

# How MOOCs can be used as an instrument of scientific research

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## **Abstract**

Massive Open Online Courses (MOOCs) are an increasingly important phenomenon in the world of technology-enhanced learning. This development opens many opportunities for interdisciplinary interaction, not only for the purpose of researching MOOCs themselves, but for integrating them into various research settings. In this publication, we address the question of how MOOCs can be used as instruments in scientific research. Our suggestions are illustrated on the example of the “Dr. Internet” project, which allowed us to gain practical experience in this area.

## **Keywords**

Case study, experiences, Higher Education, Dr. Internet

# 1 Introduction

During recent years, MOOCs have been established as a rather substantial form of knowledge transfer in various academic fields. However, their didactic potential as well as their profitability is still being called into question. Therefore, MOOCs are an interesting object of continuous scientific investigation. This research usually focuses on how MOOCs may support lecturers and students, how they enhance technology-based teaching and learning and how much effort it takes to produce and to offer a MOOC. High numbers of participants produce copious amounts of data, which are routinely collected and analyzed. Previous research mostly deals with demographic issues (NEUBÖCK et al., 2015), (rather low) completion rates (KHALIL & EBNER, 2014) or the didactic value provided by MOOCs (LACKNER et al., 2014).

In all these cases, MOOCs themselves are the objects of research. While there are certainly many inherent aspects to MOOCs that warrant further investigation, they continue to play an increasingly important role in higher education (KOPP et al., 2014). Hence, they should not only receive consideration as targets of scientific research, but also as potential tools to be integrated in a variety of research designs to the avail of several academic disciplines. In this context, the following research question is the most apparent: How can we use MOOCs as an instrument of scientific research and what are the benefits and drawbacks of integrating MOOCs in a specific research setting? This paper describes the first case (at least in Austria) where a MOOC is part of a comprehensive, multi-disciplinary scientific research project. More precisely, this particular MOOC supports the investigation of people's behavior regarding Internet use to find diagnoses for diverse disease patterns.

Unfortunately, the MOOC “Dr. Internet – determining diseases with the help of Internet searches” is scheduled to start after the submission deadline for this paper. Therefore, the authors will primarily describe the objectives and the structure of the MOOC as well as its relevance for the chosen research setting, finishing off with a preview of the expected results (which will be available when the summit takes place).

## 2 “Dr. Internet”-project: Description and objectives

The “Dr. Internet”-project focuses strongly on online searching for health-related information. The aim of the project is to investigate how the increasingly common practice of using the Internet to answer medical questions affects the doctor-patient relationship, and what benefits and risks are associated with this behavior. Recent experiences of general practitioners show that more and more patients visit their doctor’s office with previously acquired medical knowledge, obtained from online sources like popular websites, patients’ forums etc. The acquired information can be extensive, but has often been found to be inconsistent and difficult to evaluate (BENIGERI & PLUYE, 2003). Possible negative consequences include unsettled patients and overwhelmed doctors: First, Internet searches might lead patients to under- or overestimate the severity of their perceived illness. Second, some patients may only consult with their physician to get a confirmation of the self-diagnosis they have already attained with the help of the Internet, and it can prove difficult for doctors to convince them of a differing diagnosis.

Therefore, it is important to raise awareness for a more balanced and critical approach to online health information. The “Dr. Internet” project is providing a MOOC that includes six different medical case studies, all of which will be assessed and diagnosed by the participants. These case studies are presented in the form of short videos in which a patient describes or exhibits various symptoms. After watching the video, the participants are encouraged to make full use of the Internet in order to find possible diagnoses, and to discuss their assumptions with other participants in the forum of the MOOC. A special quiz format is used to gather data on the participants’ diagnosing preferences and to provide feedback on medical opinions about the subject (which will be described in more detail in chapter 3).

An experienced general practitioner designed the medical case studies for the MOOC. In addition, each module includes a video, where this doctor explains which one of the suggested diseases he believes to be the most likely one and how he came to this conclusion, as well as what to do if these symptoms were to occur in real life.

The design of the MOOC thus enables participants to question their search behavior on the Internet and evaluate their skills in the context of determining diseases. Simultaneously, the participants increase their knowledge about certain disease symptoms and receive useful instructions on what to do (e.g. searching on the Internet versus consulting a doctor) when particular symptoms occur.

The MOOC is available on the first and only Austrian MOOC-platform called “iMooX”. In contrast to many other platforms, all course materials on “iMooX” are so called Open Educational Resources (OER). This means that all videos are licensed under a Creative-Commons-License and may be accessed and used by anybody who is interested in using them (as long as this is not done for commercial purposes). Moreover, all materials stay available after the initial MOOC and the research project have finished, so that future participants may still benefit from the course experience.

### **3 MOOCs as tools of research – a case study**

The description of this case study is intended to illustrate some of the opportunities and challenges of using MOOCs as a research instrument. The “Dr. Internet” research project was contrived to integrate the MOOC within an already elaborate research design, which uses a triangulation of traditional qualitative and quantitative research methods in order to build a multifaceted database. We will first give an overview of how the MOOC is involved on various levels of data generation, followed by a preview of the expected results. Finally, we will briefly discuss the particular qualities of MOOCs in a research setting and offer a few preliminary conclusions.

#### **3.1 The “Dr. Internet” MOOC as part of a research design**

The first and most traditional axis of analysis is the accumulated data that is generated solely from the participants’ activity on the MOOC itself. In addition to person-level variables like video completion, number of “clicks”, number of threads read and posting activity in the forum etc., there is a short compulsory questionnaire which participants have to fill out during the first week of the MOOC. Questions include but are not limited to the individual health situation, any experience of researching symptoms

online and the perceived trustworthiness of medical information on the Internet. There is also a qualitative arm of analysis that will focus on the MOOC's forum, with the aim not just to observe and analyze the postings, but also to start discussion threads and provide stimuli for debate.

The second level uses data that is generated both by the MOOC users as well as by an outside comparison group that is researched before the start of the MOOC. As with most MOOCs, there are quizzes to be completed as part of each medical case. However, contrary to most conventional quizzes that are constructed to test the participant's acquired knowledge and therefore serve as an indicator of learning. The quizzes of the "Dr. Internet" MOOC are better described as polls: for each medical case, the participants are asked to assess the likelihood of eight potential diagnoses that the patient in the video could be suffering from. This likelihood is rated on a four-part scale (comprising the categories unlikely, little likely, more likely, very likely) and can only be submitted once per participant. While there is no direct feedback on whether or not the likelihood estimations are correct, the participants are not only able to see the average results of all users who have already submitted their choices, but also the average ratings of a similar survey conducted among trained physicians.

The research activity on the third level can be seen as a complimentary exploration of one of the main research questions of the Dr. Internet project, which is focused on changes in the doctor-patient-relationship due to the increase of medical information available on the Internet. Therefore, both sides need to be heard and appropriate research tools have to be employed in order to provide sufficient material. Most of the subjects will be recruited through a pyramid scheme of contacting general practitioners, asking them for interviews as well as permission to approach their patients, who will be prompted to fill out a questionnaire. In order to highlight potential differences in this population and the Internet users who participate in the MOOC, there will also be several interviews with participants of the MOOC, which will roughly follow the same outline as the questionnaire. An online version of said questionnaire will also be made available to the MOOC users at a later stage of the course, but its completion will be optional.

### **3.2 Preview of the expected results**

Starting in the last week of October 2015, the “Dr. Internet” MOOC will last for six weeks. After course completion, the analysis of data collected through or in addition to the MOOC should allow for a more profound illustration of the following aspects:

- Information on the course participants and their previous experiences with online searches for medical information. While the sample is obviously not representative of the general population, the sample size is still quite substantial (expected N=400) and relatively conclusive with regard to the target population (internet users who search for medical information online). The compulsory questionnaire as well as the forum discussions will yield data on the sociodemographic background of the course participants, their perceived physical condition, their experiences with online searches for diagnosing purposes and their interactions with medical personnel regarding their findings.
- Cross analysis of participants’ characteristics and their course activities. One reason for including the compulsory questionnaire was to be able to find out more about who performs well on the diagnosing test. Additionally, we will be able to do a cross-sectional data analysis with regard to the users’ personal characteristics and several relevant course parameters (forum posts etc.).
- Comparison of diagnosing preferences of course participants and physicians. The previously conducted survey among doctors used the same videos that the MOOC users will get to see as part of the course. We are thus collecting data that will allow us to compare the diagnosing preferences of doctors and lay-people (who are encouraged to use the Internet). This kind of comparison is not only highly relevant to the main research question of the project, but also an innovative way of administering the same test for two very different and hard-to-reach populations.

### **3.3 Benefits and drawback of MOOCs as research tools**

As demonstrated on the example of the Dr. Internet MOOC, there is a lot of potential with regard to the incorporation of MOOCs into larger and multi-level research de-

signs. The advantages are relatively clear: MOOCs provide a simple and convenient way of collecting data, and they feature innovative options of presenting materials and tasks or administer tests on a large scale, which can all be pertinent to many research settings. They allow for both observation and engagement of participants, who might be more inclined to put some effort into their tasks if they feel like they receive an interesting learning experience in return. Compared to standardized questionnaires that are administered online, MOOCs make it easier to test (or question) the same sample of participants more than once. Further possible applications of these technical opportunities also include the large area of social intervention research, where there is a wide range of conceivable interventions that could be delivered and tested online.

The disadvantages include the focus on a tech-savvy and Internet-affine population, where several important characteristics might be different from the general population. Thus, there are some research areas that are more suited to use MOOCs than others (like the “Dr. Internet” project, where the phenomenon under consideration was closely tied to Internet use in and of itself). There are also a few general characteristics of MOOCs that are detrimental to some research designs, for example the low completion rate and an overall declining frequency of activities of most course users. This is a problem for most experimental settings, where a high attrition rate severely compromises the comparability of outcomes in different groups. While some incentives that are used in traditional research settings might also prove useful here (like monetary compensation or course credits for students), it is likely that new ways of encouraging ongoing participation will have to be developed and tested.

Finally, there is the slightly ambivalent aspect of data generated through MOOCs: while they usually produce massive amounts of data, a meaningful analysis is not always possible, since “big data sets do not, by virtue of their size, inherently possess answers to interesting questions.” (REICH, 2015) Perhaps more so than with other research tools, the instrumentation of MOOCs should always go hand in hand with a clearly structured research design and a set of realistic research questions, with full consideration of the above limitations. Additionally, the incorporation of MOOCs into complex research designs requires a high degree of coordination on an interdisciplinary level, though some might argue that this could also constitute an advantage.

## 4 Conclusion

The case study of the “Dr. Internet” project demonstrates one promising approach to the question of how MOOCs can be integrated in larger research settings, and the preliminary experiences are all but favorable. More insights and actual results are sure to be available at the time of the EMOOCs 2016.

Overall, a wide range of possibilities with regard to MOOCs as research tools is yet to be explored, which no doubt will lead to the development of more recommendations as well as best practice examples. We can, however, already conclude that the instrumental use of MOOCs in scientific research will give rise to new ways of collecting and analyzing data that shows every indication of being a useful addition to the existing array of scientific methods.

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