MOOCs as Auxiliary Material for Classical Lectures and Seminars

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The physicist and professor Loránd Eötvös, after whom my university was named in 1950, said that the quality of a university depends on the quality of its professors. To challenge this claim, let us first have a historical overview of different epochs of university education and the teaching technology used.

In the Middle Ages, there were a very limited number of books available, and they were mainly for professors only. Thus, the method of education was predominantly oral lecturing and note-taking by the students attending the lectures. With the wider availability of printed books, students could even buy them and—in principle—learn without attending lectures or seminars, but this did not take place; professors were still needed to explain the content to individual students. At many universities, students also played an important role in choosing the professors to be invited to the institution.

With the advent of new media, the concepts of the "radio university," and later "TV university," were created and courses were delivered using the broadcasting possibility that reached virtually anyone interested. However popular, they did not get involved in the teaching procedure at universities; they only served as materials equivalent to popular textbooks, and personal exchange with instructors remained a determining element of the learning procedure.

The wide availability of personal computers was followed by the development of "multimedia" teaching materials. These materials also turned out to be used the same way as their predecessors, as a kind of more elaborated and user friendly "textbook." The next step was the formation of social networks based on the use of PCs and equivalent mobile devices, and a combined way of using multimedia and community portals led to what has been called "e-learning." However, the role of instructors was still important within this context; in a typical e-learning environment, it is the instructor who creates the basic materials available for students, along with the "reference manual" for their use. Though it is possible for students to interact or "discuss" the material with each other, especially within the framework of so-called e-learning 2.0, typical discussions are scattered, often irrelevant, not really allowing students to concentrate on the structure and purpose of the course. Therefore, the really efficient use of e-learning is a combination of the traditional virtual and face-to-face learning, with the professor in the leading role.

E-learning is mostly used within a higher education institution as kind of an internal network for teaching and learning purposes. The possibility to open up this platform to a larger audience led to the attendance of real-time courses online, or offline as it were, by a large number of people connected to the teaching staff and to each other by the IT network. This large-scale distribution of multimedia courses known as MOOCs is still in development, and experiences concerning their use date back only a couple of years. We can also raise the question of whether they will replace traditional (face-to-face) university courses, or if they will contribute in a determining way to those courses, or at least contribute to the credits needed for a higher education degree.

At the undergraduate level—where most of the MOOCs are used—they have drawn high participation, which could lead to a convenient solution for the problem known as "mass education." However, there is an enormous dropout rate; typically only a small fraction of the subscribed attendants participate in the prescribed activities, and only a small percent actually try to take the examination. Another problem is assessment. Though up-to-date technologies

enable personal identification using highly developed IT methods, academic honesty is not satisfactorily guaranteed in a format where examinations are unattended.

A special feature of undergraduate education—notwithstanding a few general "transferable skills" trainings—is the "socialisation" of the student in a given discipline. To become acquainted with the specific objects of a scientific discipline, to understand its specific aspects and ways of thinking, the student needs to acquire a well-developed structure of knowledge, along with a precise understanding of concepts, methods, and technical terms. At the scale current MOOCs—which can be at the order of thousands of people—there is necessarily a large variety of previous knowledge that should be considered as the basis for understanding the course material. Thus, there is no single way to explain the concepts, the meaning of terms, and the essentials of methods to different students. To cope with this challenge, a large variety of unforeseen scenarios would need to be taken into consideration and made available for the student in case s/he needed them to successfully follow the course and not to lose track. Of course, there are situations when fellow students can readily help each other, but the success of this solution depends on many factors. Questions should be worded in a clear way by the student so the s/he can be correctly understood by the peer student. There must be at least one student participating in the virtual consultation who understands the question and is also able to properly answer it. Experience does not support that this always happens. Thus, there is a great need for a careful intervention on the instructor's part to make sure that no student would be left behind in the course, not being able to become successfully "socialized" in the given discipline. Again, the need for a face-to-face contact between student and instructor is a necessary part of education, and MOOCs can only be considered as auxiliary material to the classical form of education.

Graduate education is different from the example above. Students at this level have already been "socialised"—hopefully with satisfying result—in a discipline, thus they need to enlarge the horizon of their knowledge, and mostly learn special topics within a field, more or less related to the discipline of their undergraduate studies. Considering this, students should be more alike concerning their previous knowledge on which actual course material can be based. However, in reality, this might not be the case. Modern higher education includes an increasing number of interdisciplinary programs, which results in a student audience having largely different types of formation, in different disciplines. A MOOC designed to suit students having a formation in one discipline, might not be useful at all for students trained in another discipline. A suitable example is biophysics; a background in biology gives a firm knowledge concerning species, living organisms, and physiology, without much information concerning mathematical and physical basic principles, and *vice versa*. Thus, there should at least be two (but possibly more, taking into account previous formation in chemistry, informatics, earth sciences, or even mathematics) alternative MOOCs designed for the purpose of teaching the same material.

There is also another major problem with graduate courses, especially at the level of doctoral studies. The student might need special material to be able to successfully conduct research necessary to complete advanced studies, and these materials might be the result of scientific activities dating back only for a few years. Thus, the frequent change in material, concepts, and objects included in an advanced MOOC results in its becoming obsolete soon.

To sum up, at the advanced level, there is a great need for a personal, face-to-face guidance by experienced instructors who can explain concepts to students with very different background knowledge, and are aware of the most recent developments in the given discipline. MOOCs can be very useful teaching aids at the graduate level, but the quality of education and training is critically dependent on the quality of the professors involved.