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# The Future of Teleteaching in MOOC Times

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***Abstract*—In the last decades, a lot of different e-learning platforms have established. There are several types of them for example teleteaching platforms. For a couple of years, MOOC platforms have come up and have been enjoying great popularity. In this paper we analyze how important teleteaching platforms are in times of MOOCs. A teleteaching platform is understood as an online service which offers live or recorded lectures as video streams. Furthermore, different concepts how teleteaching can be integrated into MOOC courses are discussed as well as approaches to analyze differences in learning outcome and behavior of students using MOOCs and teleteaching platforms. We analyze if there are urgent factors for the use of teleteaching systems with a view on students' behavior and learn success. It is further discussed how intelligent integration methods can be used to offer students an enhanced learning experience.**

## I. Introduction

In the early 90s, with the introduction of the World Wide Web, a lot of new learning opportunities have come up. One of the first teleteaching approaches with a video conferencing system was discussed in a graduate seminar at the University of Oslo 1993 [1]. Since 1993, a lot of different teleteaching systems (hardware and software) where introduced e.g. Epiphan[1] for recording lectures, MIT OpenCourseWare [2] as an online platform making videos accessible or tele-TASK [3] as a combined recording system and online platform. The users are able to watch recorded lectures or tutorials from universities offering lecture recordings online. However, considering the limited bandwidth and the big video size, video-based teleteaching was not available for the broad public. It was just used at universities in the beginning. After a couple of years, more and more people's internet connections have got an improved bandwidth and the opportunity to stream videos in real time. This was the start of teleteaching for millions of people all over the world. After a couple of years, teleteaching has become available at a lot of universities, companies, and other teaching institutions. Especially, after the introduction of iTunes U[2] where all universities can offer their video lectures at a central place for free. So, a lot of recorded lectures have become available. Nevertheless, teleteaching still has a flaw. Students are not able to check their knowledge. They do not have a feedback if they understood all of the discussed topics properly. Therefore, one of the first MOOC courses, maybe the first, was introduced at the University of Manitoba in 2004 [4]. Naming the very first MOOC is not easy because it depends on the exact definition of what a MOOC is (and definitions differ). Nevertheless, these courses solve the problem of the inability to check one's knowledge and understanding and they offer interactive learning experience. Additionally, MOOCs use discussion boards to share knowledge with other students who are working on the same problems at the same time. This paper is going to discuss if teleteaching is still necessary taking into account the numerous advantages of MOOCs.

Furthermore, in this paper we discuss possibilities to improve the learning experience by interactive collaborative learning on teleteaching platforms. This is especially interesting for students preparing for an exam or students who like to talk with others during learning to be sure if they got everything correctly.

## II. Related Work

During the last years, a lot of MOOCs have established like the free openHPI[3] from the Hasso Plattner Institute, the platform edX[4], introduced by Massachusetts Institute of Technology and Harvard University, and coursera[5], introduced by Stanford University. openHPI offers courses based on the lecture program of the Hasso Plattner Institute. In contrast, platforms like edX and coursera act as MOOC service providers. Different universities can use the services to offer MOOCs to the public. Because of the many contributions of universities around the globe already hundreds of courses took place on these platforms. Even though the MOOC courses are free of charge one drawback exist with platforms like edX and coursera. If the users want to get a certificate they have to pay an additional fee.

To analyze the users' interaction in MOOCs MOOCdb was introduced by Stanford University, Massachusetts Institute of Technology and Coursera, Inc. [5]. MOOCdb offers the possibility to store interaction data from different MOOC platforms at a centralized database. Out of this centralized database, MOOCviz can visualize the data from the different platforms. This approach makes a joint analysis of two courses from two platforms feasible. This paper is going to extend the idea of MOOCdb with the concept that teleteaching and MOOCs should save data in a central database. So a joint analysis of two different platforms types is realizable.

To enable video suggestions, websites like YouTube use graphs to find similar suitable videos. This is necessary considering the wide quantity of more than 45 million videos [6]. These graphs can be generated e.g. by videos watched by the same users. Nevertheless, this approach just focuses on related video search for a big amount of videos at one platform. But

[1] http://www.epiphan.com
[2] http://www.apple.com/de/apps/itunes-u
[3] http://open.hpi.de
[4] http://www.edx.org
[5] http://www.coursera.org

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it does not work across platforms. We think that a related video suggestion system is doable via realizing an integration of teleteaching and MOOCs. We are going to discuss cross platform video suggestion approaches in Section III-B.

## III. Approach

### A. *Comparison of MOOCs and Teleteaching*

MOOCs are supporting the idea to reward the users with paid or unpaid certificates. This idea leads to higher motivation in comparison to teleteaching systems. In teleteaching, users just watch videos without exams and tests which are necessary to issue a certificate. Furthermore, tests and exams give feedback to the user if the learner understands everything correctly. In addition, students prefer learning by doing with around 70% in contrast to just listening with around 4% [7]. As a consequence, MOOC self tests, tests and exams have a big advantage in the learning process compared to teleteaching systems.

Learning discussions in discussion forums are quite different in MOOCs and teleteaching. On the one hand, MOOC discussion forums often are only available for a short time for the specific course. Even when a course with the same topic starts again the discussion forum starts empty. So a lot of redundant data can be produced. On the other hand, teleteaching systems are more efficient. If teleteaching lectures offered a discussion board for each lecture, all information would be persistent and available for years after recording. So this information is long term available and no redundant data will be produced. Furthermore, the whole video content of all lectures is available in teleteaching for a long time. In contrast, MOOC content often is available online temporary only. Otherwise, an active MOOC course requires an active teaching assistant for e.g. exam support. So teleteaching is able to offer a way bigger and longer-lasting source of knowledge.

A main difference between MOOCs and teleteaching is the user focus. MOOCs focus on the actively participating users of the online portal. Whereas, teleteaching is more focused on students attending lectures and exercises. They use the online content especially as reference material to prepare for assignments or learn for an exam. Hence, MOOCs have more of a school-like style. This means one part of the topic is described and then the student can check with a small test if everything was understood correctly. Contrarily, teleteaching is much more like in a university. A video is one part of a big topic (semester) with around 90 minutes and the students have to learn by watching and listening, taking notes and deciding what is important on their own.

Even though there are a lot of advantages using MOOCs to educate the students there is a main financial drawback. MOOCs have to have a teaching assistant or teaching team for maintaining the video content, preparing the tasks for the assignments and the exam, and taking part in the discussion forums. In teleteaching, just a lecturer, a recording system, and the online platform are needed. So the management of teleteaching is easier and cheaper as the lecture itself is given anyway.

### B. *Integrate MOOCs and Teleteaching*

To increase the learning outcome in e-learning we think about the approach of linking MOOC platforms with teleteaching systems. So, all advantages out of both worlds can be combined. In a MOOC there are several possibilities to connect to an already existing teleteaching video. As a manual way the teaching assistants have to add links to teleteaching videos related to the current MOOC topic. Another way is the automatic connection of MOOCs and teleteaching. One automatic way is to analyze the keywords of a MOOC course or a MOOC section and match it with keywords from teleteaching resources.

The automatic keyword matching method should use the keywords set for this course. In the teleteaching platform all available lectures will be searched for given keywords. Now if three or more keywords match the MOOC course and the teleteaching lectures it is assumed that these courses are similar. Hence, in the MOOC course a link to the teleteaching lecture will be made available. In case the teleteaching platform does not have keywords for the lectures or courses we can determine the most important words. In tele-TASK we can use the service that all written words on the slides video stream and the spoken words of the lecturer's are available as text [8]. Zipf's law predicates that words used frequently are more important for the author than others if basic words like articles are ignored [9]. So, here we can pick the frequently used words and use them to match them with the keywords of the MOOC course like mentioned before.

In the teleteaching system tele-TASK keywords can be matched for every slide. This makes it possible to jump directly from the MOOC to the corresponding lecture at the specific time as it is shown in Figure 1. With the automatic approach, students can use an easy work flow to access additional material without extra effort for a teaching assistance.

Additionally, semantic web features can be used to link to lectures with similar content. Therefore, it is for example possible to disambiguate keywords from dbpedia[6] for a given keyword in a MOOC. In the case of dbpedia these disambiguated keywords can be found by the predicate *wikiPageDisambiguates* for a given keyword as subject. Based on the new keywords, similar teleteaching lectures can be linked out of the MOOC like it is shown in Figure 2.

It is not only possible to link to a lecture with video content and keywords. Furthermore, a link on behalf of assignments or exams is possible. So in case a learner has a wrong answer in a self-test or assignment he or she can be advised to navigate to the lecture on the teleteaching platform to watch this lecture, or just the scene where there was a problem, again. This also applies for the advice to voluntarily deepen their knowledge even though the answers were given correctly.

[6]http://dbpedia.org


Fig. 1. Jump from MOOC platform to specific time point at teleteaching platform

Listing 1. Basic example for self-test XML-format to exchange self-tests between MOOCs and teleteaching platform

```
<?xml version="1.0" encoding="UTF-8"?>
<quizzes>
  <quiz>
    <name lang="en">Self-Test 1</name>
    <instructions lang="en">
      The quiz instructions go here!
    </instructions>
    <attempts>0</attempts>
    <time_limit>3600</time_limit>
    <questions>
      <question points="10" type="MultipleAnswer">
        <text lang="en">
          Who played the football worldcup
          finals in 2014?
        </text>
        <explanation lang="en">
          A general question explanation
          shown in solved quiz.
        </explanation>
        <answers>
          <answer correct="true">
            <text lang="en">Germany></text>
            <explanation lang="en">
              A specific explanation
              shown in solved quiz
            </explanation>
          </answer>
          <answer>
            <text lang="en">Brasil></text>
            <explanation lang="en">
              A specific explanation
              shown in solved quiz
            </explanation>
          </answer>
          <answer correct="true">
            <text lang="en">Argentina></text>
            <explanation lang="en">
              A specific explanation
              shown in solved quiz
            </explanation>
          </answer>
        </answers>
      </question>
      <question points="5" type="MultipleChoice">
        ...
      </question>
    </questions>
  </quiz>
  <quiz>
    ...
  </quiz>
</quizzes>
```

In teleteaching it is possible to add a link to the current course if it matches the current watched lecture based on Keywords. Therefore, the keyword matches from a MOOC to the teleteaching portal will be used vice versa. This enables the student to access a managed course of the specific topic with additional assignments and tests to evaluate if everything was understood properly.

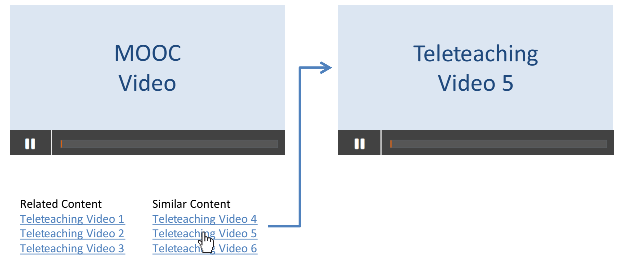


Fig. 2. Jump from MOOC platform to similar lecture at teleteaching platform

Another approach for combining MOOCs and teleteaching is to extend teleteaching with self-tests. An easy way is to reuse questions from MOOCs in lectures of teleteaching videos with the same topic. Through this enhancement teleteaching users can take advantage of high quality tests created by teachers or teaching assistants. In the platform of openHPI there is already an import function for tasks but there is no export so far. Based on the already existing XML import format an export format like it is described in Listing 1 should be implemented. This XML file should be imported into the tele-TASK web portal for a lecture with similar content. Now it is easily possible to use the same questions in the long term available teleteaching portal of tele-TASK.

Listing 2. RDF example for automatic self test generation

```
<?xml version="1.0"?>
<rdf:RDF
xmlns:rdf=
"http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:cd=
"http://www.example.com/cd#">

<rdf:Description
rdf:about=
"http://www.example.com/cd/Transport_Layer">
  <cd:haveProtocol>
    TCP
  </cd:haveProtocol>
  <cd:haveProtocol>
    UDP
  </cd:haveProtocol>
  <cd:isPartOf>
    TCP/IP Stack
  </cd:isPartOf>
  <cd:possibleService>
    Connection-oriented communication
  </cd:possibleService>
  <cd:possibleService>
    Same order delivery
  </cd:possibleService>
</rdf:Description>
</rdf:RDF>
```

Another way to create self-tests is using semantic web technologies. Like mentioned in the beginning of this section tele-TASK offers all spoken and written words of the slides in a textual form. As basis it is assumed that all detected words are well explained in context of the other words on one slide. Based on this assumption we are able to check for combinations of keywords as subject and object in semantic web descriptions. As an example we found the following combinations for *Transport Layer* as subject with the objects *TCP*, *UDP*, and *TCP/IP Stack* which all where mentioned on one slide in the lecture. Additionally, the keywords *Connection-oriented communication* and *Same order delivery* were mentioned in the lecture on different slides and are also connected in the semantic web as an object with the subject *Transport Layer*. As all of the words were mentioned somehow in the lecture the user of the teleteaching platform should know all these words. Now, the RDF example description shown in Listing 2 can be used to generate the question and answers out of the keywords matching subjects or objects out of the RDF description. First, one predicate (e.g. *haveProtocol*) is chosen out of all possible predicates. In the next step a basic request/question is made out of the subject (in this example *Transport Layer*) and the chosen predicate. A possible task could be "*Name Transport Layer protocols!*". All correct answers to this request/question have the subject *Transport Layer* and predicate *haveProtocol*. All wrong answers have another predicate. The final task with correctly marked answers for this example looks like this:

Name Transport Layer protocols!

- Same order delivery
- TCP ✓
- TCP/IP Stack
- UDP ✓
- Connection-oriented communication

### C. Analyze Differences in Learning Behavior

To analyze the learning behavior between students using MOOCs and students using teleteaching this section describes several approaches. Like it is shown in Figure 3 in the first step the video player of both platforms will be analyzed. The video player analysis focuses on how long a video is being watched before the users navigate to another website and how the users are interacting with the player. All information is going to be collected in a central database. This database can be reached by both learning platforms via a uniform REST API. The advantage of saving all data centrally is that all data can be evaluated in one place like it is known from the MOOCdb [5] and MOOCviz [10].

The first approach is to figure out how long videos are being watched in MOOCs and teleteaching systems and to analyze the differences. The main focus on the analysis is to check if differences exist, after which time watching a video is terminated by navigating elsewhere or closing the browser. For the analysis, the percentage of the watched video is interesting. Especially, taking into account that MOOC videos generally are way shorter than teleteaching videos which oftentimes are full lectures of around 90 minutes length. Commonly, students are more engaged by short videos [11] which is used in most MOOCs as an advantage. Additionally, it is also interesting to find out which video content is going to be abandoned faster than another. After implementation, the test should show if the

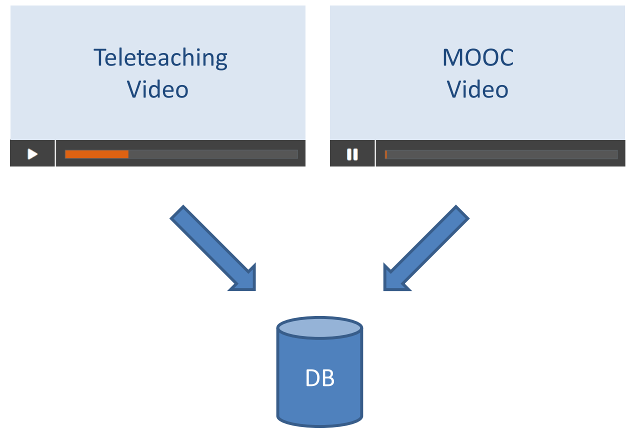


Fig. 3. Saving video player interactions on MOOC and teleteaching platform

usage of short videos in MOOCs is more useful than long full lecture videos.

Currently, teleteaching results of tele-TASK are available describing the percentages of watched video content in comparison to the complete video duration. The results were figured out by developing a concept for analyzing the Adobe Flash Media Server[7] log files [12]. Therefore, the Flash Media Server files were parsed and analyzed to find relevant information about the watching behavior of students. As a result of all lectures watched in 300 days, 12,258 hours of video were watched by the students. In comparison with the watched video duration, in average the users watch 22.24% of a complete video stream. Additionally, we have analyzed the most watched lectures at tele-TASK for 300 days. The results are shown in Figure 4. There are some exceptional values for each video in comparison with the overall value of all videos. Nevertheless, in conclusion, the percentage of the watched duration of a video is mostly around 20% to 30% except the lectures "Conferences 2012" and "Semantic Web Technologies 2013". Consequently, we have to find out the same numbers of the much smaller video parts of our MOOC platform and analyze them to see if differences exist. Furthermore, we have to find out if users watch shorter videos more patiently or not so that the lecturers can conceive and create their video lectures according to the students' learning behavior.

Another way to analyze if MOOC videos or teleteaching videos are watched more patiently is by checking the jump rates of users in videos. Therefore, it can be checked if a user just glances through videos and watches just parts for a few seconds every now and then skipping whole chapters. Or if the user is really patient and maybe does not get everything. So, the user is going to jump back to an earlier video part to watches it again. This analysis is not just showing how patient a user is. It also makes it possible to analyze which parts of a lecture are more difficult to understand [12].

Another way to analyze how attentive a user is can be recognized with the use of the player's start and stop buttons. If a user pauses a video very often (and not just for a few seconds to think about the just heard things) he or she might

[7] http://www.adobe.com/de/products/adobe-media-server-standard.html

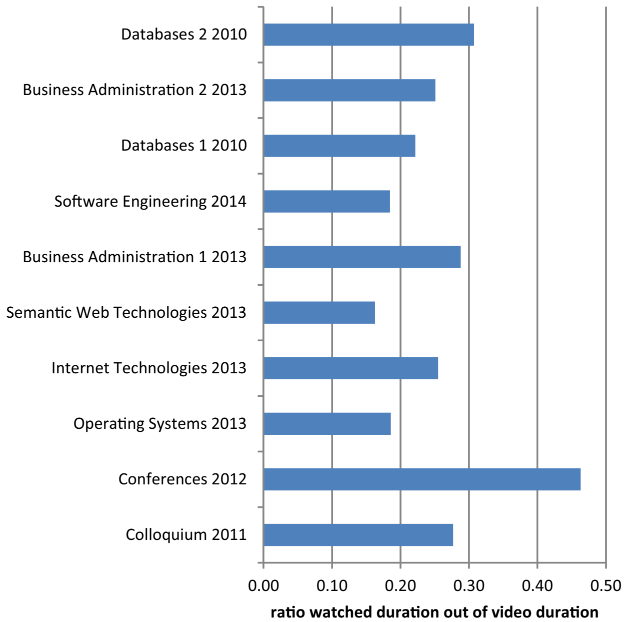


Fig. 4. Most watched tele-Task videos of 300 days with ratio of watched time and total video time

be distracted during watching a video. So, it is possible to find out if users watching MOOCs (short videos) or teleteaching (long videos) are more concentrated or they do it while doing something else at the same time.

### *D. Collaborative Learning With Teleteaching Platforms*

This approach has the intention to enhance the learning atmosphere and should motivate students to learn with teleteaching platforms. Nowadays, students learn more or less alone online which could be frustrating and less productive [13][p. 252]. To improve the learner's motivation, a collaborative approach should be implemented on teleteaching platforms. Another advantage of learning together is that students realize if they got everything correctly. Especially, when students talk about a topic they can realize if they got everything or if there is a misunderstanding or a knowledge gap. This perception is important for students because it helps them find out on which topic they have to concentrate. Furthermore, it can lead to a better grade in an exam. In order to reach our goal and give students the tools for learning collaboratively, the JavaScript library TogetherJS[8] should be utilized as a foundation. TogetherJS makes it possible to collaboratively work on one website. Possible collaborative tasks are editing forms, pointing out facts on the website to connected users by clicking, making notes together as text or by drawing on an HTML5 Canvas element. Furthermore, TogetherJS comes with basic social media interactions like text and audio chat. In the context of teleteaching it is especially interesting to use collaboration to watch the video synchronously with one or more other students like it's shown in Figure 5.

[8]https://togetherjs.com/

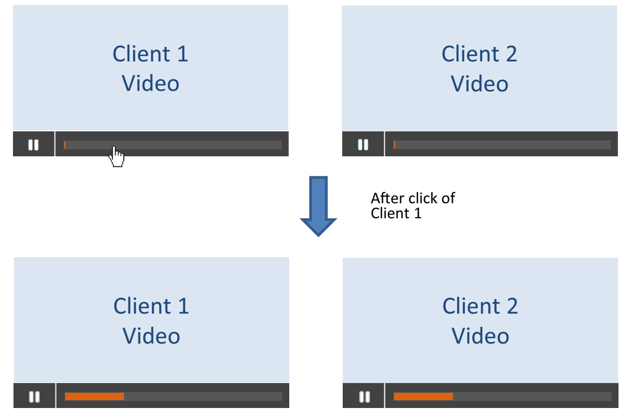


Fig. 5. Two students watching a video synchronously on different clients

To accomplish this idea an HTML5 player has to be used instead of a Flash-based player due to the fact that TogetherJS is mirroring the JavaScript actions and manipulations of the HTML Document Object Model (DOM) on all clients synchronously. Flash cannot be used because the students' interactions with the Flash player do not cause any DOM modifications or JavaScript interaction and hence cannot be detected. But for many years (before HTML5 and JavaScript were as evolved as they are now) synchronous playback of two videos (speaker and presentation) was only possible with Flash or other plugins.

Additionally, it has to be taken into account which users can collaborate to watch a video together. By default, students using TogetherJS can work together when they access the same website. Or, in case of teleteaching, when they are accessing the same video website. This behavior would not be pleasant for students if they always have to watch the video stream at the same position and with the same speed as the other users on the same video website or see the other students' mouse pointers on this website. Especially, it would be strange for students to work together with students they would not know. To avoid these problems students can become friends on the teleteaching platform. When they are friends they can see each other when they are both on the platform or watching the same video and then they can decide to watch it together. A possible solution for a tool tip that a friend is online and watching this video is shown in Figure 6.

Another way to use the feature of learning together with a teleteaching video is to schedule a collaborative learning session with one's classmates while seeing each other in person in the university at a tutorial or lecture. If they exchange email addresses one student can invite the other students by mail that they can have a learning session together. This is a way of avoiding the necessity to register at the teleteaching platform and becoming a friend with all of the other students one just met in one lecture or course.

Another way to start a collaborative session can be by mail invitation to another student who is already a friend on the web platform. If you are willing to learn mode but do not want to learn alone you can invite a friend by mail. Now it's possible for the friend to join the session and both can watch

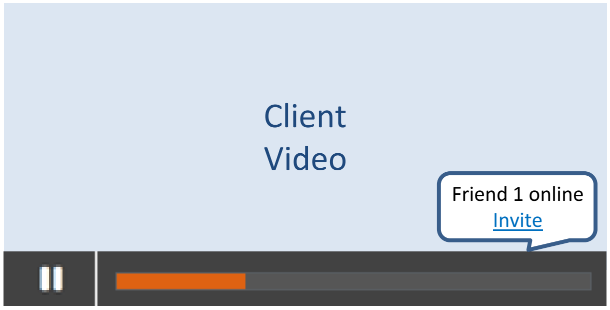


Fig. 6. Tool tip in video player that a friend is online

the video together. The main advantage of watching together should be that the video is watched completely because no one wants to disgrace oneself by stealing away early. So, this small pressure of being watched by a friend and fellow learner can be an additional motivation and also an encouragement to keep on learning. One could argue that a too strong extrinsic motivational factor (e.g. competition with a friend taken too serious) might lead to an overjustification effect [14] and hence could suppress the intrinsic motivation (the wish to learn and to feel smarter and well-prepared for the exam). But we think that the advantages of the rising intrinsic motivation caused by the helping friend and the resulting improved learning success outweigh the theoretically possible disadvantages.

Nevertheless, this theory has to be proofed by measuring if the relative duration of watching a lecture is higher with collaborative watching or without, which was described in Section III-C.

All of the herein before mentioned approaches are to be tested on the MOOC platform openHPI and the teleteaching platform tele-TASK.

## IV. Results and Future Work

This paper deals with the question if teleteaching still has its raison d'être or if it can completely be replaced by MOOCs. The result of the paper is that teleteaching with recording and publishing lectures is still necessary because of the following facts. Teleteaching makes videos available for a long time. As a consequence, teleteaching can be used like a reference book and students can just watch a lecture if they were prevented to visit it in person or they can watch a lecture again to get a better understanding. Another advantage of teleteaching is the production with less effort compared to MOOCs. For teleteaching the lecture which takes place anyway only has to be recorded and published online. In comparison, for MOOCs the teaching videos have to be recorded separately in didactically prepared, short, topic-based video parts. Additionally, all the tasks for the self test, assignments and exams have to be created, reviewed and graded. This results in a lot of time-consuming extra effort for the course's teaching team. In conclusion, teleteaching is a big information resource for students and other interested parties with a long term availability.

The goal of this paper was to point out feasible interaction between MOOCs and teleteaching to increase the learning experience for students. To improve and to find out at which points a link of both platforms is useful this paper shows approaches to analyze the behavior of students watching teleteaching and MOOC videos to reach the main goal of an enhanced experience in e-learning. Furthermore, this paper has aspirations to point out additional learning experience by collaborative learning to learn efficiently together with friends without caring for distances.

The next step of our future work is starting to realize the user analysis approaches with the platforms openHPI and tele-TASK. Meanwhile, the integration of teleteaching will be started to be realized with reference to the current results of the user analysis.

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