

Evaluation of systems for video-based online teaching

Create your own MOOC or SPOC

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There are a lot of discussions about digitalizing university teaching and opening it to civil society. In this context, we investigate the current options for setting up and distributing video-based online courses. First, we make a review of a subjectively selected set of existing platforms and technologies for video-based online courses. Next, we discuss the needs of futures online teaching concepts and the corresponding challenges of digitalization for university teaching. We summarize essential aspects of the considered platforms, technologies, and today's examples in tables. The main result is an overview of systems that can be used to start your online teaching initiative with a small budget.

Keywords: Online learning, video-based courses, MOOC, SPOC

INTRODUCTION

During the last years, online learning platforms like Coursera, FutureLearn or edX successfully established an extension of the university education and opened high quality massive open online courses (MOOC) to everyone with an internet connection. These platforms offer courses from the best universities worldwide freely accessible. This development can be considered as a democratization of the elite university sector. The main differences between the traditional university education and the online teaching platforms are the physical locations where you study and the degree you receive. Whereas, for the latter, there are first steps offering degrees from universities that you can earn primarily via online courses, though these degrees are not available for free anymore.

Consequently, the new platforms compete di-

rectly with the traditional education system. There is a trend that you can study many programs from the best universities without leaving your desk. This development raises questions about the future of traditional universities: Is there a unique selling point of the traditional institution of a university? What role does the historical place of a university play? What values have social interaction between students and with the teachers?

Currently, we find the big players on the leading platforms primarily, since they can afford the joining fee, the investments in the development of new online courses, and the corresponding infrastructure [1]. Smaller and hardly known universities have no access to these platforms, which shed a different light on the idea of democratizing education. Furthermore, the platform economy that controls the content reinforces the dominance of the top global uni-

versities. This development is logical since the attractiveness, and economic success of the platforms go hand in hand with offering high-quality content ensured by the reputation of the universities. If location and spatial boundaries are no limiting factors anymore, the winnings of the big players continue to rise, whereas the visibility of other universities decreases.

The question motivates this article, how especially smaller and less known universities may react to the rapid digitalization of the education system. How can universities transform and open themselves by their digital offers and by new forms of cooperation between each other? There are huge potentials in the public universities for creating a counterweight to the huge platforms to avoid the dominance of private companies that controls access and content. Important conditions for a bottom-up driven digital transformation of universities is the available technology and technical infrastructure.

Of course, the educational concepts need to be adapted for MOOCs (Fernández-díaz et al., 2017). In the context of an architectural program, Stellingwerff et al. (2018) described how online design education experience could be improved by using the tools provided by edX. Spyropoulou et al. (2015) reported on their results, developing a computer programming MOOC. In contrast to these descriptions of pedagogic concepts, we evaluate available systems for online teaching concerning their functionality, flexibility, and costs. We compare not all available systems but some that we considered as the most important respectively reasonable ones for our intentions.

As a result, we describe the advantages and disadvantages of the compared systems. The comparison is not very systematic because the considered systems are made for different purposes, including various possibilities and foci so that we have to compare apples with oranges partially. Nevertheless, we offer a useful insight into the system you should use with a given budget to start your online teaching initiative. We focus on video-

based learning methods for lectures, technical introductions, or tutorials that are accompanied by texts, quizzes, assignments, discussion forums, online apps, webinars, teacher-student communication, and social media chat rooms and groups.

EVALUATED SYSTEMS AND PLATFORMS

In the following, we consider some systems and platforms for video-based online teaching in more detail. Table 1 gives an overview of the main aspects of the compared technologies.

MOOC platforms

One of the obvious ways to start with offering your online video course is to join an existing MOOC platform. The advantage of such platforms is that they take care of the technical infrastructure and member management etc. You primarily need to provide the content. We contacted Coursera, FutureLearn, and edX if they would accept courses from us. We are lecturers at a smaller German University with a good international reputation. Unfortunately, only FutureLearn answered to our request. FutureLearn as the others have a partner program, which states the requirements for a partner institution. In the case of FutureLearn these are basically:

- Demonstrable expertise in an area of knowledge
- Strong academic research
- A commitment to advancing education

Other platforms like Coursera or edX have similar regulations for their partner programs. The listed criteria are reasonable for a quality assessment of a partner institution.

However, if you would like to start with a small initiative and your university is not already a partner with one of the platforms, it would require a lot of administration effort and time to become a partner, even if your institution fulfills the high demands for these criteria. To avoid these barriers, you may use a platform with lower quality content where everyone can contribute or set up your platform.

In the following, we concentrate on the possibilities and systems for setting up our teaching platform.

Advantages: You can reach a huge number of potential users with a MOOC. It is possible to collaborate with other universities for combining courses for special certificates.

Disadvantage: It is difficult to create courses that you can use as MOOC and for the students of a university in the context of a seminar. Not least, the European data protection law does not allow forcing students of your university to subscribe at a commercial MOOC platform. Therefore, the MOOC activities are separated from the traditional teaching activities at the university.

Moodle

Latest at this point, you may look at the teaching platform that your university is already using. At least in Europe, most universities have their own internally digital teaching support system. In many cases that we know of (TU Munich, ETH Zurich, Bauhaus-University Weimar, TU Vienna), Moodle is used. Moodle is an excellent system for providing digital materials for courses for managing students' submissions, grades, and communication. Usually, it is used for Small Private Online Course (SPOC).

Advantage: Moodle is open source and can be integrated very well to existing processes and legal frameworks of universities. Furthermore, it is very actively developed, and many universities invest money for developing additional modules or plugins.

Disadvantage: Moodle is relatively closed for users external to universities, and it does not provide functions to create course collection websites like the MOOCs platform show it. In our test, it was also challenging to create a good user interface for a sequence of video lectures organized in weekly modules. Also, we experienced performance issues with Moodle when loading many videos for a course, but this may be an individual technical problem that was not further investigated. The costs of Moodle depend mainly on the number of students that use the system. Either you host it yourself, or you use a basic hosting plan.

Open edX

Another option is to use Open edX, which is the open source MOOC platform developed for edX.org courses. It provides the functions that are included for courses on edX.org, but the courses are not linked with the main edx.org platform. Therefore, you need a hosting service for Open edX, which is technically relatively demanding. There are hosting services who manage the technical aspects, which starts in a basic version from 600 Euro per year but can become very expensive if you need more functionalities, students' access, or visual customization options.

Advantage: In case you use a hosting service, it works out of the box. You have the same features as courses on edX.

Disadvantage: Even if you manage to host it yourself, open EdX is too complicated that it can hardly be customized.

WordPress based Learning Management Systems

An alternative that is used by many smaller online teaching initiatives is to use the Content Management System (CMS) WordPress with plugins that extend it to a full Learning Management System (LMS). This option has the advantage that you can control many aspects of your online video teaching platform in detail. You need a web server provided by the university to host WordPress, but the installation is not very difficult. More difficult is to choose one of the available LMS plugins. We considered LearnPress and LearnDash. Many websites compare the systems, but they are either not very detailed or influenced by some companies that want to promote their products. We tested in detail the open source LearnPress and the proprietary LearnDash.

Advantage: The combination of WordPress and an LMS offers a very flexible way to combine the enormous number of plugins from the WordPress universe and the ones of the LMS. This flexibility results in a platform that is customizable to nearly any use case without advanced technical skills. The costs for hosting and the software licenses are the cheapest of all the considered options.

Table 1
Comparison of
systems and
platforms for
video-based online
teaching.

	Accessibility	Technical requirements	Flexibility	Price	Privacy
MOOC platforms (<i>Coursera, edX, FutureLearn</i>)	- Free for all	- No technical requirements are needed	- Only for MOOCs, no SPOCs are possible - The layout and course structure cannot be changed	- High fee to become a partner university - Free for students - University dependent fee for an official graduation	Coursera, edX, and FutureLearn are commercial platforms. The first both are based in the USA, the latter in the UK. Storing private student data at these platforms is not allowed under European law
Open edX	- Can be controlled individually	- If you use a hosting service, no technical requirements are needed - If you host it yourself, the technical requirements are very demanding	- Suitable for MOOCs and SPOCs - Only the customization offered by the host is possible	- Open Source - Hosting costs can become high - Student fees can be defined individually	Usually hosted by non-university services. Storing private student data at host outside the country of the university is difficult, but possible depending on the location of the hosting service
Moodle	- Usually only for university members (if hosted by the university)	- Usually hosted by the university or a hosting service. We have not found an example for a self-hosted solution	- Very flexible for using it as accompanying tool for face-to-face seminars - Difficult to customize it for video-based online courses	- Open Source - Hosting plan starting from 250\$ per year	Usually hosted by universities; therefore, privacy is not an issue. Using a hosting service may require special contracts
LearnPress (WordPress)	- Can be controlled individually	- Requires a self-hosted WordPress installation - Looks Great Out Of The Box	- Can be used for many different scenarios - There are a lot of additional plugins - Very well suited for video-based online courses	- Wordpress is free - Hosting costs - LearnPress: Free to \$249 /per year	Can easily be hosted by universities; therefore, privacy is not an issue. Using a hosting service may require special contracts
LearnDash (WordPress)	- Can be controlled individually	- Requires a self-hosted WordPress installation - Needs some time to get used to the system and set up a beautiful online course website	- Can be used for many different scenarios - There are a lot of additional plugins, but they can increase the costs substantially - Very well suited for video-based online courses	- Wordpress is free - Hosting costs - LearnDash Cost: \$159 - \$189 /per year	Can easily be hosted by universities; therefore, privacy is not an issue. Using a hosting service may require special contracts

Disadvantage: The flexibility of the WordPress-LMS results in some training time to get used to the backend functions and the visual customization options of a course website. The maintenance of the platform needs some resources.

Figure 1
Courses at the
Open Teaching
Platform OTP at the
Bauhaus-University
Weimar.

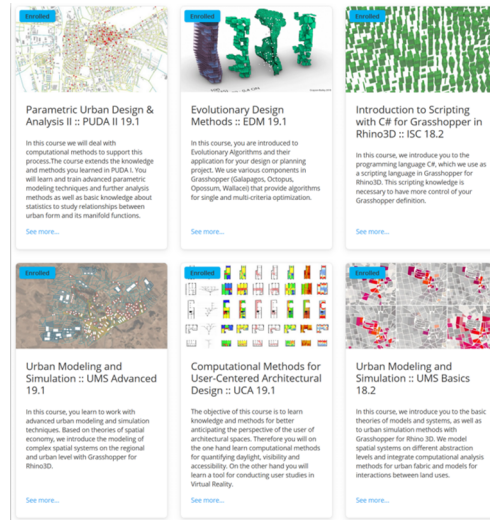
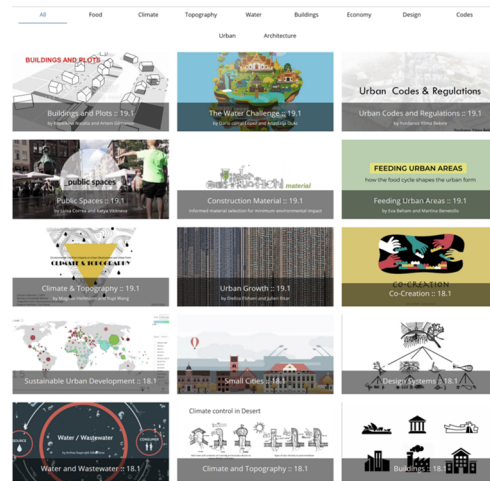


Figure 2
Results showing
some students
presentation on the
OTP of the
Bauhaus-University
Weimar. Most
presentations are
linked to VideoAnt
[4], where the
time-based
annotations are
included.



OPEN UNIVERSITY CONCEPT

In this section, we present some conceptual ideas for a modern open online university. Open means in our context, that courses are accessible for the public online without restrictions. Thus, we distinguish in the following between internal and external students. Internal are students that are inscribed at a university and external are all other participants that participate at a course for either free or a fee.

From our experience in developing our video-based Open Teaching Platform OTP at the Bauhaus-University Weimar (see Figure 1)[2], one of the challenges is how to open courses flexibly for external students based on our teaching activities at the university. The video lectures can be used for internal and external purposes, whereas the requirements to the internal students were higher. Thus, we included assignments for evaluating internal students in detail, which is not possible for a wider external audience. Furthermore, we offer regular face-to-face meetings for discussing the corresponding tasks and individual questions and projects. On the other side, we need to automatize the progress of external students as much as possible. Therefore, smart usage of quizzes with a set of randomly selected question is a good approach. The quizzes can also be linked to tasks that require the usage of defined CAAD software.

It is an open question, how to combine internal and external students. Do they take the same courses or is a separation needed? These questions need to be also reflected from a legal perspective concerning data protection rights of internal students. For example, using the real name of a student at an open teaching platform is not self-evident.

Of course, video-based online teaching requires the development of new teaching forms. We ask our students to submit their lectures in the form of videos and offer other types of student-submitted content (see Figure 2)[3]. We made excellent experiences with the technique of video annotations, as it is offered by VideoAnt [4]. It allows adding time-based comments to video lectures by students, which cre-

ates an exciting discussion dynamic. Such an approach can include contributions from internal and external students. Finally, it is an interesting method to accumulate and document research and design projects from the students systematically over many semesters, from which new students can learn.

After the first semester in which we used the new video-based online teaching method at the Bauhaus-University Weimar, we evaluated the experiences of the students. Their feedback was throughout positive, as the following comments show exemplary:

- *"everything was online, easy to follow on my own pace to learn deep topic"*
- *"keep up the high academic level of the learning platform"*
- *"communication; new topic to me; very international; very encouraging lectures"*

Online teaching offers various ways for student-student and teacher-student communication via emails, direct messages, announcements, forums, or social media frameworks. It is a meaningful approach to organize students into different groups for external and internal students to have separate communication channels, especially for information to and between internal students.

Lastly, the Holy Grail of open online teaching is the exchange of courses between universities. Theoretically, this should be possible in Europe based on the European Credit Transfer and Accumulation System (ECTS). ECTS is a credit system designed to make it easier for students to move between different countries as defined in the Bologna Process [5]. Nevertheless, the courses from other universities are not always compatible with local study plans. Thus, the practical implementation requires active and creative participation of the faculties and universities, leaving more flexibility to the students in defining their study plans.

EXAMPLES OF TODAY'S SYSTEMS

Beside the MOOC platforms introduced above, there are other examples of more or less open learning concepts that we consider in the following and summarize in Table 2:

One of the oldest alternatives to traditional universities is so-called Distance-Learning Universities. Some examples are the Fernuniversität Hagen in Germany [6], the FernUni Schweiz [7], or the Open University in England [8]. The main idea of these institutes is to offer to study while in employment. Professional schools at some universities also offer such concepts. Either the offering institutions use the classical form of sending paper-based study material by mail, or they use Moodle for distributing the content digitally and providing a more flexible digital communication channel with the lecturers.

A more restricted approach is to open courses for students already inscribed at a university. We can find such a SPOC concept at ETH Zurich, which use the term TORQEs for Tiny, Open-with-Restrictions courses focused on Quality and Effectiveness. TORQEs use Moodle for video-based courses, which are closely aligned with their face-to-face equivalents [9].

Combining content from universities in the federal state Hamburg, the Hamburg Open Online University HOOU was founded [10] with the goal of digitalizing science teaching and opening it to civil society. However, HOOU is not primarily a video-based teaching platform but provides various educational materials in the form of Open Educational Resources (OER), which may include video courses.

In contrast, to open teaching initiatives, there are commercial platforms that offer courses as paid service for an experienced professional who wants to learn a new skill. For the architecture, engineering & construction industry, there are, for example, ArchiStar Academy, ThinkParametric, and Performance Network that were founded in recent years. They offer tutorials primarily for software training and examples of projects implemented by a set of software tools.

Another alternative to offer video recordings of

Table 2
Provider of open
learning concepts.

	Accessibility	Technology	Flexibility	Costs	Privacy
Fernuniversität Hagen	National university admission and course dependent requirements	Paper-based plus Moodle	Traditional paper/mail-based system; potentials of digital online teaching are not fully used	Fee depends on the study program	According to German privacy law
FernUni Schweiz	National university admission and course dependent requirements	Moodle	Well suited for SPOCs and internal users. Difficult for open formats	Fee depends on the study program	According to Swiss privacy law
Open University	Course dependent requirements	Moodle	Well suited for SPOCs and internal users. Difficult for open formats	Fee depends on the study program	According to UK privacy law
Studying at universities while in employment	National university admission and course dependent requirements	Depends on the university, but often it is Moodle	University-specific. Usually well suited for SPOCs and internal users.	Fee depends on the study program	according to privacy law of the university's country
TORQUES ETH Zurich	Only for members of a Swiss university	Moodle	Well suited for SPOCs and internal users. Difficult for open formats	Inscription fee for a Swiss university	According to Swiss privacy law
HOOU	No restrictions	Self-developed system	Seems to be very flexible, integrating various web technologies	Free for all	According to German privacy law
OTP	Open courses without restrictions; For internal courses, the rules of the university apply	WordPress with LearnDash	Very flexible since based on WordPress, various plugins can be combined for individual purposes	Free for some courses. Costs depend on the course and certificate or graduation.	According to German privacy law
ArchiStar Academy	No restrictions	Not known	Not known; Made for architecture, engineering & construction industry	Free for essentials, EUR 570/year for full access	Commercial provider, the national law of the providers country apply
ThinkParametric	No restrictions	Not known	Not known; Made for architecture, engineering & construction industry	Membership \$19/month or \$228/year	Commercial provider, the national law of the providers country apply
Performance Network	No restrictions	Not known	Not known; Made for architecture, engineering & construction industry	For all courses on the platform: \$197/month \$1,997/year	Commercial provider, the national law of the providers country apply

courses is using YouTube or Vimeo channels. They are straightforward to handle and efficient for video distribution. There are good examples of CAAD channels [11], creative computer programming [12], or research methods [13].

However, by using such video channels, one is restricted primarily to the provision of videos. There are not many possibilities for communicating with students, adding tests, or managing inscriptions. Thus, we consider it not as a feasible option for video-based courses.

CONCLUSION

Our conclusion from the compared systems is that you need a customized website for a complete online video course. Therefore, Moodle would not be our first choice because the course structure is not ideal for a video-based online course, and we missed some functionalities to open and visually present courses. Open edX is an exciting alternative, but there are not many hosting services in Europe (which is essential concerning data protection regulations). From our perspective, the option to set up an online video course platform using WordPress extended by an LMS such as LearnDash or LearnPress is the most attractive one in terms of its flexibility but requires some technical competences.

From our experience, the most challenging aspect besides choosing the right platform is the creation of appropriate content. The new technologies allow numerous pedagogic experiments, which go far beyond just digitalizing the existing course materials. After our first semester, we changed our perspective on teaching entirely.

The development of MOOC and SPOC course formats allow an exchange of courses between universities. To a certain degree, students should be allowed to include courses from other universities in their programs, which could lead to entirely new programs across universities, where student exchange could be physical and virtual.

A remaining challenge is how universities provide sufficient resources for open online courses.

The requirements for lifelong learning in modern societies require new teaching concepts and online teaching formats that shall not be limited by national borders.

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On the accompanying post on the website [17] we provide further information on the described platforms and systems for video-based online teaching.

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