of *Open Educational Resources*.

National OER policy and practice in the Republic of Serbia

Bearing in mind the UNESCO Recommendations on open educational resources from November 2019 adopted at the 40th session of the General Assembly, the Ministry of Education of the Republic of Serbia strives to support the development of the model of open educational resources for effective, inclusive and fair access to quality educational materials. In the education system of the Republic of Serbia, there is a noticeable trend of increase in the number of OER, as well as increase in the number of employees in education engaged in this topic through various projects. However, there is also a noticeable lack of solutions or capacity that would ensure quality and monitor effects in the context of the analysis of students' achievement in education. In the development of open educational resources current focus is still in its first, i.e., early stage, where the emphasis is on creation of digital educational materials. The next stage will be aimed at increasing their availability, application and measurement of effects, as well as establishing an ecosystem of open educational practices.

Building an ecosystem of open educational resources means defining measures and implementing activities that will, among other things, influence the increase in the number of quality open educational resources, influence the increase in the degree of application of existing open educational resources (better searchability, greater visibility, new functionalities, higher quality resources), and better integration of resources in the process of teaching and learning, especially in the process of online and hybrid teaching. Ecosystem also means designing new measures through a consultative process with stakeholders to improve the quality of digital education and education in general. The principle on which all these activities and measures are based is the principle of openness in education.

A number of important repositories of open educational resources have been developed in this area so far. They contain learning objects intended for pre-university education, such as: “Creative school”, “Digital classroom”, “Learned at the seminar – applied in practice”, “Examples of successful extracurricular activities”. , “NOP - National Education Portal”, video lessons, “My School” Moodle portal, “Digital Class”, “CASA-NARA”, “Magic in the hands of the teacher”, “Net-classroom – Loop”⁶.

Recommendations and guidelines have been published: *Open educational resources*, Institute for the evaluation of quality of education and upbringing, 2022 (Gajin et al., 2022). Development of the Digital Open Educational Resources⁷ repository has begun using the DSpace software, which will contain collections of repositories intended for pre-university education.

Initiatives related to the improvement of the OER quality assurance process are deemed a priority. Quality assurance is considered a key component of the development of open educational resources, to ensure that the resources meet certain standards and are reliable, efficient and accessible to students.

International education policies and practices that encourage implementation of quality open educational resources – evaluation models

Open Educational Practices which encourage the creation, use and reuse of high-quality open educational materials and innovative pedagogical models have been part of educational policies for over a decade. The idea of OER is spread through a series of declarations, statements and initiatives such as: Guidelines for Open Educational Resources in Higher Education (UNESCO, 2011); The Paris Declaration on Open Educational Resources (UNESCO, 2012); Opening up education: Innovative teaching and learning for all through new technologies and open educational resources (European Commission, 2013), The Hague Declaration on Knowledge Discovery in the Digital Age (Hague Declaration, 2014).

It is necessary to point out that UNESCO adopted *Guidelines for Open Educational Resources*⁸ at the annual assembly in Paris, 2019, which further promote the concept of education for all and support development and sharing of open educational resources for teaching and learning, which are of invaluable benefit to students, teachers and researchers alike. At the international level, the Guidelines promote creation, use and adaptation of quality open educational resources. In addition to the

⁶ Original titles: „Креативна школа“, „Дигитална учионица“, „Сазнали на семинару - применили у пракси“, „Примери успешних ваннаставних активности“, „НОП - Национални образовни портал“, видео лекције, „Моја школа“ Moodle портал, „Дигитални час“, „CASA-NARA“, „Магија у рукама наставника“, „Нет-кабинет – Петља“(translator’s note).

⁷ Original acronym: ДООП (t/n).

⁸ <https://www.unesco.org/en/legal-affairs/recommendation-open-educational-resources-oer>

above, they emphasise the importance of adopting policies that not only support open educational resources, but also encourage the development of sustainable models of open educational resources.

The goal of creating repositories containing OER is to provide long-term access to the management of digital resources, for the benefit of current and future users, design of which is in accordance with the adopted conventions and standards in order to ensure continuous management and quality of resources, easy access to materials, security, as well as establishing a methodology for evaluating systems that meet expectations regarding relevance and reliability.

Observed in international frameworks, the ways of evaluating open educational resources for the purpose of quality assurance are usually implemented through three models (Zawacki-Richter et al., 2022): the top-down model, the model at the institutional level and the bottom-up model,

The top-down model implies the evaluation of OER by institutions towards users. This model is present in countries such as China, South Korea, Turkey, India and Canada (several provinces have made joint regulations), whose mechanisms for ensuring the quality of OER are derived from national regulations.

The model at the institutional level (Miao et al., 2019: 35-37) implies independent institutional guidelines for ensuring the quality of OER and is more closely related to the overall institutional strategy. This model is implemented at the University of South Africa (UNISA), University of Edinburgh (Scotland), University of Louvain (Belgium), Delft University of Technology (Netherlands), and Southern Alberta Institute of Technology (SAIT) in Calgary (Canada). Some state colleges in America are developing a study programme, called a Z degree (zero-textbook-cost degree), which students acquire by learning from OER. This initiative seeks to reduce attrition and increase the number of graduates by engaging faculties to redesign study and degree programmes by replacing original teaching materials with OER. The short-term goal is to reduce costs for students and accelerate their progress through university, but an important secondary goal is to change the culture of institutions so that systems and structures are created to better connect the curriculum and open pedagogy with updated learning outcomes. Another example is the Community College Consortium for Open Educational Resources, with members in twenty-seven US states and two Canadian provinces. Their mission is to promote the adoption of open education to improve teaching and learning at universities of social and technical studies. Students should have equal access to high-quality educational materials to achieve their academic goals.

The bottom-up model starts with individuals working on OER. These initiatives are project-based, and their development begins on a smaller scale with pilot projects. The analysis of what has been achieved after completion opens up the space for recognising and solving the emerging and discovered challenges, which should be overcome in the following projects in order to enable further progress of OER development. The German system has experimented with the value of OER by promoting projects and pilots (Orr et al., 2017). It is assumed that the success of these

projects could lead to adaptation of a political framework to ensure greater integration of OER into the education system.

A good example of development of open educational practice through quality partnership is the Open Education Practices Scotland – OEPS⁹ project, led by the Open University in Scotland and financially supported by the Scottish Funding Council. While planning the development strategy of the OEPS project, it was necessary to take into account several key factors: engaging in open educational practice from the perspective of social justice; the possibility of building a quality network for the application of digital technologies in learning by experts from Scottish universities and teachers who are organised around the concept of Open Scotland; the absence of points of contact between educational technologist practitioners and the wider educational community; the existence of a small number of licensed open courses; ignorance of examples of good open educational practice and very few users of open online courses and open educational materials; the need to focus on pedagogy rather than technology; the necessity of working in the formal and informal sector, in order to establish good practice (Cannell, 2017).

It should be noted that the OEPS project rests on a partner with rich experience – the Open University in Great Britain, which is known for creating high-quality educational resources. It has maintained a reputation as the leader for development of platforms with open educational materials such as: OpenLearn and FutureLearn.

Another fruitful partnership, within the OEPS project, was a partnership to design resources that support individuals with Parkinson’s disease and their families. This partnership encouraged the development of accessible educational resources ranging from printed materials, online communication, to reflective learning materials and open educational badges that were later used within the project as a verified indicator of interest, progress, knowledge, skills and abilities within academic or work context. The results of this three-year project (2014-2017) include: work with 68 organisations across Scotland (universities, colleges, schools, businesses, unions, organisations) through 79 workshops, 44 presentations, 4 one-day forums, a seminar, a two-day symposium; fifteen new open education licensed courses created by a number of different partners and open education badges for almost all courses.

The findings of the OEPS project (Cannell, 2017) indicate that open educational resources represent a new opportunity for raising the quality of student-centred education (constructivist approach), both in formal and informal education. Furthermore, the necessity is emphasised for a clearer inclusion of open education and open licensing in professional education of teachers, along with need for a critical look at the challenges in this area.

One of the most famous leaders in the publication of open educational resources, since 2001, is MIT (Massachusetts Institute of Technology). Their educational resources confirm the quality and relevance of this institution, but also its contribution to spreading knowledge and increasing the availability of education. OER not only

⁹ Available at: <https://www.open.edu/openlearncreate/course/index.php?categoryid=24>

allow individual educational modules to be completed and improved with additional materials, but they very often allow reviewing and improving or even establishing new quality educational programmes, and even entire study programmes and study systems.

Open access in Croatia dates back to 1997, when the CROSBİ repository of scientific papers was founded. The Croatian Declaration on Open Access was adopted in 2012. Today, there are more than 130 institutional, 4 university and 2 national open access repositories in Croatia. They are available in three systems: Directory of Open Access Repositories (OpenDOAR): 120 repositories; Aggregator of Croatian repositories and archives (Ara): 142 repositories; and Digital academic archives and repositories (Dabar): 137 repositories (SRCE, 2023).

Under the auspices of the Croatian Ministry of Education and Science, CARNET was the host of the project for the construction of digital educational resources Edutorij. This repository of digital educational resources was created as part of the *e-School project: Establishing a system for the development of digitally mature schools* (2015-2022), which enables the publication, access, storage and exchange of digital educational resources (manuals, textbooks, books, home readers, practice books, workbooks, atlases, online courses, educational games, learning scenarios and lesson plans, lectures and scripts, final and seminar papers, educational modules, books of proceedings, journals, as well as all other materials related to education and syllabuses), created primarily by teachers and students of Croatian primary and secondary schools, but also by experts from other educational institutions. In addition to those materials, Edutory also contains educational resources created on other CARNET systems and platforms, as well as those created within the activities of publishing houses. The users of Edutorij are primarily teachers and students of Croatian primary and secondary schools, but also employees of faculties, institutes, as well as all those who have an electronic identity in the AAI@EduHr system. It is necessary for authors, if they want their educational resources to be adequately presented, recognisable and easily accessible to other users, to enter as much metadata as possible, which enables the fastest and easiest way to reach the resources the user is looking for during the search.

For this reason, a unique system of awarding digital award badges was designed and established, which visually convey how well and into detail an individual author has described their materials. The badges that the author can win are bronze (50% metadata entered), silver (70%) and gold (90%). The system of awarding badges is visible when entering new material and is displayed in the form of a scale marked with percentages won. Given that some metadata is entered automatically, all authors start with the already won 37%, and for each new entered data (mandatory, recommended or optional), additional points are won according to the following criteria: attaching the material and entering mandatory metadata (50%); entering all recommended metadata (30%) and entering optional metadata (20%).

Evaluation of the quality of the resources in the Edutorij repository is conducted by peer review. The repository allows the author to send their material for evaluation

upon publication to other experts in the same field, i.e. to teachers who indicated in their profiles that they teach those subjects. Participation in the professional evaluation process is only possible for school employees, as well as teachers who are registered outside the AAI@EduHr system, such as retired teachers. After reviewing the material, evaluators (peer reviewers) can write their comments to the author (who may or may not act upon them) and give the educational material their rating in stars for three areas: 1) expertise; 2) pedagogical aspect; 3) use of technology. Publishers, students and other users of the repository cannot give a professional rating¹⁰.

The relationship between quality standards of textbooks, electronic supplementary materials, digital textbooks and open educational resources

The education policy in the Republic of Serbia clearly defines and regulates the market of textbooks and textbook sets, manuals and teaching materials, supplementary materials and teaching aids for primary and secondary schools. The Rulebook on textbook quality standards and instructions on their use (Official Gazette of RS, No. 42/2016 and 45/2018) determine the quality standards that must be met by textbooks, electronic supplements, manuals and teaching materials, additional teaching aids, didactic and didactic game-based materials, which are approved for use in pre-school, primary and secondary education, based on the legally prescribed procedure.

The Rulebook defines five quality standards:

1. The content of the textbook is relevant for the curriculum implementation;
2. The textbook encourages student development and enables independent learning;
3. The textbook is designed in accordance with didactic-methodological requirements;
4. The language of the textbook is appropriate and functional; and
5. The visual, graphic and technical design of the textbook make it easy to use.

Each of the mentioned standards is accompanied by quality indicators. The number of indicators per standard ranges from five to nine. The quality of textbooks is assessed based on the fulfilment of quality standards. If one of the indicators is not satisfied, the textbook will not be approved by the evaluator.

The electronic supplement, as stated by the Textbooks Act, accompanies the textbook, which means that it is not an independent teaching resource and should not be equated with a textbook that is provided in an electronic medium. Its content, volume and functions can be very different. The author has freedom in creating the supplement (not all contents from the textbook need to be represented), but the way it is prepared must ensure interactivity and maximum usability of all the advantages of the medium in terms of encouraging independence in learning, checking and expanding knowledge and skills, as well as creative work.

¹⁰ <https://edutorij.e-skole.hr/share/page/static?pageId=faq>

Textbooks Act stipulates that the approved textbook must be adapted for students with developmental and physical disabilities in terms of content, font or format. The method of adjustment is prescribed by the minister. The adapted textbook is evaluated based on the fulfilment of textbook quality standards and the fulfilment of the additional indicators. For children and students with developmental and physical disabilities, the textbook is prepared in accordance with their needs and capabilities. To carry out educational work with visually impaired children and students, the textbook is issued in Braille, in electronic form or in adapted formats (page content printed enlarged, photos processed for the needs of visually impaired students, photographic enlargements, relief drawings, diagrams, maps, sound records or other forms or mediums).

Unlike printed textbook, digital textbook is a didactically designed teaching tool in digital form, which is used on a digital device in educational work, and which enables students' independent knowledge construction, taking into account their characteristics. Pešikan and Lalović (2023:23) propose six categories of standards for digital textbooks and supporting digital educational materials:

1. Textbook and curriculum (the textbook contributes to the achievement of the general goals of academic and pedagogical education; textbook is aligned with the goals and outcomes of the syllabus; content of the textbook is up-to-date and adequately presented; volume of the textbook is adequate, there is a balance between depth and breadth in content construction);
2. Structure and didactic organisation of the textbook content (textbook contains instructions for use; textbook content is clearly organised; textbook content is coherent; keywords, key concepts and unfamiliar words are marked in the text);
3. Learning and the textbook (textbook represents a model of successful learning, and it guides and directs the student in the learning process; textbook offers a variety of learning activities, which are in alignment with goals and outcomes of the subject and students' developmental possibilities, competencies and prior knowledge; student monitoring of their own progress and achievement check are ensured);
4. Language of the textbook (textbook is written in accordance with grammar and spelling norms of the standard literary language; textbook is adapted to age and language abilities of the students);
5. Pedagogical use of digital functions (interactive activities and multimedia content encourage and facilitate learning; there is an appropriate balance between text and multimedia content and/or interactive tasks); and
6. Technical and functional requirements (digital textbook must be compatible with computer devices and modern operating systems; all hyperlinks are valid and all copyright respected; digital textbook is easy and simple for students to use; other technical and technological requirements of the digital textbook work well).

Pešikan and Lalović (2023: 64) state that the purpose of standards and quality assessment procedures for both *digital textbooks* and *supplementary educational digital materials* is to answer the question whether, and to what extent, they contribute to learning and achieving the learning goals of the subject for which they are intended, i.e. whether and to what extent they support and encourage students' (independent) knowledge construction. That is why the purpose of quality standards in this area is not to look for mistakes, but rather to eliminate those mistakes that impede the learning process in a way that can call into question the basic purpose of these or any teaching resources – quality teaching and learning.

Although open educational resources are not the same as a digital textbook, they share certain pedagogical implications – they can be used in the teaching and learning process if they are adequately aligned with the goals and outcomes of the subject for which they are intended, i.e. if their content is such that they encourage and support the construction of students' knowledge. Bearing the same basic goal in mind, we believe that some other postulates of digital textbooks quality can also be applied to the practice of quality assurance related to open educational resources.

Namely, OER quality standards should not be a measure of ideal OER. These standards should be formulated in a way to clearly represent the quality *threshold* that every OER must “cross”, without compromising on educational materials that can be harmful to students' learning and development. Such quality standards provide a framework, but also leave enough freedom for the authors to design creative didactic-methodological-technological solutions that will facilitate and improve the teaching and learning process. In reference literature (Gajin et al. 2022) which focuses on the OER quality assurance in repositories, the meta-analysis by Atens and Haveman (2013) is often reinterpreted. Google Scholar¹¹ provides 92 citations of this meta-analysis in which the cited authors provide an overview of quality assurance indicators from 80 analysed OER repositories.

In Table 1, which we reworked for the purposes of this report, we can see a set of ten quality assurance indicators with descriptions derived from examples of good practice (which promote openness and key principles (themes) such as: search, sharing, reuse and collaboration).

In order for the existing OER to be found and used, they need to be easy to search and download. Since the materials are stored in repositories, the search and retrieval functionality (within the interface, via an OER aggregation service, or via a search engine such as Google) is crucial. Sharing is the activity of education personnel who convert learning resources into OER and share it by uploading it to a repository. The role of repositories is not only to enable sharing of resources, but also to facilitate and encourage sharing. Reuse of resources must be allowed and simple. Given that, it is necessary to work on the improvement of educational practice, i.e. on reduction of obstacles and resistance. We can say that a quality OER repository is not only a base of online resources, but a place for collaboration: knowledge exchange, evaluation

¹¹ More details: https://scholar.google.com/scholar?cites=694716450406119633&as_sdt=2005&sciodt=0,5&hl=sr, [Retrieved: 28/11/2023].

and co-creation. Through the possibility of social interaction, OER can be viewed, commented on and rated.

In Table 1, the social characteristics (DC) are those related to the tools that enable social interaction within the repository, while technical characteristics (TC) refer to the design and functionality of the repository interface (Atenas, Havemann, 2013).

Table 1 OER repositories quality assurance indicators (Adapted according to: Atenas, Havemann 2013)

| Indicators of Quality Assurance | Description | Principles | DC, TC |
|---------------------------------|--|-----------------------------------|--------|
| Featured resources | Ability of featuring resources that are potentially of high interest to teachers because of their design or content. | Search, Share, Collaborate | DC |
| User evaluation tools | Tools for the resources to be evaluated by users aiming to rate a resource. | Collaborate | DC |
| Peer Review | Peer review as policy to revise and analyse each resource to ensure its quality. | Collaborate | DC |
| Authorship | Analyse if the repositories include the name of the author(s) of the resources. | Search, Reuse | DC |
| Keywords | Methodically describe the resources to facilitate the retrieval of the materials within certain specific subject areas. | Search | TC |
| Metadata | Introduce standardised formats of metadata (Dublin Core - IEEE LOM - OAIPMH) for interoperability | Search, Share, Reuse | TC |
| Multilingual support | Design the interface in a multilingual way to widen the scope of users by allowing them to perform search of content in different languages. | Search, Share, Reuse, Collaborate | TC |
| Social Media support | Introduce social media tools to enable users to share the resources within social media platforms. | Search, Share, Reuse, Collaborate | DC, TC |
| Creative Commons Licences | Specify the type of Creative Commons Licence per resource or give information about the specific type of licence for all the resources. | Search, Reuse, Collaborate | TK |
| Source Code or Original Files | Allow downloading the original files or source code of resources so they can be adapted. | Reuse, Collaborate | TK |

We find the quality indicators from Table 1 unique compared to the quality indicators of printed and digital textbooks, as well as e-supplements.

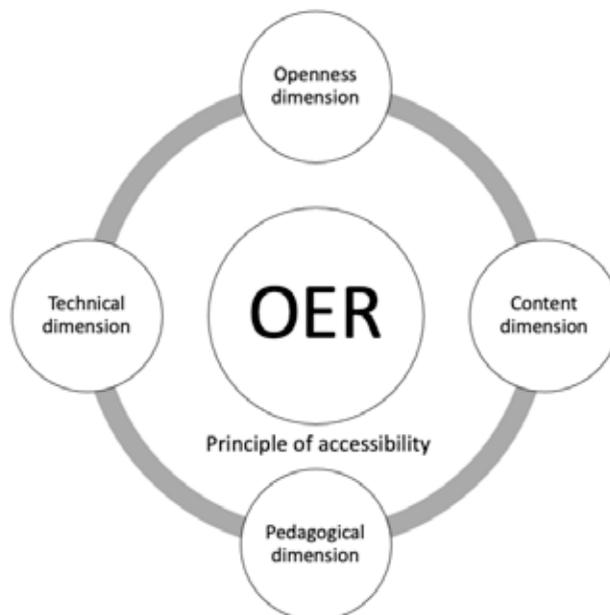
The OER quality verification, with the elements that we can see above, is also mentioned by other authors related to printed and digital textbooks. Thus, Elias and

colleagues (Elias et al, 2020) distinguish: the structure of educational material (clear taxonomy, simple navigation, adaptability of the structure, the possibility of finding material); learning content (text quality, content compatibility with different devices, accessibility of presented content, multilingual content) and self-evaluation (there is content for self-evaluation; availability of answers, average number of questions related to content, e.g. number of questions for each learning objective).

We can say that we share the opinion with some authors who consider that concept related to the construction of software quality standards (Almendro & Silveira, 2018), mobile applications (Ristić & Blagadanić, 2017), printed and digital textbooks and textbook supplements can be one of the signposts in the process of construction of OER quality assurance.

Proposal of a multidimensional model of OER quality standards

Based on the analysis of the existing policy and practice of OER quality assurance, the relevant scientific and professional literature on the evaluation of OER (Velázquez, according to: Almendro & Silveira, 2018), the analysis of the relationship between the quality standards for printed textbooks, e-supplements, digital textbooks and OER, a multidimensional model of OER quality standards was created, as shown in Graph 1. It consists of the: 1) openness dimension; 2) content dimension; 3) pedagogical dimension and 4) technical dimension. It is important to underline that each of these dimensions rely on the accessibility dimension. This multidimensional model is inspired by a graphical representation of technical, pedagogical and content dimensions of OER (Velázquez, according to: Almendro & Silveira, 2018).



Graph 1 *Multidimensional representation of OER quality standards*

Openness dimension

Key issues regarding the dimension of openness include free access to educational materials that are available to all (Inamorato dos Santos et. al., 2016), openness of the material, licensing system and authorship, metadata description of material, user feedback, keyword search enabled (Atenas & Havemann, 2013).

Educational materials can be: 1) individual educational digital materials in digital format (mp3; mp4; doc/docx; pdf; ppt/pptx/pps; jpg; png; xsl/slsx, etc.) which include recordings of lectures, lecture notes, learning materials, textbooks, individual modules, workbooks, online tutorials, interactive tasks, lesson plans, charts, tests, or any other materials prepared for learning and teaching purposes, and 2) entire educational online programmes (massive open online courses) available through university consortia such as: Coursera, Udacity and others.

Openness represents the freedom to manage educational resources. There are five levels of openness, known in literature (Bliss, & Tuiloma, 2022) as the 5Rs:

- Retain – make, own, and control a copy of the resource (e.g., download and keep your own copy);
- Revise – edit, adapt, and modify a copy of the resource (e.g., translate into another language);
- Remix – combine an original or revised copy of the resource with other existing material to create something new (e.g., make a mashup);
- Reuse – use an original, revised, or remixed copy of the resource publicly (e.g., on a website, in a presentation, in a class);
- Redistribute – share copies of an original, revised, or remixed copy of the resource with others (e.g., post a copy online or give one to a friend).

The licensing system being increasingly used worldwide for the publication of open educational resources is the Creative Commons (CC) licences. They provide rights of use and enable distribution, modification and redesign of the author's work under several conditions: naming the original author (BY); sharing with no commercial profit (NC); sharing as no derivative copies (ND); sharing alike, i.e. under the same conditions as the original work (SA); dedicating a work to the public domain (CC0). Compliance with the mentioned attributes is mandatory if they are included in the licence. CC BY is *the most liberal* licence for the user as the only condition for using the work is to credit the original author. Licences with the ND (no derivatives) attribution do not permit any adaptations of the material itself, so a material with this attribute is not considered OER. The openness of the material and the fact that it can be openly and freely accessed via OER does not make the material less valuable and does not mean that its creation was not planned or based on relevant sources. An example of important material publication under the CC0 – public domain licence is the publication of the Europeana multimedia library (<https://www.europeana.eu/en>), which published 20 million records as public domain in 2012 (Kučina-Softić & Rako, 2018: 135).

Gathering feedback from students and teachers who use OER can help identify areas for improvement and ensure that resources meet their needs. This feedback can be used to revise OER and improve its quality over time. An indicator of quality assurance (Atenas & Havemann, 2013) is derived from OER integrated evaluation tools (evaluation by users) and an applied assessment policy (Peer Reviews) by professional members of the public.

Content dimension

Through its clear and logical structure, digital OER should contribute to the achievement of learning outcomes of a subject. Texts, images, graphics, 3D graphics, audio recordings, video recordings or animations must serve the purpose of presenting the content in the best possible way and understanding it alike. Links and QR codes leading to the internet content must be active and functional, and aligned with the course syllabus. The software in which OER content is created must support functions of the operating system (e.g. zoom, text-to-speech, etc.) and comply with assistive technology in order for the OER to be accessible. If a textual description (narration) is added to non-textual OER elements, such as images, OER will be even more approachable.

Pedagogical dimension

OER should be designed bearing specific pedagogical principles in mind, such as active learning, learner-centeredness, and engagement. These principles help ensure that students are able to interact with the resources in a desired way and achieve their learning goals.

The pedagogical dimension of OER includes instructional design (based on learning theories: behaviourism, cognitivism, constructivism, connectivism) that can be decisive for the quality of OER. When designing OER, it is desirable to apply some of the instructional design elements (e.g. the ADDI model or the IDL model). When designing OER, one should keep in mind the target group of OER users (pupils, students, employees) and how to best support them.

Technical dimension

OER should be developed to meet specific technical standards, such as interoperability and metadata standards (Dublin Core, IEEE LOM, OAI-PMH), which help ensure that resources can be easily shared and found by students and teachers. Technical dimension includes the high quality of multimedia devices implemented in OER, as well as simple and transparent navigation in interactive programmed OER.

There are many software solutions available for creating open educational resources. These can be:

1. Learning management systems, which allow teachers to create online courses. The examples are: Moodle, Office 365 Platform, Canvas, and Blackboard. These platforms, now increasingly based on AI tools, can also be used to create and share OER with students.

2. Educational material management systems allow teachers to manage digital material, such as text, images, audio and video records. Examples are WordPress and Drupal. These platforms can be used to create and share OER.
3. Authoring tools such as Articulate Storyline, Adobe Captivate, and Lectora also enable the creation of OER.
4. Social media platforms can also be used to share OER and interact with students. However, the application of these software solutions raises issues of privacy, security and data management, so they are not recommended for the educational community.

The choice of software solution will depend on specific needs and goals. For professional applications, specialised repository platforms are most commonly used, such as e.g. DSpace. It is an open-source software solution that has a number of functionalities that repositories imply, including the possibility of automatic meta-data exchange in the Dublin Core specification via the OAI-PMH protocol.

Moodle is a popular open-source learning management system that also includes DSpace integration. Teachers can use Moodle to create and share OER, and students can access materials directly from the Moodle platform. Apart from that possibility, MoodleNet is also in use as a shared open code platform that can be used in two ways – as a central MoodleNet service or by setting up your own instance of MoodleNet. The central MoodleNet service contains OERs that are directly added to it by individuals or institutions that develop them, as well as OERs from other instances of the MoodleNet platform that are connected with it, therefore creating the potential to use these resources in millions of courses with one click. MoodleNet is an integral part of the Moodle ecosystem and is closely related to the Moodle learning management system, and its version for business users (Moodle Workplace). On the other hand, it can also be used completely independently in combination with any other system for developing/displaying educational materials because resources are easily retrieved and referenced from it.

Another software solution compatible with DSpace software is Islandora. It allows teachers to manage and share OER, and includes functions such as metadata management, version control and access control.

Principle of accessibility

It is necessary to ensure that open educational resources are available to all students, including those with additional educational needs. If the goal of OER is to be widely available, then accessibility considerations must be at the forefront during the development stages. Based on a literature source (Chambers, 2022: 6), ten key elements were selected that should be taken into account when developing accessible OER.

1. **Software used to create the OER** – Compatible with assistive technology; Does not disable features (i.e., zoom, text-to-speech) of the computer's operating system.

2. **Non-Text items/ Images** – Include text descriptions for all images/non-text items.
3. **Use of colour** – Use alternative means (i.e., pattern) rather than colour to differentiate content where needed.
4. **Text** – Ensure accurate optical character recognition (OCR) for all text, so that it can be accessed by screen readers, PDF.
5. **Format** – Ensure content can be read by a range of assistive technology, such as DAISY or refreshable Braille.
6. **Multimedia/Video/Audio** – Use closed captions and/or transcripts to relay content.
7. **Links** – Links are distinguished by means other than colour (i.e., box, text label).
8. **Contrast** – Must have sufficient contrast between text and background.
9. **Form Fields** – Form fields have appropriate text labels.
10. **Font** – Font size and colour should be adjustable.

Over ten years ago, it was considered that when developing platforms, tools and devices, it is useful to initially consider principles of accessibility for web access (WebAIM, 2013). These principles are: Perceivable (has to be able to be accessed by the brain – sight, hearing, touch); Operable (content can be navigated through multiple methods – mouse, keyboard, assistive technology); Understandable (using simple language and explaining background information – use of alternative/supplemental content such as graphics and illustrations); Robust (as much as possible, the content is compatible with a wide variety of browsers and screen).

Based on our experience and earlier research (Ristić, 2017), we can say that in order to create the dimension of accessibility, it is necessary for educational institutions to be fully digitally mature.

About the instrument for OER quality evaluation

An instrument for evaluating four areas emerged from the multidimensional model based on the education system in Serbia: openness dimension, content dimension, pedagogical dimension and technical dimension.

1. The OER quality indicators for the dimension of openness are: 1. it is published in an open format (most often with a Creative Commons Licence) and 2. it is a free educational material in digital form. The evaluator can choose an option (by entering the + sign in the appropriate YES or NO column of the form), as the indicator of satisfaction.
2. OER quality indicators for the content dimension are: 1. it has a prominent purpose and ways of use (in the resource and/or through the metadata description); 2. it is based on scientifically confirmed facts, interpretations, conclusions; current data and modern achievements; 3. it contains correctly cited literature sources;

4. it has functional hyperlinks and/or QR codes. 5. it has a clear and logical structure, and 6. it respects the linguistic and spelling norms of the language in which it is written. The evaluator has three options, in addition to choosing YES and NO, they can choose the N/A option (the indicator is not applicable and does not affect the assessment of the standard fulfilment). For indicators 5 and 6, the YES indicator has two subcategories: *completely* or *to a large extent*.
3. OER quality indicators for the pedagogical dimension are: 1. it is aligned with the goals and learning outcomes (which are visible in the resource and/or through the metadata description); 2. it is appropriate to the development characteristics of the user in the context of volume and complexity; 3. it is designed to suit active construction of knowledge, and 4. it is designed to suit the development of learners' reflective practice. For all indicators, the evaluator can choose the option YES with the subcategories *completely* or *to a large extent*; NO, and N/A.
 4. OER quality indicators for the technical dimension are: 1. it has a simple user interface and intuitive navigation; 2. it enables easy download, use and sharing; 3. it can be used without additional installation of commercial programmes or programme plugins; 4. it enables adaptable screen displays on different digital devices (computer, tablet, mobile phone), and 5. it enables clear readability, high-quality noise-free sound and a satisfactory quality of images and videos.

The evaluator of OER quality standards indicators can rate them as: YES (if the indicator is fulfilled), with subvariants *completely* and *to a large extent* (for indicators 2.5, 3.1, 3.2, 3.3, 3.4 and 4.1); NO (if the indicator is not fulfilled) or N/A (the indicator is not applicable and does not affect the assessment of the standard fulfilment). It is necessary for the evaluators to write an explanation for each area (dimension), in which they will state the reasons why they assigned YES, NO, or N/A for the indicators within that area.

If the *principle of accessibility* is applied to OER (as Serbia is in the early stages of creating OER), it is necessary for the evaluator to write an explanation in which they will explain which segments of this principle are represented and in what way. The segments are: 1. It contains graphic and multimedia elements accompanied by a name or explanation; 2. It has hyperlinks that differ from the rest of the text, not only by their colour and by being underlined, but also by some other features (e.g. a frame); 3. It supports the operating system functions (e.g. zoom, text-to-speech, etc.) and compliance with assistive technology, and 4. Non-textual OER elements such as images include textual descriptions (accessibility dimension).

It is essential that the OER being evaluated respect the laws of the Republic of Serbia, support equality, promote social cohesion, and inclusiveness, and not discriminate on any basis. The rubrics in the *Form for evaluating the quality of open educational resources* refer to individual educational materials in the format of a digital record (lecture recordings, lecture notes, learning materials, textbooks, modules, workbooks, online tutorials, interactive tasks, lesson plans, charts, tests or any other materials prepared for learning and teaching purposes), as well as entire educational online programmes.

Conclusion

Based on everything analysed, we can conclude that OER can be used in the teaching and learning process if they are adequately aligned with the goals and outcomes of the subject for which they are intended, i.e. if their content is such that they encourage and support students' knowledge construction. OER represent a new possibility for raising the quality of education that is student-centred (constructivist approach), both in formal and informal education.

The proposed multidimensional model for evaluating OER quality standards in Serbia consists of the: openness dimension, content dimension, pedagogical dimension and technical dimension. It can support the development of quality digital content for online and distance learning because it simultaneously provides quality framework and an instrument for evaluation, but also leaves enough freedom for authors to design creative didactic-methodological-technological solutions that will facilitate and improve the teaching and learning process. If OER are to be widely available, accessibility considerations must be brought to the forefront during the development stages.

We can conclude that OER quality standards and evaluation instruments should be formulated in a way to clearly represent the quality threshold that each OER must "cross", without compromising on educational materials that may be harmful to students' learning and development. Digital maturity of educational institutions is an imperative that includes leadership/management and vision, contexts, ICT infrastructure, resources, curriculum and technology learning support. It points to the necessity of a clearer and constant inclusion of open education and open licensing in the professional education of teachers, along with the necessity for a critical view of the challenges that exist in this area.

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Propozycja wielowymiarowego modelu do oceny standardów jakości otwartych zasobów edukacyjnych OZE

Wzrost liczby cyfrowych repozytoriów otwartych zasobów edukacyjnych (OZE), wspierających formalne, nieformalne i ustawiczne uczenie się, sprawia, że kwestia jakości OZE staje się coraz ważniejsza i bardziej aktualna. Celem artykułu jest zaproponowanie wielowymiarowego modelu oceny standardów jakości OZE w Serbii, w celu wsparcia rozwoju wysokiej jakości treści cyfrowych do celów kształcenia online i zdalnego. Po przeanalizowaniu krajowych i międzynarodowych polityk oraz praktyk, które zachęcają do wdrażania wysokiej jakości OZE, przeprowadzono analizę odpowiedniej literatury przedmiotu na temat oceny OZE, a także analizę związku pomiędzy standardami jakości stosowanymi wobec podręczników drukowanych, suplementów elektronicznych, podręczników cyfrowych i standardami stosowanymi wobec OZE. Stosując metodę modelowania i studium przypadku, przedstawiliśmy wielowymiarowy model oceny standardów jakości, na który składają się: wymiar otwartości, wymiar treści, wymiar pedagogiczny i wymiar techniczny. Należy podkreślić, że jeśli chcemy, aby OZE były dostępne dla wszystkich, którzy chcą się uczyć, w tym dla osób ze szczególnymi potrzebami edukacyjnymi, każdy z tych wymiarów powinien opierać się na wymiarze dostępności.

Na podstawie przeprowadzonych analiz możemy stwierdzić, że OZE można wykorzystywać w procesie nauczania i uczenia się, jeśli są one odpowiednio dostosowane do celów i zamierzonych rezultatów przedmiotu nauczania, dla którego są przeznaczone, tzn. jeśli ich treść jest taka, że zachęcają i wspierają budowanie wiedzy. OZE stanowią nową szansę na podniesienie jakości kształcenia skoncentrowanego na uczniu (podejście konstruktywistyczne) zarówno w edukacji formalnej, jak i nieformalnej. OZE same w sobie nie powinny być wzorcem dla idealnych/modelowych OZE. Standardy jakości OZE i narzędzia oceny powinny być sformułowane w taki sposób, aby wyraźnie przedstawiały próg jakości, który każde OZE musi „przekroczyć”, nie generując lub nie zawierając przy tym materiałów edukacyjnych, które mogą mieć negatywny wpływ na uczenie się i rozwój uczniów. Takie standardy jakości, podobnie jak proponowany wielowymiarowy model, powinny stanowić ramy, ale także pozostawiać autorom wystarczającą swobodę, umożliwiającą zaprojektowanie kreatywnych rozwiązań dydaktyczno-metodyczno-technologicznych, które ułatwią i usprawnią proces nauczania oraz uczenia się. Jednocześnie niezwykle istotne jest, aby otwarta edukacja i otwarte licencjonowanie były stale uwzględniane w kształceniu zawodowym nauczycieli, przy czym należy krytycznie podchodzić do wyzwań, jakie istnieją w tym obszarze.

Słowa kluczowe: Otwarte Zasoby Edukacyjne (OZE); standardy jakości; model wielowymiarowy; edukacja, uczenie się.

Предлог вишедимензионалног модела за вредновање стандарда квалитета ООР-а

Повећање дигиталних репозиторијума Отворених образовних ресурса (ООР) (енг. *Open Educational Resources* (OER)) за подршку формалном, неформалном и целоживотном учењу даје на значају и актуелности питању квалитета ООР. Циљ рада је предлог вишедимензионалног модела за вредновање стандарда квалитета ООР у Србији у функцији подршке развоју квалитетних дигиталних садржаја за онлајн учење и учење на даљину. Након анализе националне и међународне политике и праксе које подстичу имплементацију квалитетних ООР, вршена је анализа релевантне литературе о вредновању ООР као и анализа односа стандарда квалитета штампаних уџбеника, е-додатака, дигиталних уџбеника и ООР. Методом моделовања и студије случаја дошли смо до предлога вишедимензионалног модела за вредновање стандарда квалитета који се састоји из: димензије отворености, димензије садржаја, педагошке димензије и техничке димензије. Важно је подвући да свака од ових димензија треба да се ослања на димензију приступачности уколико желимо да ООР буду доступни свима који желе да уче, укључујући и оне са додатним образовним потребама.

На основу свега анализираног можемо закључити да се ООР могу користити у процесу наставе и учења уколико су адекватно усклађени са циљевима и исходима наставног предмета за који су намењени, односно уколико им је садржај такав да подстичу и подржавају изградњу знања. ООР представљају нову могућност за подизање квалитета образовања које је усмерено ка ученику (конструктивистички приступ), како у формалном, тако и у неформалном образовању. ООР не треба да буду мера за идеалан ООР. Стандарди квалитета ООР и инструменти за вредновање треба да буду формулисани тако да јасно представе праг квалитета који мора да “прескочи” сваки ООР, без компромиса у погледу образовних материјала који могу да буду штетни по учење и развој ученика. Такви стандарди квалитета, као предложени вишедимензионални модел, треба да дају оквир, али и остављају довољно слободе ауторима да осмисле креативна дидактичко-методичко-технолошка решења која ће олакшати и побољшати процес наставе и учења. Истовремено суштински је важно константно укључивање отвореног образовања и отвореног лиценцирања у професионално образовање наставника, уз неопходност критичког сагледавања изазова који постоје у овај области.

Кључне речи: отворени образовни ресурси (ООР); стандарди квалитета; вишедимензионални модел; образовање; учење.

Prijedlog višedimenzionalnog modela vrednovanja standarda kvalitete otvorenih obrazovnih resursa

Povećanje broja otvorenih digitalnih repozitorija obrazovnih resursa (OOR) kontinuirano raste. Njihova ulogu u procesu formalnog i neformalnog obrazovanja te osobito kao podrška cjeloživotnom učenju dodatno naglašava važnost njihove kvalitete.

U ovom radu predlaže se višedimenzionalan evaluacijski model standarda kvalitete OOR u Srbiji u funkciji podrške razvoju kvalitetnih digitalnih sadržaja za online učenje i učenje na daljinu. Nakon analize nacionalnih i međunarodnih javnih obrazovnih politika i praksi koje zagovaraju primjenu kvalitetnih OOR-a, analizirana je relevantna literatura o vrednovanju OORa te analiza standarda kvalitete tiskanih udžbenika, e-dopune, digitalnih udžbenika i OOR. Primjenom metode modeliranja i studije slučaja, predložen je višedimenzionalni model vrednovanja standarda kvalitete. Model obuhvaća dimenzije otvorenosti i sadržaja te tehničke i pedagoške dimenzije. Pristupačnost OOR svima koji žele učiti, uključujući i pojedince sa specifičnim obrazovnim potrebama, je prediktor ostvarivosti svake od navedenih dimenzija.

Provedena analiza opravdava zaključak da se OOR mogu koristiti u procesu učenja i poučavanja ako su primjereno usklađeni s obrazovnim ciljevima i ishodima te sadržajem potiču i podržavaju konstrukciju znanja. OOR omogućavaju konstruktivistički pristup obrazovanja usmjerenog na pojedinca u okviru formalnog i neformalnog obrazovanja.

Standardi kvalitete OOR i instrumenti evaluacije trebali bi jasno formulirati okvir kvalitete koji svaki OOR mora ispunjavati bez sadržaja koji bi mogli biti (potencijalno) ugrožavajući za pojedinca, njegov razvoj i učenje. Standardi kvalitete, predloženi ovim modelom, daju okvir ali i ostavljaju dovoljno slobode za osmišljavanje kreativnih didaktičko-metodičkih i tehnoloških rješenja koja mogu olakšati i unaprijediti proces učenja i poučavanja. Kako bi kvalitetno koristili takve resurse iznimno je važno uključivanje OOR i licenciranja u stručno obrazovanje učitelja uz kritičko sagledavanje izazova koji se javljaju u tom području.

Ključne riječi: otvoreni obrazovni resursi (OOR); standardi kvalitete; obrazovanje; višedimenzionalni model; učenje.