

# Modern technologies and concepts for education II – Open digital resources, MOOC etc.

Tomáš Zeman, Marek Nevosad

## **Annotation**

In the initial part, MOOC courses, their history, recommended structure, platforms (including their features) and actual data are described in more detail. This is followed by a chapter on open educational resource. In the next section, the types of learning objects are briefly described and their basic recommended technical parameters are mentioned. A separate section is dedicated to interactive elements that are typical for online learning materials. The material also describes copyright and licenses that are appropriate for electronic learning objects and program fragments.

## **Objectives**

The aim of the course is to introduce the student to the basic concepts related to the development of electronic educational materials.

## **Keywords**

MOOCs, open digital resources, learning objects, e-learning.

## **Date of Creation**

10. 1. 2022

## **Duration**

30 hours

## **Language**

English

## **License**

## ISBN

## Literature

- [1] Varianty licence Creative Commons. In: *Creative Commons Česká republika [online]*. [cit. 2022-01-10]. Available from: <https://www.creativecommons.cz/licence-cc/varianty-licence/>
- [2] NEUMAJER, O a D RŮŽIČKOVÁ, 2016. Kritéria kvality digitálních vzdělávacích zdrojů podpořených z veřejných rozpočtů. *Metodický portál RVP.CZ [online]*. 18. 8. 2016 [cit. 2022-01-11]. ISSN 1802-4785. Available from: <https://clanky.rvp.cz/clanek/c/Z/21071/KRITERIA-KVALITY-DIGITALNICH-VZDELAVACICH-ZDROJU-PODPORENYCH-Z-VEREJNYCH-ROZPOCTU.html>
- [3] Kredit (školství): ECTS, 2022. In: *Wikipedia: otevřená encyklopedie [online]*. San Francisco (CA): Wikimedia Foundation [cit. 2022-01-11]. Available from: [https://cs.wikipedia.org/wiki/Kredit\\_\(%C5%A1kolstv%C3%AD\)](https://cs.wikipedia.org/wiki/Kredit_(%C5%A1kolstv%C3%AD))
- [1] Definition Massive Open Online Courses (MOOCs), 2015. In: *HOME: Higher education Online: MOOCs the European way [online]*. European Association of Distance Teaching Universities, 12. 3. 2015 [cit. 2022-01-11]. Available from: [https://home.eadtu.eu/images/Results/Definition\\_Massive\\_Open\\_Online\\_Courses.pdf](https://home.eadtu.eu/images/Results/Definition_Massive_Open_Online_Courses.pdf)
- [2] A Brief History of MOOCs. In: *McGill Association of University Teachers: MAUT [online]*. 3495 Peel St., #202, Montréal, Québec, Canada H3A 1W7 [cit. 2022-01-12]. Available from: <https://www.mcgill.ca/maut/news-current-affairs/moocs/history>
- [3] PATRA, Suparn. [2022] The 250 Most Popular Online Courses of All Time. In: *Class Central [online]*. 2022-01-10 [cit. 2022-01-12]. Available from: <https://www.classcentral.com/report/most-popular-online-courses/>
- [4] SHAH, Dhawal. By The Numbers: MOOCs in 2021. In: *Class Central [online]*. 2021-12-01 [cit. 2022-01-12]. Available from: <https://www.classcentral.com/report/mooc-stats-2021/>
- [5] SHAH, Dhawal, Laurie PICKARD a Rui MA. Massive List of MOOC Platforms Around The World in 2022. In: *Class Central [online]*. 2022-01-11 [cit. 2022-01-17]. Available from: <https://www.classcentral.com/report/mooc-platforms/>
- [6] *MOOC list: A complete list of MOOCs and free online courses [online]*. [cit. 2022-01-25]. Available from: <https://www.mooc-list.com/>
- [7] Creative Commons [online]. Available from <https://creativecommons.org/>
- [8] Google LLC. YouTube. Policy, safety, & copyright – Copyright and rights management [online]. Available from <https://support.google.com/youtube/answer/2797468?hl=en>
- [9] Vimeo.com, Inc. Creative Commons [online]. Available from <https://vimeo.com/creativecommons>

- [10] Free Software Foundation. GNU General Public License [online]. Available from <http://www.gnu.org/licenses/gpl-3.0.html>
- [11] Klevetová, D.a Dlabalová, I., Motivační prvky při práci se seniory, Grada, 2008, ISBN 978-80-247-2169-9 [cit. 2022-01-10]
- [12] Škvorová, J. a Škvor, D.: Proč zlobím? lehká mozková dysfunkce LMD/ADHD, Praha: Triton. 2003. ISBN 80-7254-407-1, [cit. 2022-01-10 p. 20]

## CHAPTER 1

# MOOC – introduction to the problem

### DEFINITION

MOOC [4] are courses:

- designed for a large number of participants,
- accessible to anyone with an internet connection, from anywhere,
- open to all with no requirement of initial knowledge, and
- a course is offered completely free.

MOOCs are now an integral part of modern online education. **MOOC** is an English acronym whose meaning is *massive open online course*. The individual words have their own essential meaning.

- **Massive** – the word refers to a large number of students. A MOOC is not for tens or hundreds of people, but for thousands or tens of thousands (or even more in some cases) of students. How can this be achieved? Firstly, the choice of the course language will help: thousands of students can be reached much more easily if the course is in English, for example; on the other hand, courses prepared in Czech may appeal to far fewer people. Furthermore, the course must have an attractive topic, be adequately developed and have a suitable (excellent!) lecturer(s). And it has to be offered in such a way that the information about its existence reaches potential candidates. There is also a theoretical minimum of 150 course participants.
- **Open** – available to all without restriction. What does this mean? No previous knowledge (prerequisites) or education is required to complete the course. This does not mean that every course has to be for beginners; however, it is important that even in an advanced course, enrolment in the course cannot be conditioned, for example, by an entrance test. And openness means in particular that the (whole) course, i.e. all educational content, is free, so the interested person is not limited by lack of money (or unwillingness to spend it). However, there is one big **BUT**. It is indeed free to sign up for the course, browse parts of it and complete the specified activities. Many courses allow you to issue a certificate upon completion and may not be free. Certificate prices vary – often between \$100 and \$200. Any additional fees then depend on the business model of the course – additional services may be offered for money, such as academic tutoring or remedial courses.
- **On-line** – the course is accessible via electronic communication networks and all course-related activities are conducted remotely. This means that the course participant is not limited by his/her current geographical location and can take the course from anywhere. The prerequisite is, of

course, an internet connection and appropriate technical equipment for the course participant. On the other hand, it should be noted that not all activities associated with the course must necessarily be completed online. He/she can download some of the learning materials or objects (if the license allows it) and use them offline according to his/her needs.

- **Course** – the MOOC should contain everything needed to learn the subject, e.g.: learning objectives, syllabus, lesson plans, text documents (scripts), instructional videos, exercises, tests, communication with other course participants (forums, social media), links to other resources. These components of the MOOC are usually organized into teaching weeks; the individual weeks have a similar structure. The minimum course size is 1 ECTS [3], which corresponds to a study effort of 25-30 hours.

## SUMMARY

MOOC means "free online course", which is available to a large number of people without restrictions.

[Interaktivní prvek](#)

[Interaktivní prvek](#)

**Does the MOOC have to be in English?**

---

- yes  
 no

**Can a MOOC include face-to-face activities?**

---

- yes  
 no

**Can a MOOC be charged?**

---

- yes  
 no

**Can enrollment in a MOOC course be conditional on an entrance test?**

---

yes

no

## CHAPTER 2

# History of MOOCs

Leaving aside the predecessors of MOOCs (for example, the first remote education can be considered correspondence courses, which appeared as early as 1840), the first MOOC was introduced in 2008. The course was titled "Connectivism and Connectivity Knowledge" and aimed to take advantage of the interaction among students through online tools providing a more engaging learning environment than traditional tools. Over 2000 students from all over the world participated in the course. The type of MOOC focusing on interaction and connectivity between participants is referred to by the acronym cMOOC (the letter c stands for connectivist).

In 2011, the first truly "massive" MOOC appeared – the topic of artificial intelligence attracted over 160,000 students; however, only one in eight completed the course... Such courses came to be known by the acronym xMOOC (the letter x stands for extended) and focused less on student interaction and more on reaching large numbers of students.

Between 2011 and 2013, the Udacity, Coursera, and edX platforms were established; Udacity later switched to a commercial, fee-based model (so it stopped providing MOOCs, which are by definition free).

The largest number of students [5] enrolled in Coursera courses – more than 4 million students. Udacity and edX both have over a million students.

[Interaktivní prvek](#)

## CHAPTER 3

# Structure of the MOOC

The structure of the MOOC course is not mandatory, however the MOOC should include some of the sections listed below. The course can be divided into:

- descriptive part,
- learning part, and
- final part.



## 3.1 Descriptive part

The descriptive section contains basic information about the course. It is used to decide whether it makes sense for a particular person to register (enroll) in the course. This section is therefore usually accessible without the need to register for the course. In the descriptive part of the course, we will find in particular:

- **Title and introduction of the course** or course topic – incorporation into a broader (scientific) topic.
- **Annotation** – basic information about the course, explanation of which topics will be covered.
- **Learning objectives** – what the student should obtain after completing the MOOC.
- **Course creators and tutors** – the names and professional backgrounds of both the course creators and their tutors (if different) are given; basic information (and/or a links) about the institution (often a university) that guarantees the MOOC is also given.
- **Keywords.**
- **The level of the course** – It is simply stated in levels, e.g.: beginner, intermediate, advanced, expert.
- **Recommended prerequisites** – the knowledge that a candidate should have in order to comfortably complete the MOOC in a given period; however, these prerequisites cannot be a condition for enrollment in the course,
- **Licenses** – information on the general licensing policy and how the learning objects included in the course can be handled; often free [Creative Commons](#) licenses are used [1]; licenses can also be listed for individual learning objects.
- **Certificate** – rules for awarding a certificate or badge; there are also specified fees for awarding a certificate or badge.
- **Timetable** – contains information about when the course opens and closes, information about the expected study time (usually in weeks) and the time requirements (usually in hours of study effort); some courses may open permanently, others may open once; often courses open repeatedly for a certain period of time (e.g. for the duration of a semester or other teaching period).
- **Instructions** – Information on how to use the course correctly; this includes the language of the course, the subtitle languages for the videos and may contain technical information (e.g. whether it is suitable for viewing on a mobile phone, what is the recommended browser, etc.).
- **FAQ** – frequently asked questions about the course and answers to them.

Browse > Physical Science and Engineering > Electrical Engineering

Offered By



# Introduction to Electronics

★★★★☆ 4.7 2,242 ratings



Dr. Bonnie H. Ferri [+1 more instructor](#)

[Go To Course](#)

*Already enrolled*

*Financial aid available*

178,182 already enrolled

[About](#) [Instructors](#) [Syllabus](#) [Reviews](#) [Enrollment Options](#) [FAQ](#)

## About this Course

135,264 recent views

This course introduces students to the basic components of electronics: diodes, transistors, and op amps. It covers the basic operation and some common applications.

Fig. 1. Example of the introductory part of a MOOC (Coursera platform)

## 3.2 Learning part

The learning part is crucial from the student's point of view – here he/she will receive all the learning materials, he/she can take part in continuous tests, discussions between students are open and recommended and used resources are listed. The learning part is usually accessible only after registering (logging) to the MOOC course. The different parts may be accessible to the student sequentially, as he/she progresses through the steps.

The basic hierarchical unit tends to be one week (the number of weeks in a course can range from 4 to 12), with learning materials, activities and other subjects are usually concentrated in each week:

- **Educational video/audio** – video presentations, usually several shorter videos; videos are often subtitled (also in different languages); although the inclusion of a video in a MOOC is not mandatory, it is a typical learning object for MOOCs.
- **Text documents** – these can be parts (chapters) of textbooks (e.g. in pdf format), handouts for presentations (e.g. in pptx format) or other learning material.
- **Student work** – usually a specific assignment.
- **References** – links to related materials.
- **Communication** – discussion (especially) among students about the topic, questions to think about.
- **Tests** – summary tests and interactive exercises.
- **FAQ** – frequently asked questions and answers on the topic.
- **Resources** – recommended and used sources (books, scripts, internet sources) of information on the topic.

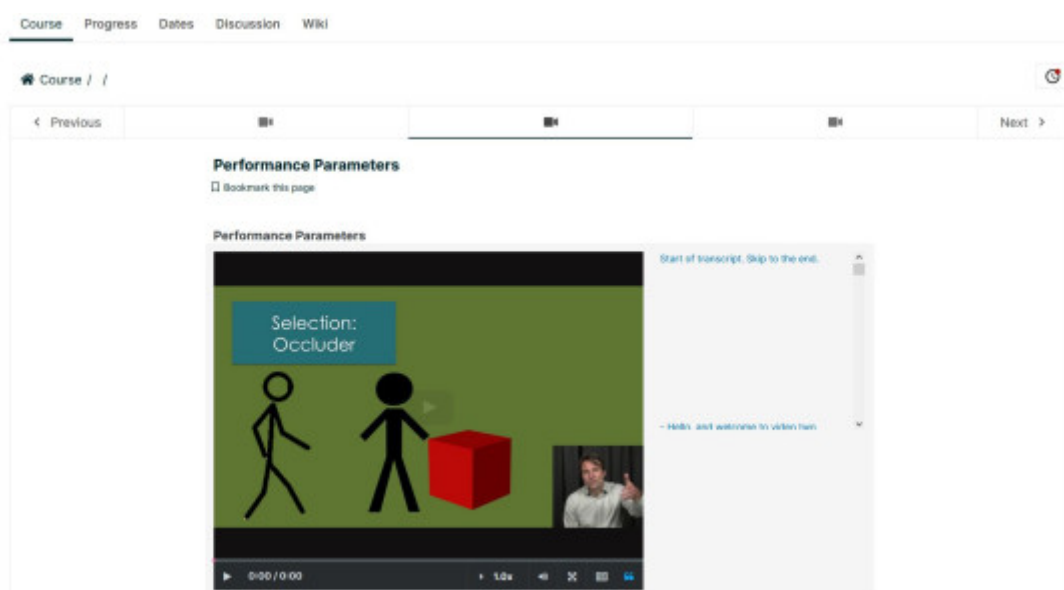


Fig. 2. Example of the learning part of the MOOC (edX platform)

### 3.3 Final part

The final part may include activities aimed at issuing a certificate, evaluation questionnaires, etc:

- **Evaluation questionnaire** – serves as feedback for the creators of the MOOC, based on the students' experience, the MOOC can be gradually updated or modified.
- **Final test** – it can be a more demanding testing and examination procedure whose results should answer the question of whether the student understood the course topic sufficiently.
- **Certificate creation** – If a student meets the criteria for a certificate, he/she can obtain one as part of this activity; it is often paid to issue a certificate.
- **A thank you** – a final goodbye from the authors of MOOC and tutors with students.
- **Offering other courses** – promotion of other (MOOC) courses.

## 3.4 Summary

### SUMMARY

The MOOC structure is not mandatory. Nevertheless, the courses have their usual structure, which offers primarily pedagogical content (videos, texts, interactive exercises, tests, practice), usually organized into teaching weeks. MOOCs also contain general and technical information about the course and activities aimed at verifying the knowledge acquired in the course (including the possibility of issuing a certificate).

#### [Interaktivní prvek](#)

**Is the MOOC structure mandatory?**

---

- yes
- no

**Can the course structure include learning materials and activities for a study effort equivalent to 40 hours?**

---

- yes
- no

**Is it necessary to have at least one video in the MOOC?**

---

- yes
- no

**Can the MOOC structure include learning materials and activities for a study effort equivalent to 20 hours?**

---

- yes
- no

## CHAPTER 4

# Criteria for MOOCs

A MOOC – as an educational resource – should meet certain criteria related to its general characteristics and qualitative parameters. The basic parameters related to the interpretation of the abbreviation MOOC (Massive, Open, Online, Course) have already been explained in the introductory section.

A MOOC should also meet other criteria, which include [2]:

- **Technical processing** – respecting typographic rules, meeting aesthetic and graphic requirements.
- **Compliance with legal regulations** – equal access to education, education for objective and tolerant views, fulfilling copyright and other legal requirements.
- **Professional accuracy** – the content of the MOOC is in line with the state of knowledge in the relevant professional disciplines, has up-to-date references to other resources, allows for updating.
- **Language** – the language culture respects the rules of spelling and the form and culture of expression of the respective language.
- **Didactic and methodological treatment** – the elements and objects of the used material (text, graphics, structural elements, hyperlinks, videos, sound recordings, animations, interactive elements, etc.), their combinations and the MOOC as a whole correspond to the desired target group, the purpose of use and support active learning.
- **Appropriateness** – the MOOC is appropriate to the age of the target group, their experience, abilities and prerequisites.
- **Functionality** – the MOOC is adapted to the intended purpose, e.g. presentation, information (knowledge, learning) transfer, knowledge acquisition, skills development, attitude formation, verification and assessment of learning outcomes, motivation, planning, management of the learning process.
- **Active learning** – appropriate form of tasks and assignments, the possibility of cooperation and communication between MOOC participants, promoting independence and interest in finding one's own way to knowledge, the possibility of feedback, the possibility of individual differentiation.
- **User-friendliness** – working with MOOC is intuitive, easy to navigate and easy to learn to use effectively.

## CHAPTER 5

# Platforms for MOOCs

The website provides lists (they also function as search engines) of MOOCs regardless of their home platform. For example, the [MOOC list](#) page [9] is well known.

## 5.1 International platforms

[Coursera](#) has been running [8] since January 2012. It is currently the largest MOOC platform in the world; it even entered the American Stock Exchange in 2021. So far, Coursera has offered approximately 8250 MOOCs from more than 250 authoring institutions.

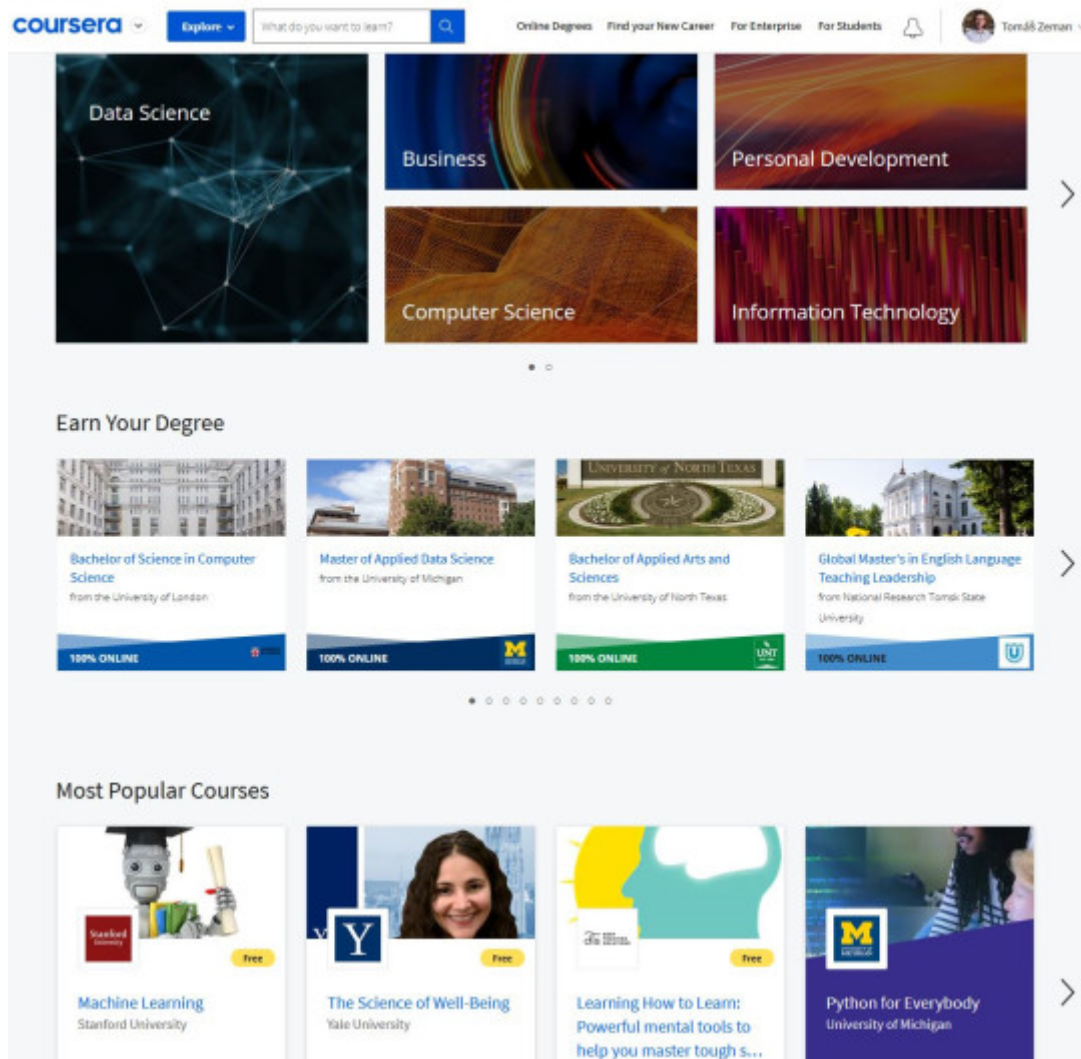


Fig. 3. Coursera platform

[edX](#) was founded in 2012 by two universities: Harvard University and **MIT** (*Massachusetts Institute of Technology*). edX is the second largest MOOC platform in the world with more than 42 million students, offering approximately 3,550 courses. edX has a total of 139 university partners – MOOC creators and providers. EdX also offers a number of different types of certification programs.



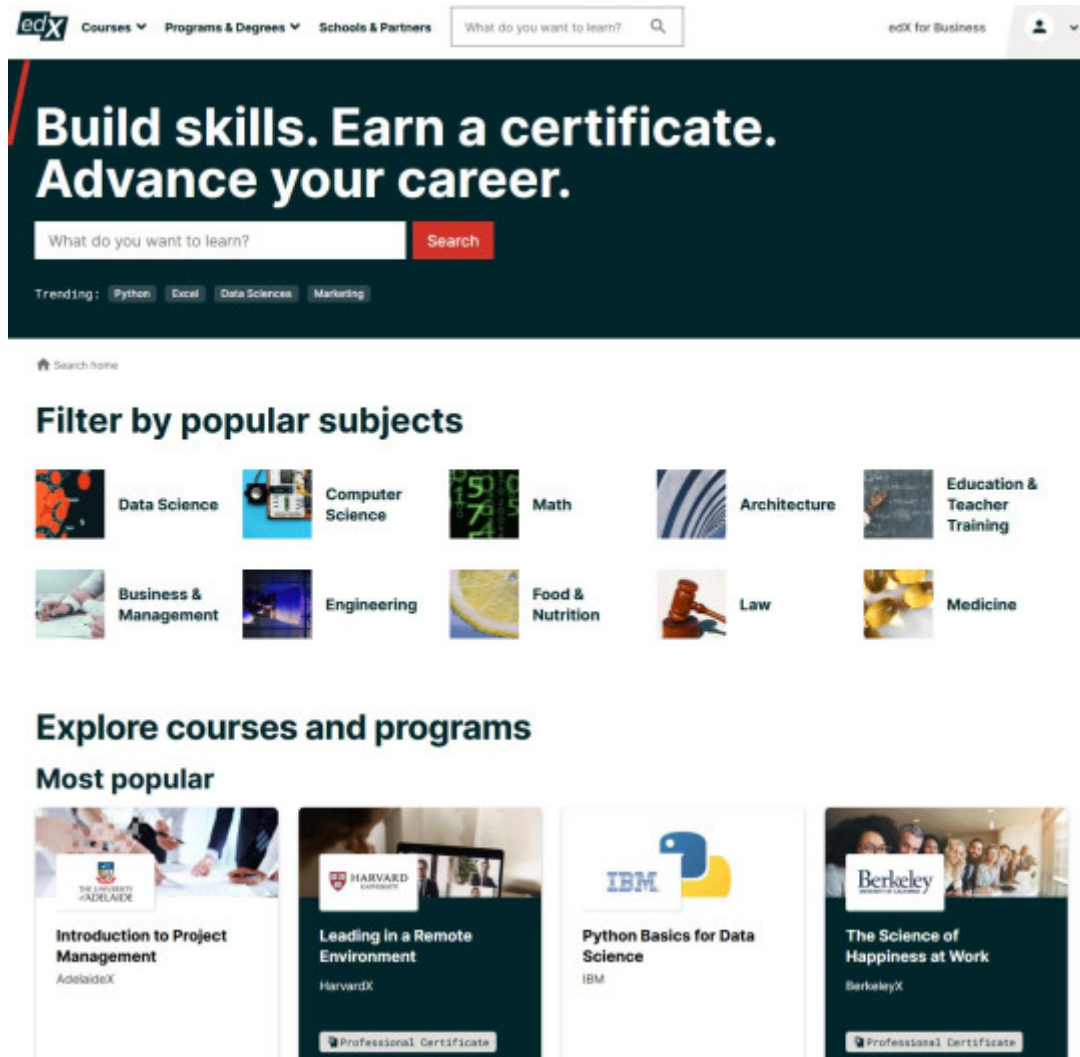






Fig. 4. edX platform

The [FutureLearn](#) platform was also founded in 2012 by the UK's Open University. Most of FutureLearn's university partners are from Europe.

## Short online courses

Choose from hundreds of online courses from top universities and specialist organisations.

Explore featured courses

 <p>FutureLearn <b>Introduction to Data Analytics with Python</b> ★★★★☆ 4.2 (15 reviews) <a href="#">Find out more</a></p>	 <p>Social Media College <b>Instagram Marketing: Instagram Essentials and Content Creation</b> ★★★★★ 4.9 (10 reviews) <a href="#">Find out more</a></p>	 <p>King's College London <b>Integrating Care: Depression, Anxiety and Physical Illness</b> ★★★★★ 4.8 (255 reviews) <a href="#">Find out more</a></p>	 <p>Trinity College Dublin <b>Exercise Prescription for the Prevention and Treatment of Disease</b> ★★★★★ 4.7 (171 reviews) <a href="#">Find out more</a></p>
---	--	---	--

Explore 1385 courses




<p>Subject</p> <ul style="list-style-type: none"> <li>All subjects</li> <li>Business &amp; Management</li> <li>Creative Arts &amp; Media</li> <li>Nature &amp; Environment</li> <li>Politics &amp; Society</li> <li>Literature</li> <li>Healthcare &amp; Medicine</li> <li>Science, Engineering &amp; Maths</li> <li>Law</li> <li>History</li> </ul>	 <p>University of Leeds <b>Anatomy: Know Your Abdomen</b> ★★★★★ 4.6 (201 reviews) Discover the human abdomen and how</p>	 <p>University of Leeds <b>Atmospheric Chemistry: Planets and Life Beyond Earth</b> ★★★★★ 4.5 (95 reviews)</p>	 <p>King's College London <b>Basic English 1: Elementary</b> ★★★★★ 4.8 (4743 reviews) Learn basic English for everyday</p>
--	--	---	--

Fig. 5. Future Learn platform

**Swayam** is India's national platform for MOOCs. It offers more than 2253 courses that are prepared by more than two hundred Indian universities. Swayam allows students in India to earn academic credits online.

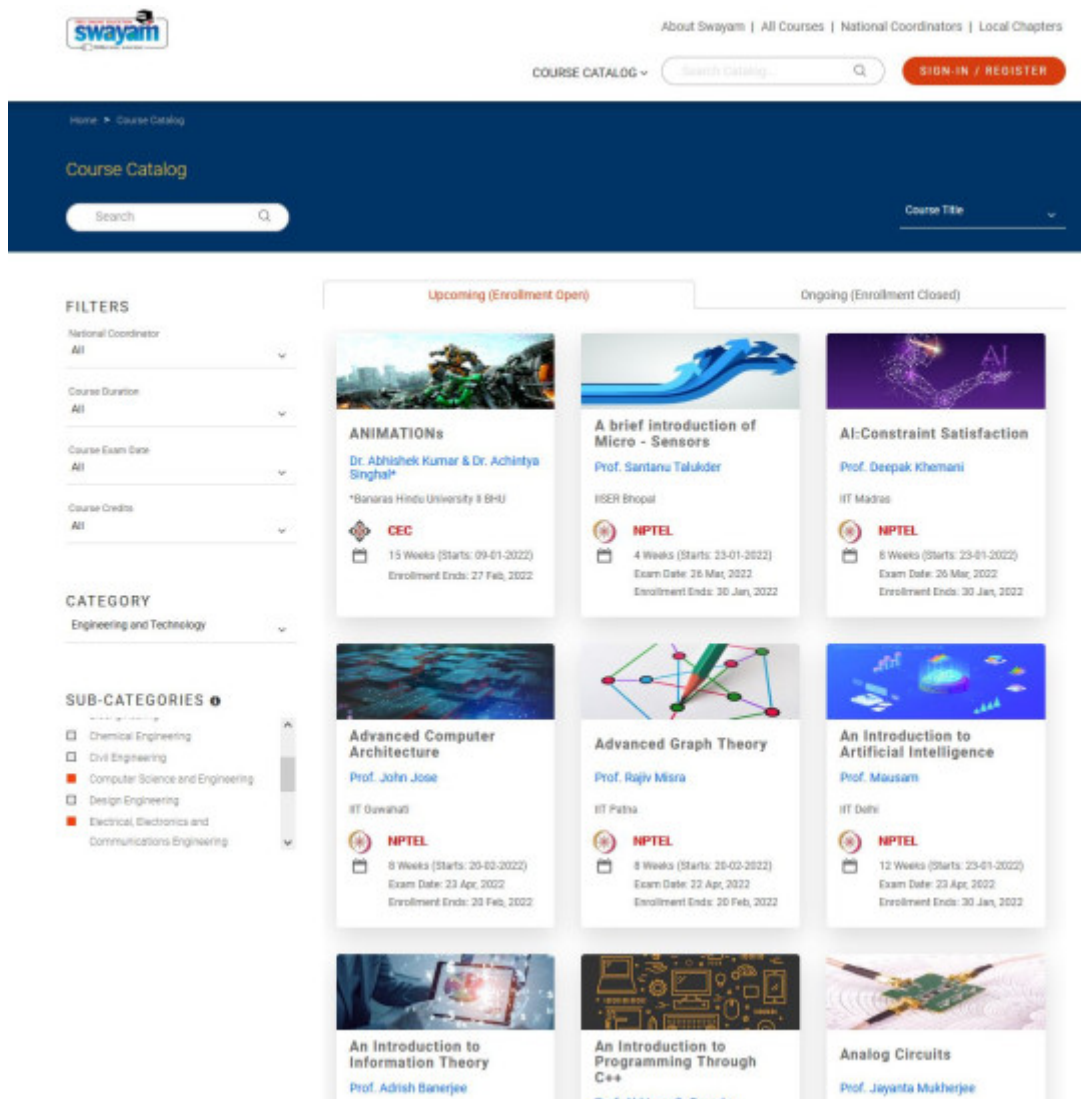


Fig. 6. Swayam platform

**XuetangX** is China's first and largest MOOC platform. The platform was founded (based on a modified version of Open edX) in 2013 by Tsinghua University under the supervision of the Chinese government. The platform was redesigned in 2020. XuetangX currently has more than 80 million registered users. XuetangX offers more than 5000 courses.

## 5.2 National platforms (In Czech)

There are not many platforms for MOOCs in Czech. It is logical - such a platform, and the MOOCs collected in it, cannot have a global impact. Some platforms offer paid courses (i.e. they are not MOOCs). Most platforms also offer MOOCs in English.

[MOOC Charles university](#) contains courses divided into 9 thematic groups; there are a total of 46 MOOCs in these groups. The courses are in Czech, English, Spanish and Portuguese. The MOOCs are stored on the common Moodle platform.

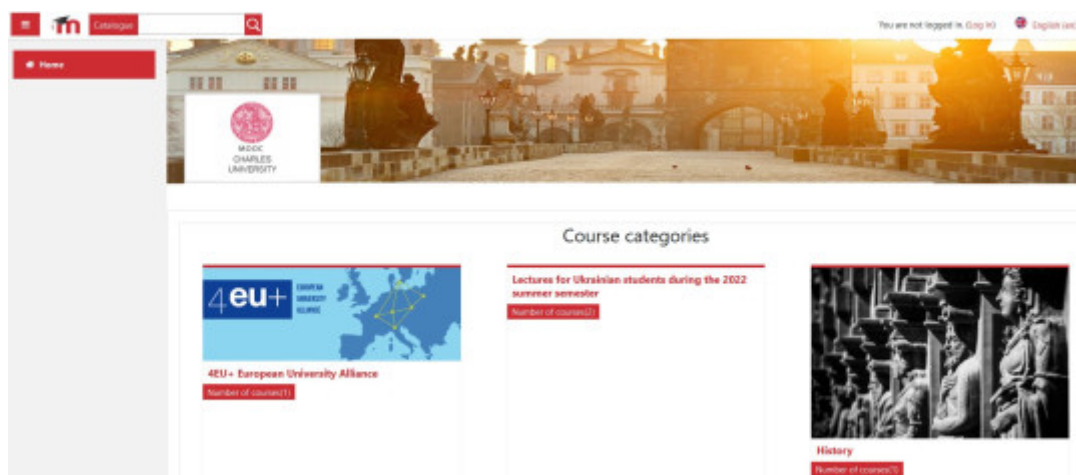


Fig. 7. MOOC Platform of Charles University

The [VET Innovation](#) Portal (Higher Vocational Education) contains MOOCs divided into four thematic areas ([economics](#), [technology](#), [health](#) and [social and pedagogical areas](#)). A total of 73 MOOCs are available (the most represented is the social and pedagogical thematic area ), mostly in Czech, but also in English and German. The Moodle environment is also used here. The primary target group is students and teachers of higher vocational schools.

## Platforma MOOC

Právě se nacházíte na platformě MOOC vzniklé v rámci projektů Inovace VOV. Naleznete zde řadu kurzů nejrůznějšího zaměření ze zdravotnické oblasti, přes témata ekonomická až po témata z technické oblasti. Nabízíme MOOC zaměřené na studium odborného jazyka, tak i čisté odborné v češtině. Máte-li zájem o pedagogicko-sociální témata, můžete se připojit na sesterskou platformu pro MOOC [zde](#).

### Dostupné kurzy

The screenshot displays a grid of 12 course cards on the MOOC platform. Each card features a thumbnail image, a title, a course number in parentheses, and a 'Více' button with a right-pointing arrow.

- Card 1:** Thumbnail: A man in a suit. Title: **Tvorba podnikatelského plánu I (63)**. Button: **Více** →
- Card 2:** Thumbnail: A man in a white shirt. Title: **Sportovní masáž - Základy praxe sportovní masáže I. (64)**. Button: **Více** →
- Card 3:** Thumbnail: A man in a white shirt. Title: **Sportovní masáž - Základy praxe sportovní masáže II. (64)**. Button: **Více** →
- Card 4:** Thumbnail: A man in a white shirt. Title: **Sportovní masáž - Management a marketing ve sportu (64)**. Button: **Více** →
- Card 5:** Thumbnail: A man in a suit. Title: **Tvorba podnikatelského plánu II (63)**. Button: **Více** →
- Card 6:** Thumbnail: Two men in suits. Title: **Etika mezinárodního obchodu (66)**. Button: **Více** →
- Card 7:** Thumbnail: A woman in a pink top. Title: **Zasilatelství (66)**. Button: **Více** →
- Card 8:** Thumbnail: Earth from space. Title: **Zeměpis cestovního ruchu Evropy (65)**. Button: **Více** →
- Card 9:** Thumbnail: A person with a backpack in a mountain landscape.
- Card 10:** Thumbnail: A hand pointing to a flowchart.
- Card 11:** Thumbnail: A person in a red cap taking a photo.
- Card 12:** Thumbnail: A man in a suit. Title: **Otevřené vzdělávání a MOOCy - úvod**. Name: **Dorazek Lukáš**.

Fig. 8. Higher Vocational Education MOOC Platform (Economic area)

[Learn2Code](#) offers 11 MOOCs for free (i.e. in MOOC mode), and dozens of other courses for a fee. The platform is mainly focused on programming (as the name indicates).

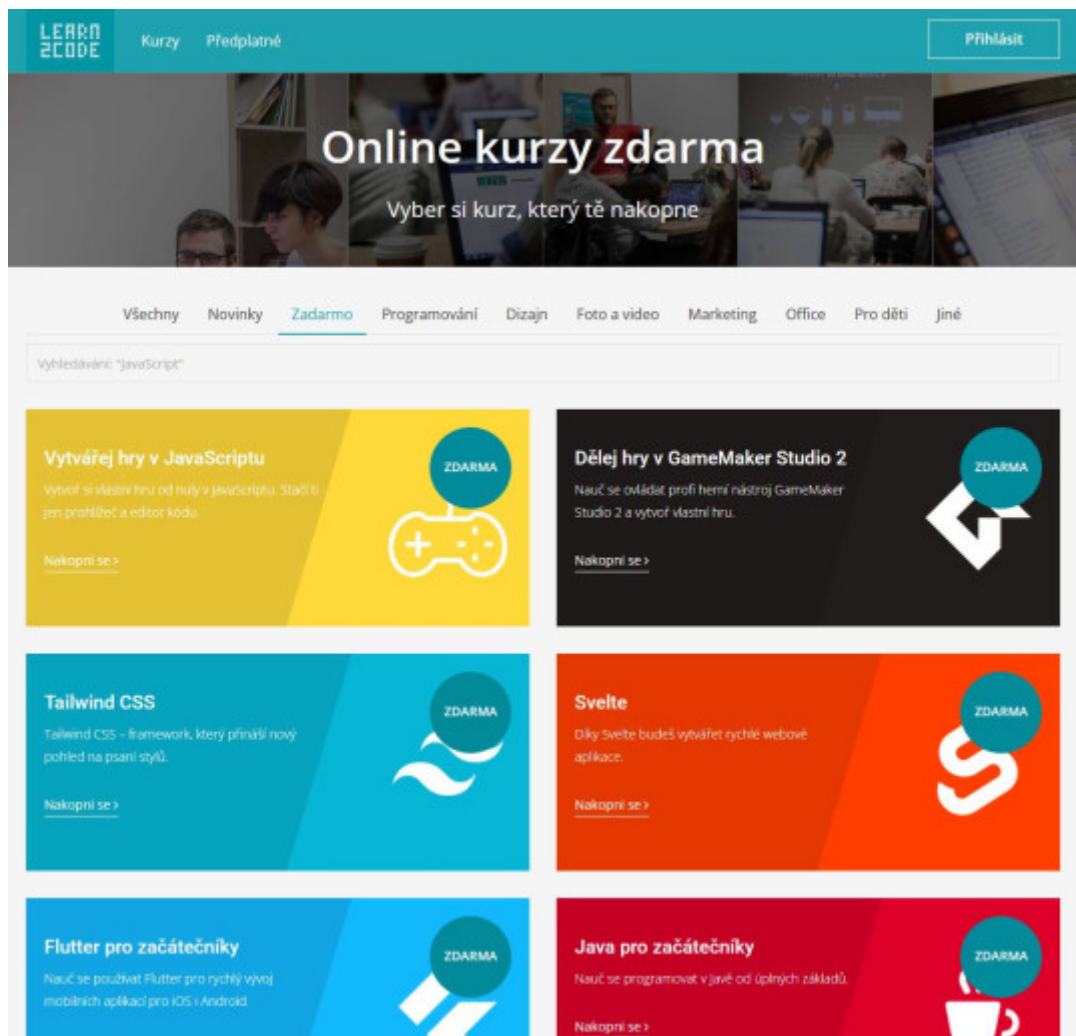


Fig. 9. Learn2Code platform

Nostis – the environment is run by Nugis Finem, a non-profit organization dedicated to innovation in education. The platform contains several (units) of MOOCs in the field of law. The MOOCs were created by Palacký University in Olomouc and one MOOC each by Charles University in Prague and Masaryk University in Brno.

## 5.3 Summary

[Video 1. edX platform](#)

[Video 2. Coursera platform](#)

[Video 3. Future Learn platform](#)

### SUMMARY

Forty of the most important platforms are available for MOOCs. The most successful platforms offer several thousand MOOCs, have tens of millions of learners and collaborate with hundreds of universities. There are currently a total of about 20,000 MOOC courses worldwide.

**The most successful platforms for MOOCs in the Czech environment are:**

- units of MOOCs
- dozens of MOOCs
- hundreds of MOOCs
- thousands of MOOCs
- tens of thousands of MOOCs

**Approximate the total number of MOOCs (worldwide):**

- hundreds
- thousands
- tens of thousands
- hundreds of thousands
- Millions

**The most successful platform has approx:**

---

- 80 MOOCs
- 800 MOOCs
- 8 000 MOOCs
- 40 000 MOOCs
- 80 000 MOOCs

**Platforms generally include MOOCs in:**

---

- English only
- English and another language
- English or another languages
- compulsory in at least two world languages
- compulsory in at least three world languages

**Number of university partners of the most successful MOOC platforms:**

---

- units
- dozens
- hundreds
- thousands
- tens of thousands



## CHAPTER 6

# Statistical data on MOOCs

### 6.1 Most popular MOOCs

Among the 250 most popular MOOCs [6], the number of enrolled participants ranges from 160,000 to 4.5 million. Yet there are 15 courses with more than 1 million registrations. These top 250 MOOCs have 104 million students enrolled; thus, the average number of enrolled participants is 416 thousand per MOOC.

By topic, nearly 40% of the courses are in the business and humanities. The most popular courses were mostly in English, with 227 MOOCs, 19 in Spanish and the rest in French, Dutch and Portuguese.

The top ten MOOCs that had the most enrolled participants include:

- Machine Learning (Stanford University)
- The Science of Well-Being (Yale University)
- CS50's Introduction to Computer Science (Harvard University)
- Learning How to Learn: Powerful mental tools to help you master tough subjects (University of California, San Diego)
- Programming for Everybody (Getting Started with Python) – University of Michigan
- English for Career Development (University of Pennsylvania)
- Introduction to Computer Science and Programming Using Python (Massachusetts Institute of Technology)
- COVID-19 Contact Tracing from (Hopkins University)
- IELTS Academic Test Preparation (University of Queensland)

## 6.2 Data on MOOCs in 2021

In 2021, 220 million students (excluding China) participated in at least one MOOC. More than 950 institutions authored MOOCs. The total number of available courses according to [7] is more than 19,400.

The largest platforms distributed their learners as follows:

- [Coursera](#) – 97 million students with 6,000 courses on offer,
- [edX](#) – 42 million students with 3,550 courses on offer,
- [FutureLearn](#) – 17 million students with 1,400 courses on offer,
- [Swayam](#) – 22 million students with 1,465 courses on offer.

The number of courses has been growing almost linearly since 2015, see figure.

©

For licensing reasons, this image cannot be directly incorporated into the material. Click [HERE](#) to see the image.

Fig. 10. Number of MOOCs since 2012 (data does not include Chinese MOOCs)

## CHAPTER 7

# Open Educational Resources

### DEFINITION

An e-learning resource (or "digital resource") can be defined as digitally processed learning material that aims to present a particular set of knowledge and, if necessary, to practise or assess it.

Simply we can say that it is any digital educational tool or set of such tools intended for education, both in the form of sub-elements and aggregated units. These may include, but are not limited to, courses, textbooks, videos, images, tests, interactive tools.

**Open Educational Resources (OER)**, are a specific category of electronic digital materials that also address copyright issues. In this case, these are digital resources with an "open licence" that allows free use, modification of their content by other users, with none or limited restrictions.

### INTERESTING

The use of OER is most common in university-level education. Several initiatives have been set up to promote it, e.g. the Cape Town Declaration (2007) involving 363 organisations.

The Cape Town Open Education Declaration has so far been signed by 3230 individuals and 33 organisations. However, it is worth noting that the signing of the Declaration is online via an e-form on the Declaration's website.

[Interaktivní prvek](#)

## CHAPTER 8

# Authors' rights and licences in education

In terms of licensing restrictions, the fundamental principle is to allow the reuse of **OER** - in part or in full, to make corrections, translations, supplementation of material and its redistribution. There are many types of licenses - some less restrictive, some more restrictive - after all, each author can invent his own license. Given that this is in fact legislation and the definition of the rules for the use of the work and the licence must reflect the intention, be comprehensible and internationally applicable, it is best to use one of the existing copyright licences.

Not all licenses are appropriate for every type of author's work. It should be kept in mind that software projects have different aspects of use than do the typical audio-visual or similar pieces.

The most widely used licenses for audio-visual (and even text-only) works is the Creative Commons set of licenses [10] (founded in 2002), sometimes referred to simply by the acronym CC. The essence of Creative Commons licenses is to define the conditions for distribution, publication and possible modification of the work. And the distribution of the work is the essence of this license. The core principle of the Creative Commons licence is to attribute the source (the author). Other license terms are already optional, which can be imagined as a selection of "packages" that the author can choose. These options are also suitable for **OER**.

## 8.1 Variations of Creative Commons licenses

The basic version of the licence is of the type: "BY" (specify author). It is included in almost all combinations of this license.

The Creative Commons extensible license "packages" give options regarding the monetization of the material, how it can be modified, and how the license of the distributed work is to be governed. The different elements of a CC licence are listed in the table 1 below.

Table 1. Creative Commons licence variants

label - short	label - full	meaning
BY	attribution	Credit must be given to the creator
SA	share alike	Adaptations must be shared under the same terms
NC	non-commercial	Only non-commercial uses of the work are permitted
ND	no derivate works	No derivatives or adaptations of the work are permitted

## 8.2 Version of the licence

The above definitions identify only the variations of the licence that apply to the work. From the legal point of view, the text of the licence itself is relevant. The content of the licence is subject to evolution and is identified by a version number. The most up-to-date, as of today (2022), is version 4.0. Previous versions have been translated and adapted to national versions - international and various national versions have been released (although compatible with each other, for example, a work published under the German version of the licence is also (in equivalent terms) distributable under the Czech version of the licence). Since version 4.0 there is only one, international version of the licence.

The version number also indicates all the details of the material to be referenced in the source citation (BY).

When licensing a material, it is best to choose the latest version of the licence.

### INTERESTING

The term "attribution" is not just the name of the author, it is the full quotation of the source. The author's name itself does not have to be the author's real name, but it can be a nickname - then we cite the nickname. The title of the work, the source of the work, the license for the work and the link to the license are also to be included.

The details of the source citation may vary in different versions of the licence.

There is one specific variant of the Creative Commons licence, Creative Commons 0 ([CC0](#)), which is intended as a licence for works where the author does not claim copyright. This is the only type of Creative Commons licence that does not require attribution.

### EXAMPLE

#### **Creative Commons BY-SA-NC**

When reusing or redistributing such a work, attribution of the author is required, as well as not monetizing the work and redistributing it under the same license (in this case, Creative Commons BY-SA-NC).

[Interaktivní prvek](#)

[Interaktivní prvek](#)

[Interaktivní prvek](#)

[Interaktivní prvek](#)

## 8.3 Video Distribution from a Licensing Perspective

One of the most widely used and well-known platforms for video distribution and sharing is the YouTube platform from Google.

The service allows you to distribute videos with a [Creative Commons BY 3.0](#) license or a YouTube's own license, which is more restrictive for redistribution and use of the video. [11]

The second most widely used platform is Vimeo. Unlike YouTube, it offers the full range of Creative Commons licenses in version 3.0. [12]

Compared to YouTube, the Vimeo platform offers limited space to upload and distribute video content free of charge.

## 8.4 Copyright vs. Copyleft



Fig. 11. The "copyleft" licence mark

The expression "copyright" is well-known and is used to identify intellectual property rights, whereas the term "copyleft" is a pun intended to express the opposite of copyright.

The label "copyleft" defines that a derivative work based on another work with this license must be distributed using the license of the original work.

### INTERESTING

Do you remember that the Creative Commons license has a "SA" (share alike) variant? Adding this attribute to a work's license results in a "copyleft" license for the work. This means that a work derived from a one with a "CC BY-SA" license must be redistributed under the same type of "CC BY-SA" license. It is not possible to redistribute such a work under a license with attributes such as "NC", "ND" or under a completely different license.

### INTERESTING

The familiar © symbol has no legal meaning for a long time, and more likely it just informs that the work is subject to "some" type of copyright.



## 8.5 Licences for software source codes

Creative Commons licenses are intended for audio visual or text-based works and are not suitable for use in programming products. For these, the integration into other entities and the subsequent licensing and distribution of the original content under a different licence, and the use of parts or outputs of the work, need to be addressed.

There are many types of licenses that allow you to distribute and use the software source codes. Many differ in specific terms. One of the less restrictive and one of the most popular is the **MIT** (*Massachusetts Institute of Technology*) software license. It is not a copyleft license, so it is possible to distribute the resulting work under another license. However, this license also has its own terms of use.

Popular copyleft licenses are e.g. **GNU GPL** (*GNU General Public License*) [13], which ensures that everything contained in the creator's work will bear the original creator's attribution and must be distributed under the same or compatible license. Attractive? Only until you find out that as a programmer you can't use existing source code libraries, because those libraries are released with an incompatible license for your work, and you have to reinvent already invented.



Fig. 12. Source code license

## 8.6 Suitable licences for OER

As mentioned in Chapter 1, **OERs** are intended to be open for modification and use in future works. Therefore, it can be concluded that the "ND" version of the Creative Commons licence is not suitable.

The "NC" variant is not an issue and it is up to the author to allow the monetisation of his material by a third party or to deny this option entirely. Principally, the **OER** should be available free of charge.

The most suitable variants for **OERs** are "CC BY", "CC BY-SA", "CC BY-SA-NC". For software packages, there are the MIT or GNU GPL licenses.

It is also possible to create an **OER** that consists of different objects, with each object having a different license that is compatible with the Open Educational Resources license. These licences are often incompatible, so it is not possible to distribute the resulting **OER** as a single unit with a single licence.

[Interaktivní prvek](#)

[Interaktivní prvek](#)

### SUMMARY

Things to remember:

- not everything on the internet can be republished,
- Creative Commons licenses offer a wide variety of options, and each author can arrange the license in a way that suits them,
- when using a Creative Commons licence, the author must always be attributed (except for the [CC0](#) licence),
- not all CC licence packages are suitable and applicable for **OER**.

**Check the license option that does NOT belong in the Creative Commons license set**

- Attribution
- Share-Alike
- No Derivate Works
- Noncommercial
- Ask for Use

**The GNU GPL license for computer programs is**

---

- "copyleft" license
- license restricting commercial use
- license ensuring that the work cannot be freely shared on the internet
- license ensuring that the work cannot be freely modified without the author's consent

**The YouTube license also allows you to share the work under the Creative Commons license**

---

- BY-SA
- BY-NC
- BY-SA-NC
- BY

## CHAPTER 9

# Dealing with OER in practice

OER handling can be divided into two main aspects. The environment in which OER is used and the content of which it is composed. The environment provides a user interface and comfort in using OER. These include the ability to create notes in the text, create bookmarks, search through the material, view the content of the material, view lists of abbreviations, images or track the progress through the material.

The OER itself is composed of individual content blocks - text, video, audio, elements for verification of understanding.

[Interaktivní prvek](#)

## 9.1 Texts

It is advisable to follow a structure when preparing a longer educational text. Such teaching material is divided into chapters, sub-chapters, headings and blocks of text with specific educational relevance. This structure makes the text easier to read and helps students with visual memorisation.

As an educational block, it is imaginable to have definitions, explanatory notes, interesting facts, illustrative examples with solutions, various lists of e.g. advantages and disadvantages. These blocks can be graphically separated from the text, most often by highlighting the text, frames, or accompanying symbols.

Shorter units with examples are more suitable.

**2.3 Vzorkovací teorém**

**POZNÁMKA** Nezávisle na sobě americký matematik a elektrotechnik Claude Shannon a sovětský radiotechnik Vladimír Alexandrovič Kotělnikov matematicky dokázali, že k přenosu signálu postačí přenést pouze omezený počet jeho okamžitých hodnot bez ztráty informace. Na základě toho byl zformulován tzv. **Shannon-Kotělnikovův teorém** o minimální **vzorkovací frekvenci**. Americký vědec v oblasti zpracování signálů švédského původu Harry Nyquist formuloval nezávisle na Shannonovi a Kotělnikovi v téže době stejnou podmínku na minimální vzorkovací **frekvenci**. Zavedl také pojem poloviční vzorkovací frekvence, která je pojmenována jako Nyquistova frekvence.

Dále uvedeme definici vzorkovacího teorému:

**DEFINICE** Vzorkovací teorém udává, že minimální vzorkovací frekvence  $f_v$  spojitého signálu musí být minimálně **dvakrát větší** než nejvyšší přenášená frekvence  $f_{max}$  obsažená ve spojitém signálu  $x_u(t)$ , tedy:

$$f_v > 2f_{max}$$

Dodržení vzorkovacího teorému je nutné pro bezproblémovou rekonstrukci spojitého signálu z jejich vzorků, jinak se při převodu zpět na analogový signál mohou v důsledku aliasingu objevit frekvence, které v něm původně nebyly.

Vyberte správné přiřazení

$f_v \leq f_{max}$	Vyberte vzorkovací teorém	_____
Vzorkovací teorém	Vyberte vzorkovací teorém	_____
$f_v > 2f_{max}$	Vyberte vzorkovací teorém	_____
$f_v < 2f_{max}$	Vzorkovací frekvence $f_v$ a maximální frekvence ve spojitém signálu $f_{max}$	_____
$f_v \geq 2f_{max}$	Vyberte vzorkovací teorém	_____

ZOBRAZIT LICENCE Zkontroluj řešení

**ZAJÍMAVOST** Vzorkovací teorém používá nejvyšší přenášenou frekvenci signálu  $f_{max}$ . Existuje řada signálů, u kterých není maximální přenášená frekvence patrná. Jako příklad může sloužit zpracování řečového signálu nebo zpracování obrazových, seismologických a dalších signálů. V takovém případě musíme před vzorkováním použít filtr dolní propusti, který omezí maximální frekvenci signálu. Nazývá se říká antialiasingový filtr. Ten nedovolí, aby se do vzorkovacího obvodu dostala vyšší frekvence. Připomeňme, že antialiasingový filtr je **analogový** (nebo spínaný), v žádném případě nemůže být digitální. Vzorkovací teorém je odvozen pro ideální antialiasingovou dolní propust, jak je znázorněno na obrázku 12 a). Ideální filtr je pouze matematická fikce. Reálná dolní propust je znázorněna na obrázku 12 b). Mezi propustným a nepropustným pásmem je tzv. **přechodové pásmo**  $f_T = f_s - f_p$ , které zvyšuje vzorkovací kmitočet  $f_v > 2f_{max} + f_t$ . Čím vyšší je řád filtru, tím užší je přechodové pásmo.

Fig. 13. A sample text with the definition of the educational parts (Retrieved from VOV)

## 5.1 DCS



Distributed Control Systems (**DCS**) are large process control systems **PCS** (Process Control Systems - also used as synonyms), which began to be used in the 60 years with the advent of the first control computers, which represented the numerical solution of the centralized control of large technological systems such as chemical processes, power plants, etc. They were built as suitable centralized solution.



Some **DCS** systems are specialized, some are, however applicable in more areas. Exceptions are control systems, where extremely high demands on safety and reliability of the control system. Highly secure and reliable systems are very expensive and therefore not deployed where it is not absolutely necessary. These systems are characterized by strict hierarchical construction with three levels of control that is bottom-up:

- Sensors level - sensors, actuators
- Level of the first control (technology control and regulation)
- Operator level
- Superior level

In any case, however, still represent a large **DCS** control system with only a high degree of reliability in areas where it is necessary to treat a large number of inputs and outputs of various types and where reliability and security is absolutely categorical requirement. Their advantage is also the compactness of the system.

Fig. 14. A sample text with the definition of the educational parts (Retrieved from publi - Červený)

[Interaktivní prvek](#)

## 9.2 Images and videos

Images are a common part of OER.

Images can be divided into two basic types:

- vector (schematics - most often in SVG format),
- raster (photographs - most often in JPG, PNG, GIF format).

### 9.2.1 Vector images - diagrams

When creating schematic images, consider using vector graphics. It allows magnification and (in some cases) sharpen lines (does not blur smaller elements when compressing or displaying raster images). When creating multiple images in one OER, it is advisable to maintain their uniformity, i.e. colour, font sizes, types of graphic elements (arrows, line strength, etc.).

### 9.2.2 Raster images - photos

For photographs, it is advisable to maintain:

- sufficient resolution (too low resolution reduces image quality),
- not too high resolution (large image size),
- suitable composition,
- motif (what is in the photo),
- technical quality (sharpness, brightness).

The choice of the image size depends on its content. For example, to describe a larger entity, we do not need to see much detail.

The use of illustrative images serves as a supplement to a more complex text. These images are intended to evoke an atmosphere and to bring the topic closer to the foreground or, on the contrary, to lighten the topic.

Images can also be taken from other sources, but copyright and licenses must always be considered. You can find freely available online image galleries that offer a large number of images with appropriate licenses (e.g. [CC0](#)) or CC BY(-SA) licenses.

#### EXAMPLE

Example of image galleries with Creative Commons licenses

- <https://pxhere.com/> (license [CC0](#))

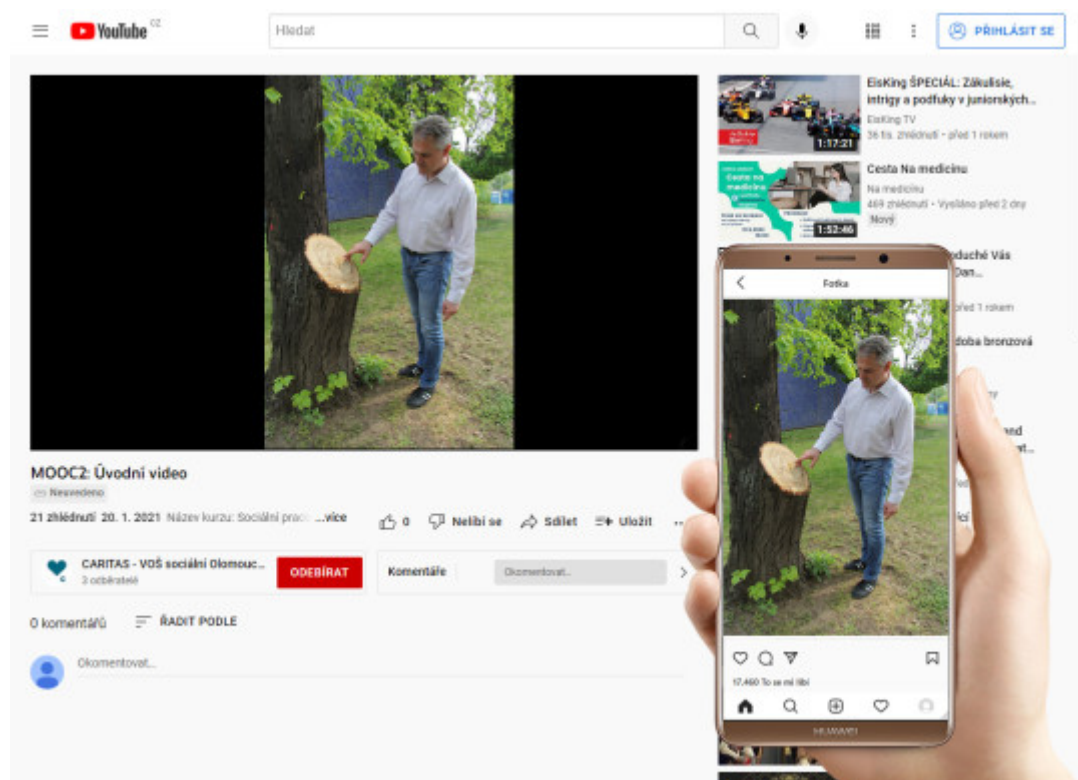
- <https://www.mediawiki.org> (various licenses, often CC BY-SA license)

## 9.2.3 Basics of image composition

Image composition applies especially to images (photos) and video. When creating diagrams, we try to cover the image evenly.

### 9.2.3.1 Landscape or portrait?

It depends on the intended use. In the past, video was essentially landscape-based, based on the habit of playing video on TVs, monitors, and projection screens. Nowadays, when social networks (e.g. Instagram, Facebook) are widely used and videos are displayed on mobile phones, which are, on the contrary, portrait-oriented, this rule is no longer completely valid. The determining factor is which device we expect to be viewed most often by the user.





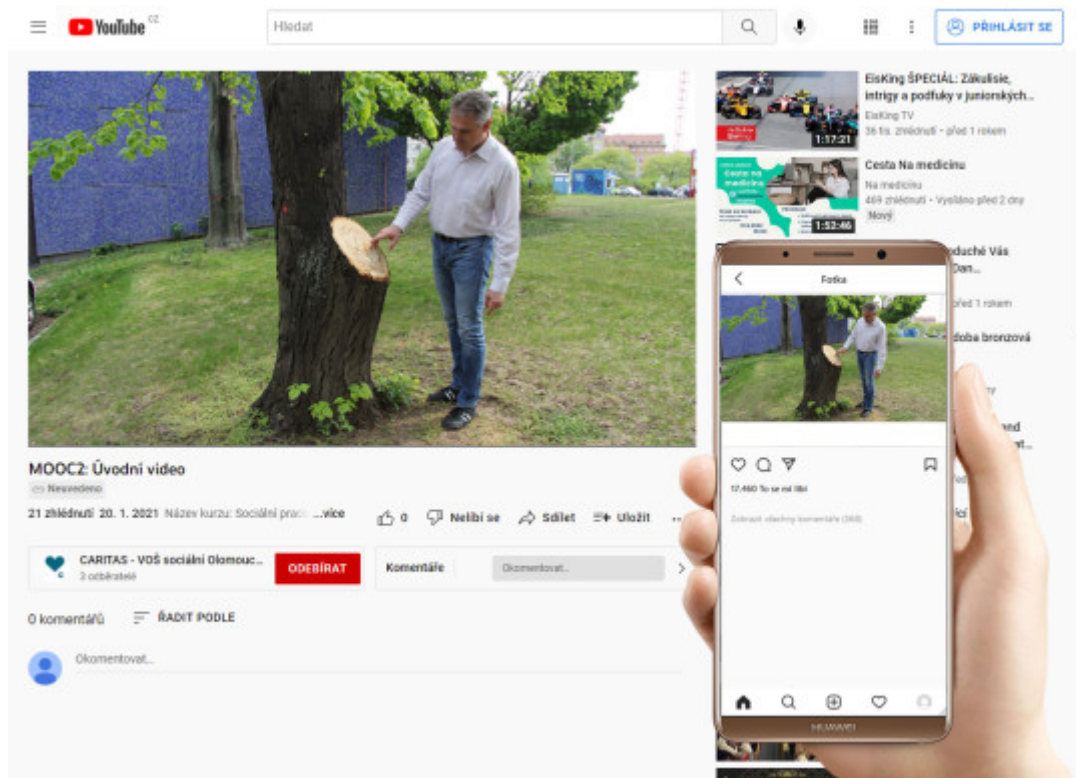


Fig. 15. Viewing video in landscape or portrait?

### 9.2.3.2 Where to place the object in the camera lens

The basic options for placing an object in a photo or video are:

- to the centre,
- to the golden ratio.

#### DEFINITION

##### Golden ratio

We can simply imagine it as a position in the picture that gives us one of the best looking positions in the picture. The golden ratio comes from nature and its application in mathematics and geometry. It is used very often in art and for a very long time. The first mention of the definition of the golden ratio comes from the Greek mathematician Euclid. [Geometric construction of the golden ratio.](#)

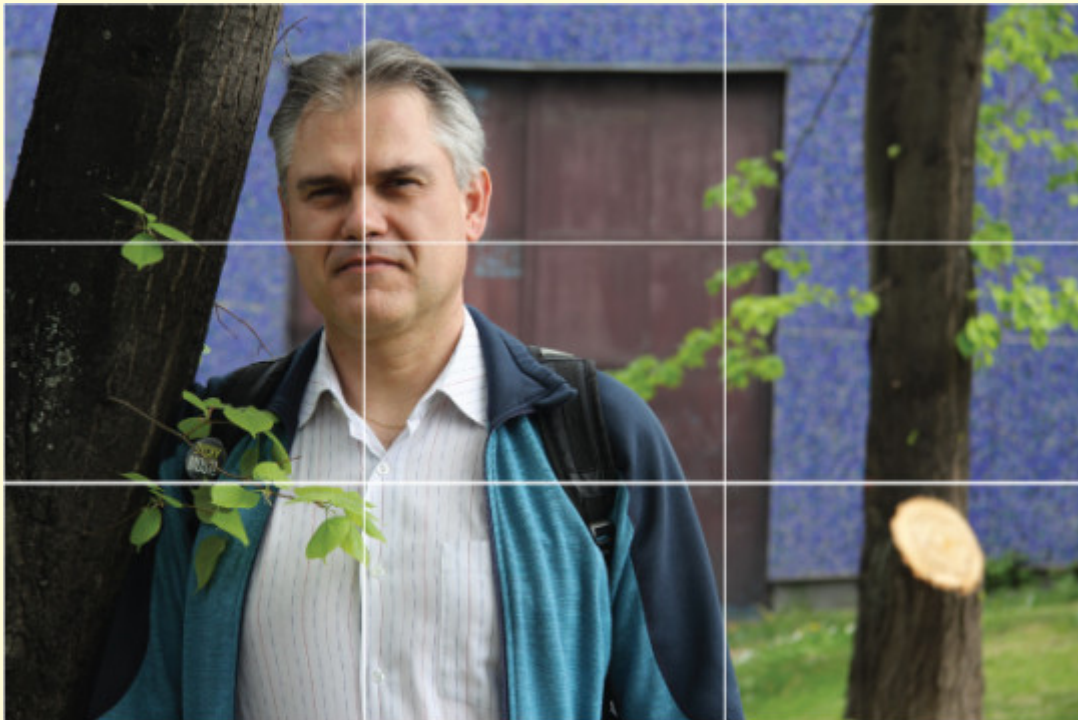


Fig. 16. The simplified design of the golden ratio

**The simplified - practical - concept of the golden section is to divide the image into thirds: vertically and horizontally.**

[Interaktivní prvek](#)

An object placed at the intersection of these thirds seems to be the best.

**If we have an object (person, subject) covering a large part of the image area, we choose to place it in the centre.**



**When shooting or filming a person who is not looking directly into the camera, it is advisable to place the person approximately one third of the frame and always so that they are looking in the direction of the image.**



### *9.2.3.3 Image cropping*

A person should not be cropped at the joints, i.e. ankles, elbows, neck, etc.



Fig. 17. Improper cropping of a person

## 9.3 Shooting video with a person

In a short video, we choose one shot from one spot. For a longer speech, at least two shots from different angles. The scene can be completely without camera movement.

[Video 4. Example of multiple shots when filming a person's speech](#)

### 9.3.1 Background of the shot and depth of field

When filming or photographing a subject or person of the speaker, a shallow depth of field is often used - the blurred background effect. Such a background does not distract, it only completes the picture and places the speaker in the environment. **The focus is always on the speaker's eyes.**

When conceptualizing a shot, it is important not to omit the background. It is not advisable to create shots against a completely blank uniform background (e.g. a monochrome wall). At the same time, care should be taken to avoid various objects sticking out of the subject's head (such as a lamp, a tree, etc.), especially in the case of human subjects.



Fig. 18. It is also necessary to pay attention to the background behind the photographed or filmed object.

### 9.3.2 Lights

Using intense light, the filmed person gets very sharp features. It is best to choose dim and diffused light.

Beware of the use of artificial light, it may interfere with image recording and lighting technology (e.g. fluorescent lamps) - such light may flicker on the recording. At the same time, it should be considered that artificial light is usually not pure white and has a yellow tinge .

When using artificial lamp lighting, a diffuser is used in front of the light.

### 9.3.3 Recording a longer continuous speech

Various teleprompters can be used to record longer speech to be fluent. You can use professional devices (more expensive option) or you can do with an amateur solution. Professional solutions are most often based on semi-transparent mirrors. For amateur solutions, it is possible to use, for example, a laptop. In this case, choose one with a smaller diagonal at a greater distance with a larger font - this will limit the visible eye movement when reading text from a device.



Fig. 19. Demonstration of using an amateur teleprompter when shooting video for this material

## **9.4 Video distribution and format**

Videos reach a large data volume and it is necessary to address how the video itself will be distributed to the user. There are two options: direct download or use one of the available video distribution platforms (e.g. YouTube, Vimeo).

Direct downloading has the disadvantage of requiring its own infrastructure and the need to address sufficient capacity of the transmission medium (transmission speed) to meet the demands of multiple users accessing the video at the same time. Conventional website hosting services are generally not optimised for video transmission and distribution of large data files.

When using third-party services, you should focus on the availability of the service and its capabilities and conditions.

When recording landscape video, a 16:9 aspect ratio with Full HD resolution (1920 x 1080 pixels) at 25 frames per second is commonly used today. The video output format is most commonly MP4, AVHCD, or MOV.

## 9.5 Audio recording

When recording audio, we often do not use an integrated microphone in the device and choose external microphones (lapel, directional, headsets). Integrated microphones are often multi-directional over shorter distances and can also record the noise of the device itself (zoom, focusing mechanics of the recording device, etc.).

For audio recording, the standard format is MP3 (MPEG-1 or MPEG-2 Audio Layer III), WAV (Waveform audio) or format AAC. Sampling rate of 44.1 kHz or 48 kHz, two-channel recording (stereo), 16 bits per sample.

[Interaktivní prvek](#)

**To construct the golden ratio, we can use a grid in the camera to divide the image**

---

- into thirds
- into quarters
- into fifths

**Select the format for the video**

---

- MP3
- MP4
- WAV
- AAC
- WMA

**Select the format exclusively for audio**

---

- MPEG1
- MPEG2
- MP4
- FLAC

## CHAPTER 10

# Interactive elements

Texts, images and videos can be described as passive elements. The user is only a consumer of the content and does not have to develop any targeted activity of his own. The ability to remember information conveyed in this way is not very high (10 to 15% is reported for reading text) [14, 15]. To be more effective, OER can include activating elements where the user develops an activity and the learning impact (memorization) is higher (most people remember up to 80% of the information they consume) [14]. Such designed exercises can increase the clarity (illustrativeness) and test the application of the acquired knowledge.

### [Interaktivní prvek](#)

We can imagine elements of various kinds. From simple ones such as tests, filling, matching, sorting, splitting, to complex ones such as active images, various interactive games, 360° videos, 3D objects or virtual reality.

Various types of objects, such as images, audio and other media can be used within the interactive elements. For example, it is possible to assign images, select a response according to the sound being played.

Interactive games are already complex and challenging to create. It is one of the most entertaining methods for students. The disadvantage of such a game is the traceability of specific information. With a similar effect, there are also elements of creation in virtual reality that focus on memorization through experience.

Checking questions in the form of tests are used to quickly check the comprehension of the text. Quizzes with one or more possible answers are the most common. Some learning environments also allow for scoring results for the whole ODZ. A modern trend in education is so-called gamification, which means the introduction of game elements into education. This includes, for example, completing different tasks, achieving levels, collecting experience, badges and rewards.

In this material you can find some examples of the interactive elements and at the end evaluate whether you better remember what you have learned with the elements.

Examples of third-party interactive exercise sites are:

- <https://h5p.org/>
- <https://quizlet.com/>
- <https://hotpot.uvic.ca/>



Some of these elements can be integrated directly into larger learning units or used separately. Incorporating elements directly into ODZ is more technically demanding and licensing restrictions need to be considered. Making elements available on external sites often requires a user account for these services, which can be a barrier for many users.

One of the most demanding environments for the preparation and implementation of interactive elements is the virtual reality environment. Today you can find several educational games (mostly in the field of health, history) which are available for free. The prerequisite is the possession of a virtual headset (virtual reality glasses, controllers).



Video 5. Using virtual reality for education

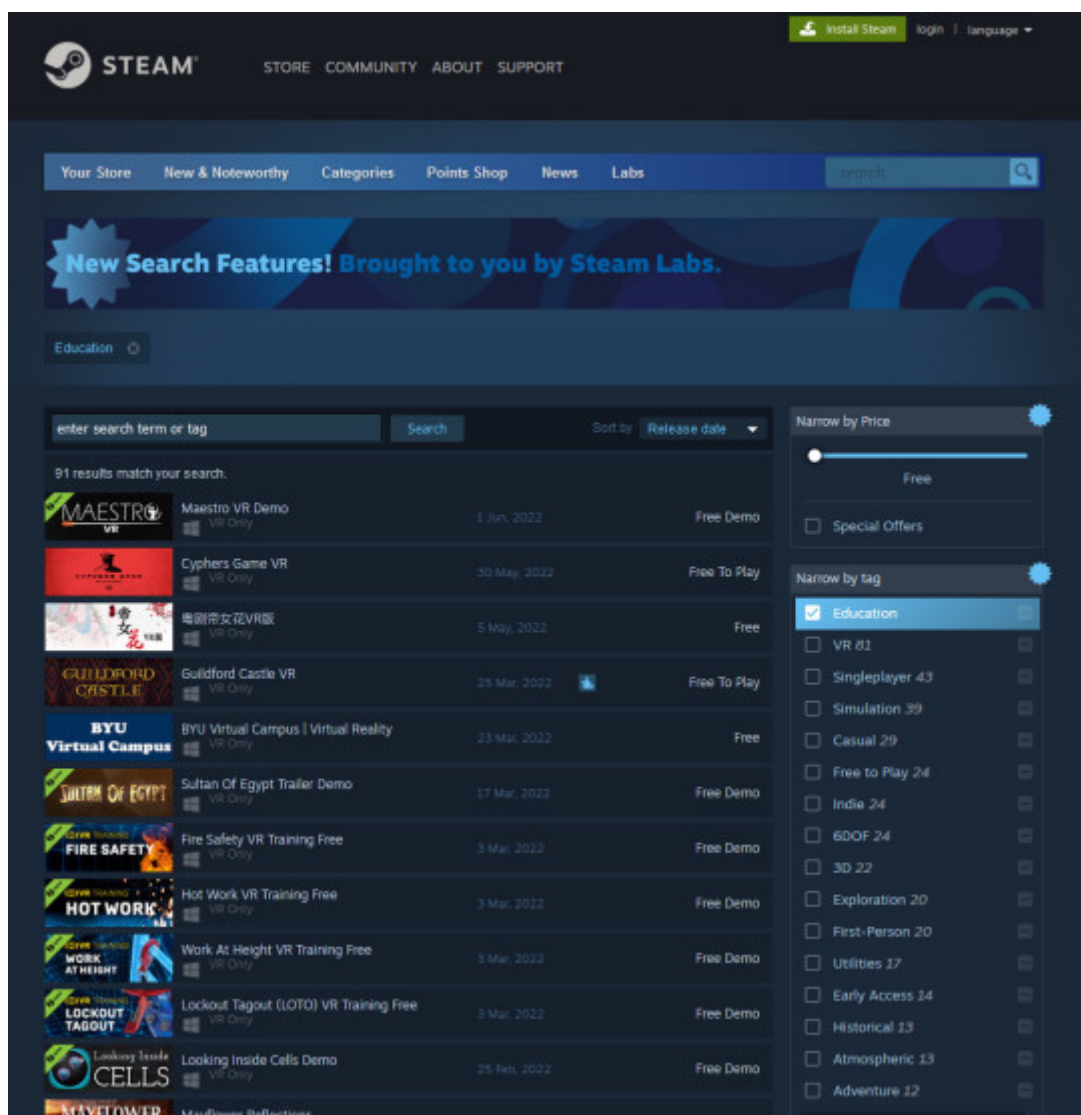


Fig. 20. Steam store screenshot with free tutorial games (

[https://store.steampowered.com/search/?sort\\_by=Released\\_DESC&force\\_infinite=1&maxprice=free&tags=1036&vr-support=401%2C102%2C201&snr=1\\_7\\_7\\_240\\_7&page=1](https://store.steampowered.com/search/?sort_by=Released_DESC&force_infinite=1&maxprice=free&tags=1036&vr-support=401%2C102%2C201&snr=1_7_7_240_7&page=1))

Another - quite sophisticated - option is the use of augmented reality. This means that real scenery (e.g. an engine or a landscape), which is captured and displayed on (e.g.) a mobile phone, is enhanced by additional elements (the names of individual components are added to the captured image of the engine, or the names of important mountains, ponds or other significant points are added to the captured landscape).

**The OER does NOT allow**

---

- free use of the work
- the possibility of changing the work
- the right of the author to choose where the work may be published

**Identify the characteristics of a well-designed, more complex educational text**

---

- contains a list of abbreviations
- highlighting parts of the text
- searching options

**What CANNOT be considered an interactive element**

---

- test
- hyperlink
- matching of terms
- word completion
- element of virtual reality