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Finding valuable direction for teaching and learning in campus-integrated Medical Massive Open Online Courses

Hendriks, R.A.

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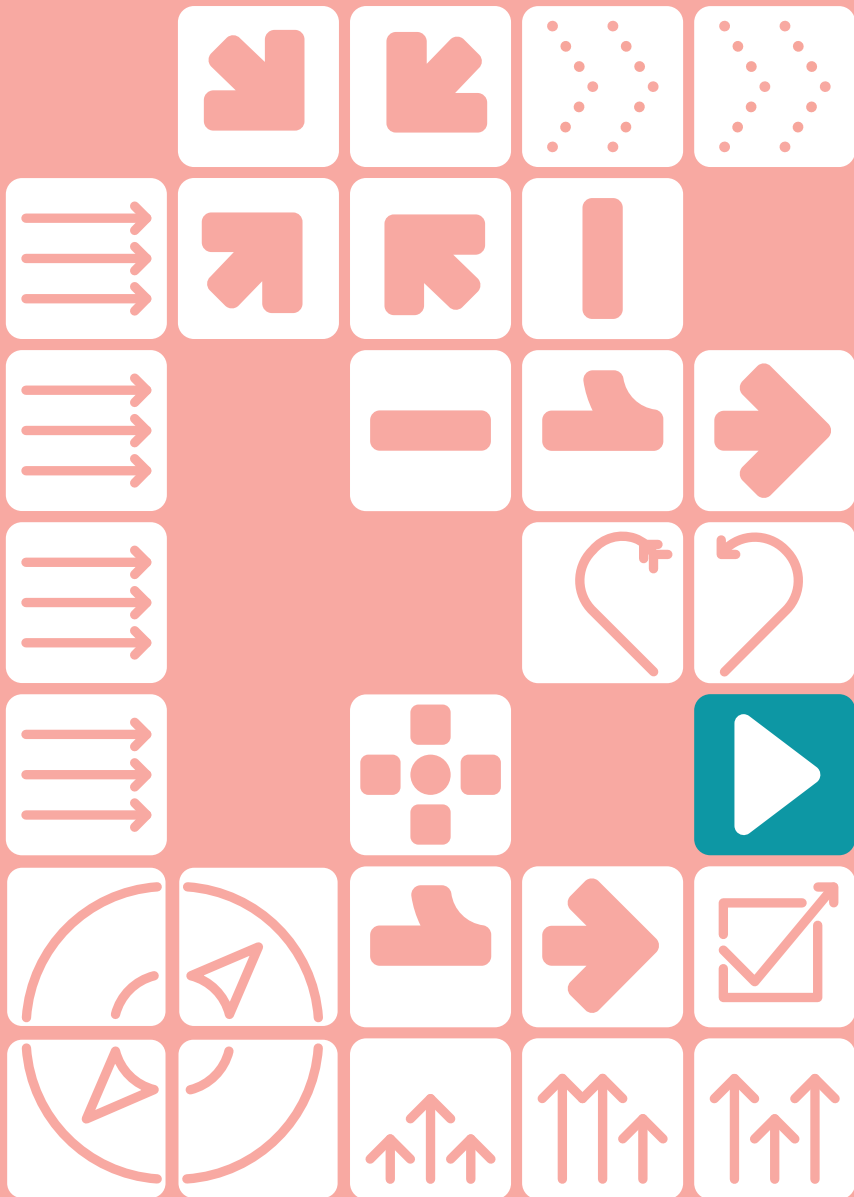
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CHAPTER 2



**Teaching Modes and
Social-epistemological
Dimensions in Medical Massive
Open Online Courses:
Lessons for Integration in
Campus Education**

Renée A. Hendriks
Peter G. M. de Jong
Wilfried F. Admiraal
Marlies E. J. Reinders

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Abstract

Medical Massive Open Online Courses (MOOCs) have been integrated into formal campus teaching by several universities. However, teaching attributes of medical MOOCs have not been systematically investigated. Additionally, guidelines are needed to inform integration practices. This study systematically investigated the available teaching modes and social-epistemological dimensions of medical MOOCs.

An overview of MOOCs on a medical topic was compiled and inclusion criteria were developed. A data collection tool was composed and calibrated. For data collection, out of 410 MOOCs 33 were selected based on these criteria. Investigators enrolled in selected MOOCs and analysed teaching modes after examination of all course pages. Teaching modes were categorised in social-epistemological dimensions according to the Teaching Approach Framework.

Twenty-nine different teaching modes were found, showing wide distributions. Analysis of social-epistemological dimensions showed medical MOOCs focus on constructivist and individual teaching modes as opposed to objectivist and group modes.

Medical MOOCs do not have a universal teaching mode profile. They contain a rich variety of teaching modes for integration in campus education of which videos, discussion boards and multiple choice questions are used regularly. Constructivist teaching modes are readily available in medical MOOCs and can support educational innovation of formal campus teaching when integrated.

Introduction

Massive Open Online Courses (MOOCs) are fully online courses, open to anyone, in which large numbers of learners can enrol. They offer a new way to learn medical concepts and are popular among learners and faculty. Many MOOCs in the medical field have been developed in the last few years. In 2014, 225 medical courses were available (Liyanagunawardena & Williams, 2014); in 2017, 511 courses were found in a similar search (Goldberg & Crocombe, 2017). Medical MOOCs offer (a) the possibility to use ‘exemplar’ learning materials from experts in their field instead of each university making their own (Doherty et al., 2015; Sharma et al., 2014), (b) access to topics not normally available in the curriculum (Doherty et al., 2015), (c) access to education from institutions that not all students can travel to (Doherty et al., 2015), (d) enhanced understanding of pathology not common to students’ resident country (Sharma et al., 2014), (e) the opportunity to remove costs and inconvenience of getting to a single location (Davies, 2013), (f) enhanced communication among international communities of clinicians and student clinicians, (g) innovative teaching models for student learning (Goldberg & Crocombe, 2017), and (h) the convenience of creating a course once and delivering it multiple times without extra effort or cost (Sarkar & Bharadwaj, 2015).

At first the impact of MOOCs was predicted to be extensive, as they challenged the traditional higher education model and offered to learn according to the principles of connectivism: diverse, autonomous, open, and connected networks of people and media create and hold knowledge (Downes, 2008). For medical education, successful implementation of MOOCs was stated to require conceptual changes in understanding by instructors and students (Masters, 2011).

Although originally developed for students that are not connected to the institution, integration of this type of online courses into formal medical campus education is upcoming (Dandache et al., 2017; Marks & Meek, 2018; Maxwell et al., 2018; Reinders & de Jong, 2016; Robinson, 2016; Swinnerton et al., 2017). Studies have described health care MOOC integration in many forms; in undergraduate and graduate education, as an elective and as a mandatory component, blended or fully online, and as an addition to or as a replacement of formal courses. Additionally a flipped classroom design has been reported (Dandache et al., 2017), and one paper described students being involved in the creation of content for a MOOC as part of an elective course (Maxwell et al., 2018).

When one desires to integrate MOOC content from their own or another institution into their formal campus teaching, it is essential to know what teaching modes are being offered in medical MOOCs and guidelines are needed to decide if the MOOC content is suitable for the given classroom context. So far little research in this area has been performed on MOOCs in general. One interesting study has investigated teaching modes in 24 MOOCs on topics in a range of different academic disciplines (Toven-Lindsey et al., 2015). They found that in the

majority of the courses digital textbooks (75%) and instructor videos (58%) were used as modes of instruction. Interaction among students was possible through a combination of discussion boards (67%) and chat/study groups (25%) and with instructors through discussion boards (29%) and synchronous 'live' events (8%). Most abundant formal assessment modes were multiple choice questions (58%) and open ended short questions (33%). Yet this investigation considered only one medical MOOC and thus is not representative for informing integration of MOOCs in medical education. Medical MOOCs are said to characteristically offer videos, discussion boards and multiple choice questions (Dandache et al., 2017; Hoy, 2014; Robinson, 2016), but their teaching modes have not been systematically examined.

In addition to determining the available teaching modes in each course, it is also important to take into account their educational qualities. When integrating MOOCs or MOOC materials into a specific context it matters whether the MOOC teaching approaches are more focused on individual learning or group learning and whether knowledge is transmitted or constructed. Arbaugh and Benbunan-Fich (2006) have developed a Teaching Approach Framework which characterizes these social and epistemological dimensions. In this model, two underlying dimensions are formulated: approaches can be either individual or group oriented and either objectivist or constructivist. These dimensions result in four possible combinations: 1) objectivist-individual; knowledge transfer from teacher to one individual, 2) objectivist-group; knowledge transfer from teacher to a group, 3) constructivist-individual; knowledge construction by an individual, and 4) constructivist-group; knowledge construction by a group. Toven-Lindsey et al (2015) found that, of the mainly non-medical MOOCs they investigated, most had educational strategies tied to objectivist views of knowledge, which made them question how revolutionary MOOCs truly are for higher education.

In addition to classifications such as 'revolutionary' or 'old-school' that might be tied to teaching preferences (Harder, 2013), these dimensions can offer guidelines for integrating MOOC content into specific campus contexts. For example, group learning has been found to be preferable to individual learning for difficult problems, whereas individual learning is more effective for simpler tasks (Kirschner et al., 2008). Additionally, objectivist modes might be preferred when students need to be informed in limited time and constructivist modes require more advanced knowledge and comprehension on the part of the student, and more qualitative feedback from the teacher (Huang, 2002).

To our knowledge the teaching modes and their social and epistemological dimensions in medical MOOCs have not yet been analysed. The aim of this study is to specify the materials and teaching approaches available in medical MOOCs that qualify for integration in formal student education. To this end our research questions are:

1. What instruction, interaction and assessment modes are present in medical MOOCs?
2. What are the social and epistemological dimensions of the teaching modes available in medical MOOCs?

Methods

MOOC Selection

An overview of MOOCs on a medical topic was compiled using the course search engine www.class-central.com, selecting the categories *Disease & Disorders* and *Health Care* (part of the category Health and Medicine) as well as the category *Biology* (part of Science). Inclusion criteria for the investigation were: 1) medical condition or disease in title to ensure relevance for medical students; 2) availability in the English language and between September 2017 and February 2018 when the study was conducted, for comprehensibility and accessibility of the courses; 3) no course fees other than for an optional certificate, as one of the main advantages of integrating MOOCs is using free materials; and 4) the target group as stated by the course information page should not explicitly exclude students as the main target group for integration purposes is students.

In the first overview 410 MOOCs were identified, of which 33 MOOCs were included in the study based on the described criteria (figure 1). The selected MOOCs were hosted on a variety of ten different platforms and offered by two health organizations, three partnerships of institutions and 26 different universities, with three courses from the same university. A list of the included MOOCs can be found in Appendix A.

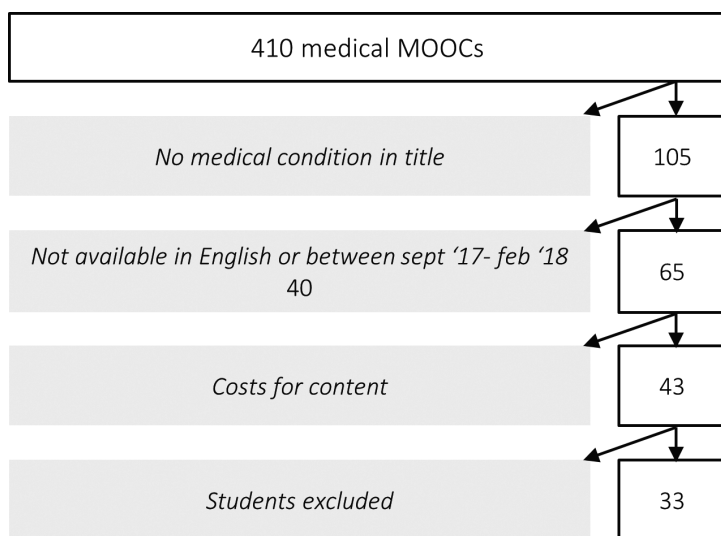


Figure 1. MOOC inclusion process.

Materials

A data collection tool was composed for inventory of general information and presence and number of instruction, interaction and assessment modes, based on the above-described study (Toven-Lindsey et al., 2015). Virtual patient cases, games and external resources were

added to this tool, as we knew from our experience these could be available in medical MOOCs as well. Teaching modes not predetermined in the tool but found in the courses were added in an open text field. The categories used for each teaching mode are presented in table 1 and 2; the complete tool is available in appendix B.

Analysis of Teaching Modes

Data collection was carried out in two phases. The first phase consisted of calibration of the data collection tool. Included MOOCs were listed in a random order and the first four courses were individually assessed by the first and second author by enrolling in the selected MOOCs as a learner and examining all course pages. After each MOOC, use and results of the tool were discussed until authors fully agreed and a diary of this calibration was kept. For the second phase, all four courses were re-examined by the first author. The first author then examined the remainder of the courses and consulted with the second author and calibration diary when unsure.

Analysis of Social-epistemological Dimensions

For analysis of social-epistemological dimensions, the Teaching Approach Framework (Arbaugh & Benbunan-Finch, 2006) was utilized to categorise all teaching approaches as *Objectivist-Individual*, *Objectivist-Group*, *Constructivist-Individual* or *Constructivist-Group*. Categorisations previously implemented by Toven-Lindsey et al. (2015) were applied and newly found teaching approaches were allotted to one of the four social-epistemological dimensions. First all authors categorised the newly found teaching modes individually, which was followed by a collective discussion about the discrepancies until all concurred. Descriptive statistics were used to present the variety of both teaching modes and social and epistemological dimensions.

Results

Teaching Modes

Instruction modes

All 33 examined MOOCs offered videos in which the instructor is talking to the camera, and text-pages or digital textbooks as can be seen in table 1. External links to webpages were available in 94% (31) of the courses. In 14 of those, instructions to use these links for assignments were offered. In 48% (16) of the courses, illustrations or simulations to clarify concepts were found, and in 30% (10) of the courses PowerPoint presentations or screencast recordings with a voiceover were identified. Recorded traditional lectures were found in 6% (2) of the MOOCs. Three categories of instruction modes described by Toven-Lindsey et al. (2015) were not encountered at all: animation figures (that act as course guide), interactive online laboratories (to conduct virtual experiments), and whiteboard drawings with voiceover were only embedded in instructor videos and as such were not coded separately. In addition to the list of Toven-Lindsey et al. (2015) three additional instruction modes were found: audio

files/podcasts, thought trees/word clouds, and flashcards. These were offered in respectively 9% (3), 6% (2) and 3% (1) of the courses investigated. In general, the distribution of the modes of instruction varied considerable among MOOCs as shown in figures 2 and 3.

Interaction Modes

Out of 33 MOOCs, 6% (2) had no option to interact with peers or instructors. No synchronous live events or study groups were encountered in any of the MOOCs; the only form of interaction available was via general forums or an option to create forums. In addition to a general encouragement to discuss or ask questions about course topics in 94% (31) of the MOOCs, 88% (29) of the courses implemented more specific prompts. A prompt to introduce oneself to other learners was found in 70% (23) of the MOOCs, and in nine of these, it was stated that staff or instructors would also interact with students on the introduction forum. Prompts to answer content specific questions were encountered in 61% (20) of the MOOCs and in fifteen of these courses, staff or instructor were stated to be active on these discussion boards. A prompt to specifically interact and respond to forum posts of other learners was found in 9% (3) of the MOOCs.

Assessment Modes

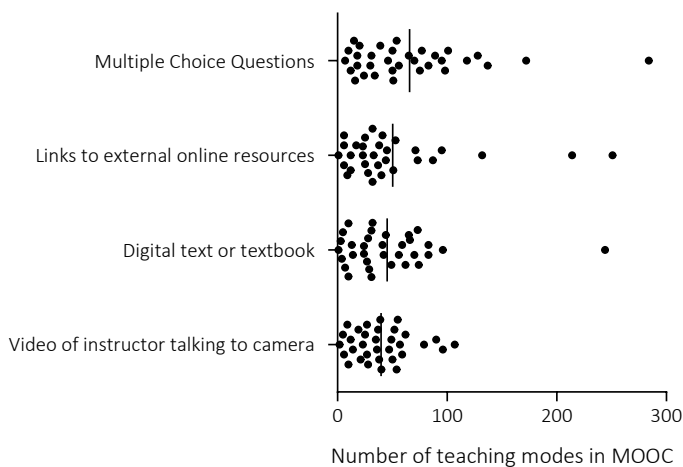
All 33 investigated MOOCs included Multiple Choice Questions (MCQs) in their assessment structure. Open ended questions were available in two forms: 1) one word answer or fill in the blanks questions, and 2) longer, essay or reflection type answer questions. Type 1 was incorporated in 6% (2) of the MOOCs, 36% (12) of the MOOCs incorporated type 2 and 3% (1) of the MOOCs included both forms of open ended questions. MCQs were typically automatically assessed, as were short open ended questions. Open ended long answer questions were self-assessed or peer-assessed. For 9% (3) of the courses it was unclear who would or should assess the open ended long answer questions. Variation in the distribution of the assessment modes is shown in figure 2 and 3. Formal assessment structures, or assessments that had to be concluded for graduation of the course were found in 88% (29). These assessment structures consisted of one, two or three of the following five components: 1) MCQs, 2) open ended short answer questions, 3) self-assessed open ended long answer questions, 4) peer-assessed open ended long answer questions and 5) obligatory discussion contributions. MCQs were part of formal assessment in 73% (24) of the courses and open ended questions with a long answer in 30% (10), of which three courses were self-assessed and seven were peer-assessed. One course included a mandatory discussion board post. Formal assessment components were spread over the course period, with most courses offering a weekly assessment. All courses offered multiple attempts at assessments and 88% (29) of the courses offered a certificate. Of these, 4 also offered an optional exam for formal (continuing) medical education credit.

Table 1A. Presence of teaching modes in investigated MOOCs.

MOOC no.	Instruction modes													Interaction modes									Assessment modes					Multifunctional modes		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X						
1	x		x	x	x	x	x		x			x	x	x	x		x	x						x						
2	x		x	x	x	x						x	x	x	x	x	x	x						x						
3	x		x	x	x	x						x	x	x	x	x	x	x		x										
4	x		x	x	x	x				x		x	x	x	x	x	x	x		x				x						
5	x		x	x	x	x						x	x	x	x	x	x	x												
6	x		x	x	x	x						x	x	x	x	x	x	x						x						
7	x		x	x	x	x			x			x	x	x	x	x	x	x						x						
8	x		x	x	x	x						x	x	x	x	x	x	x						x						
9	x		x	x	x	x						x	x	x	x	x	x	x						x						
10	x		x	x	x	x						x	x	x	x	x	x	x						x						
11	x		x	x	x	x						x	x	x	x	x	x	x						x						
12	x		x	x	x	x						x	x	x	x	x	x	x												
13	x		x	x	x	x						x	x	x	x	x	x	x												
14	x		x	x	x	x						x	x	x	x	x	x	x												
15	x		x	x	x	x						x	x	x	x	x	x	x						x						
16	x		x	x	x	x						x	x	x	x	x	x	x												
17	x		x	x	x	x						x	x	x	x	x	x	x												
18	x		x	x	x	x						x	x	x	x	x	x	x												
19	x		x	x	x	x						x	x	x	x	x	x	x												
20	x		x	x	x	x						x	x	x	x	x	x	x												
21	x		x	x	x	x						x	x	x	x	x	x	x												
22	x		x	x	x	x						x	x	x	x	x	x	x												
23	x		x	x	x	x				x		x	x	x	x	x	x	x												
24	x		x	x	x	x						x	x	x	x	x	x	x												
25	x		x	x	x	x						x	x	x	x	x	x	x												
26	x		x	x	x	x						x	x	x	x	x	x	x												
27	x		x	x	x	x						x	x	x	x	x	x	x												
28	x		x	x	x	x						x	x	x	x	x	x	x												
29	x		x	x	x	x						x	x	x	x	x	x	x												
30	x		x	x	x	x						x	x	x	x	x	x	x												
31	x		x	x	x	x						x	x	x	x	x	x	x												
32	x		x	x	x	x						x	x	x	x	x	x	x												
33	x		x	x	x	x						x	x	x	x	x	x	x												
Total (%)	100	6	30	94	100	30	9	3	18	48	6	94	61	94	9	70	100	9	21	39	55	3	12							

Table 1B. Specification for designations in table 1A.

Instruction modes	A	Digital text or textbook
	B	Recorded traditional lecture
	C	Independent activities related to content
	D	Links to external online resources
	E	Prompts to use external links
	F	Video of instructor talking to camera*
	G	PPTslideswith voiceover
	H	Audiofiles
	I	Flashcards
	J	PPT slides
	K	Illustrations or simulations
	L	Thoughttrees or word clouds
Interaction modes	M	Discussionboards for asking questions
	N	Discussionboard answering questions prompted
	O	Discussion boards for discussing course materials
	P	Prompts to respond to peers
	Q	Discussion board prompt to introduce oneself
Assessment modes	R	Multiple Choice Questions
	S	Open ended question with short answer
	T	Open ended question peer reviewed
	U	Open ended question with long answer
Multifunctional modes	V	Virtual patient cases
	W	Virtual microscope activities
	X	Games

**Figure 2.** Wide distribution of number of teaching modes.

Multifunctional Modes

Three of the teaching modes were used for instruction as well as assessment. Games were used by 12% (4) of the courses, virtual patient cases by 55% (18) and virtual microscopy exercises by 3% (1). In one course, learners were asked to create a game about a virtual patient case.

Social-epistemological Dimensions

In addition to the previous categorisation by Toven-Lindsey et al. (2015), fifteen teaching modes were categorised into social-epistemological dimensions (table 2). Including the modes previously categorised, of 29 teaching modes, 45% (13) were categorised as Objectivist-Individual, 3% (1) as Objectivist-Group, 31% (9) as Constructivist-Individual and 21% (6) as Constructivist-Group. Of the investigated courses 6% (2) only included teaching modes that are in the Objectivist-Individual and Constructivist-Individual dimensions as can be seen in figure 4. All other investigated MOOCs employed all of the social-epistemological dimensions. Courses varied in the dimensions that applied mostly, with 45% (15) of the courses focusing on constructivist modes, 39% (13) of the courses focusing on objectivist modes and the remaining 5 courses offering equal variety in objectivist and constructivist modes. All courses favoured individual teaching modes, with a maximum of 100% and a minimum of 60% of the course teaching modes being individually oriented.

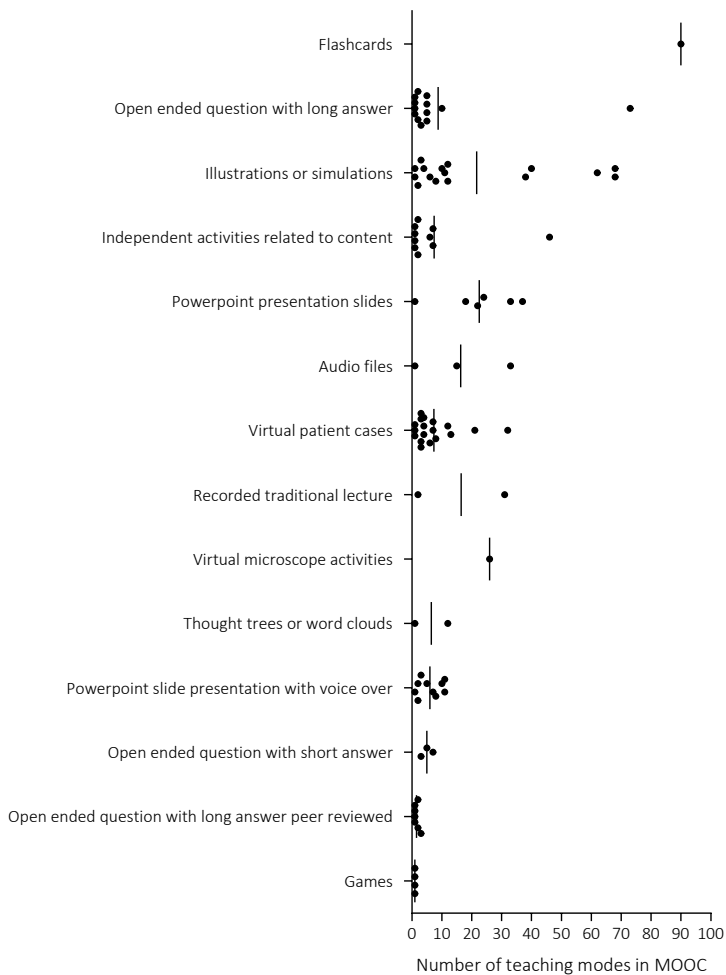


Figure 3. More narrow distribution of number of teaching modes.

Discussion

This study shows medical MOOCs are richer than previously described, even richer than other, non-medical MOOCs that have been systematically investigated (Toven-Lindsey et al., 2015). Videos, discussion boards and multiple choice questions are used regularly in that order, respectively as main components of instruction, interaction and assessment, however medical MOOCs do not have a universal profile in terms of teaching modes as each

Table 2. Social-epistemological dimensions of teaching modes.

Teaching modes	OI	OG	CI	CG
Instruction modes				
Digital text or textbook	x			
Recorded traditional lecture	x			
Independent activities related to content			x	
Links to external online resources			x	
Prompts to use external link for activities in the course			x	
Interactive online labs			x	
Video of whiteboard with voiceover	x			
Video of instructor talking to camera*	x			
PowerPoint slide presentation with voice over	x			
Audio files	x			
Flashcards	x			
Animations	x			
PowerPoint presentation slides	x			
Illustrations or simulations	x			
Thought trees or word clouds				x
Interaction modes				
Discussion boards available for freely asking questions		x		
Discussion board posts answering questions prompted			x	
Live video conference or events with instructor				x
Discussion boards available for discussing course materials				x
Chat or study groups				x
Prompts to respond to peers on specific topics for threaded dialogue				x
Discussion board prompt to introduce oneself				x
Assessment modes				
Multiple Choice Questions	x			
Open ended question with short answer	x			
Peer reviewed open ended question with long answer				x
Open ended question with long answer			x	
Multifunctional modes				
Virtual patient cases			x	
Virtual microscope activities			x	
Games	x**		x***	

*Other modes are sometimes included in videos, ** MOOC #1 and #33, *** MOOC #10 and #14

differs in variety and amount of teaching modes. Many of the investigated courses focus on constructivist teaching modes and few focus on group learning. Implications for integration of medical MOOCs in formal campus teaching and future research are described below. Teaching modes of medical MOOCs have been described to include video lectures (Davies, 2013), multiple choice questions (Doherty et al., 2015), discussions with peers (Subhi et al., 2014) and even virtual patient cases (Robinson, 2016), but they have not been systematically investigated before. In addition to previous studies, we have found audio files, virtual microscope activities, thought trees, games, and flashcards, which prove MOOC instruction modes to be more diverse than described before. Additionally, although we did not find the interaction modes of study groups or synchronous live events, MOOC discussion boards seem to have more options than just being available or not. The MOOCs in our sample differ in two ways: in the presence of specific prompts to use the discussion boards, and in the kinds of specific prompts used. A possible explanation for this wider variety of teaching modes is that current MOOC educators can be seen as ‘early adapters’ that are highly interested in innovation of education, and who like to experiment with new teaching modes in the MOOC environment (Haywood et al., 2015). A reason for finding so many new teaching modes in this sample of medical MOOCs specifically, could be that the previous investigation of non-medical MOOCs was conducted three years earlier (Toven-Lindsey et al., 2015). Some teaching modes might not have been supported by the MOOC platforms then and early adapters might since have rediscovered the possibilities for innovating in MOOCs. For expensive teaching modes, such as virtual microscope activities or serious games, medical faculties might simply be able to invest more into innovations financially.

We have found a great variety in what each MOOC offers and that no two courses offer the same combination and dispersion of teaching modes. Thus, medical MOOCs do not seem to have a universal profile in terms of teaching modes. This means that in examining features and effects of MOOCs, a description of the MOOC’s specific teaching modes profile should be part of the contextual description of the study. A comprehensive description could be helpful to describe specific MOOC teaching profiles in order to meet specific individual or contextual educational needs.

Medical MOOCs contain both objectivist and constructivist teaching modes, which makes them useful for integration into campus teaching. In contrast to Toven-Lindsey et al. (2015) finding teaching strategies mostly tied to objectivist views of knowledge, our sample showed in a majority of the courses, a focus on constructivist teaching modes as opposed to objectivist teaching modes. This finding aligns with the idea that medical MOOCs generally offer innovative ways of student learning (Goldberg & Crocombe, 2017). Medical MOOCs have also been said to be mostly useful for undergraduate students, as pre-medical courses are in many cases lecture based and information dense (Harder, 2013). Indeed objectivistic teaching modes such as lecture videos are very fitting for the purpose of transferring factual knowledge, but the notion

that the main delivery mode is through videos (Davies, 2013) is contested by our findings. A reason for the extended availability of constructivist teaching modes in medical MOOCs could also be the aim of educators to innovate (Goldberg & Crocombe, 2017; Haywood et al., 2015), or the financial freedom to include educational specialists in the development phase of the MOOC. Another possibility is that many of the courses in our sample aim to further develop clinical reasoning skills in their learners, which is reflected in the percentage of courses (55%) offering activities for this goal. As clinical reasoning is a higher order skill, it requires the use of constructivist teaching modes. Thus in this regard, content and learning goals might also be stimulators for focussing on specific epistemological dimensions.

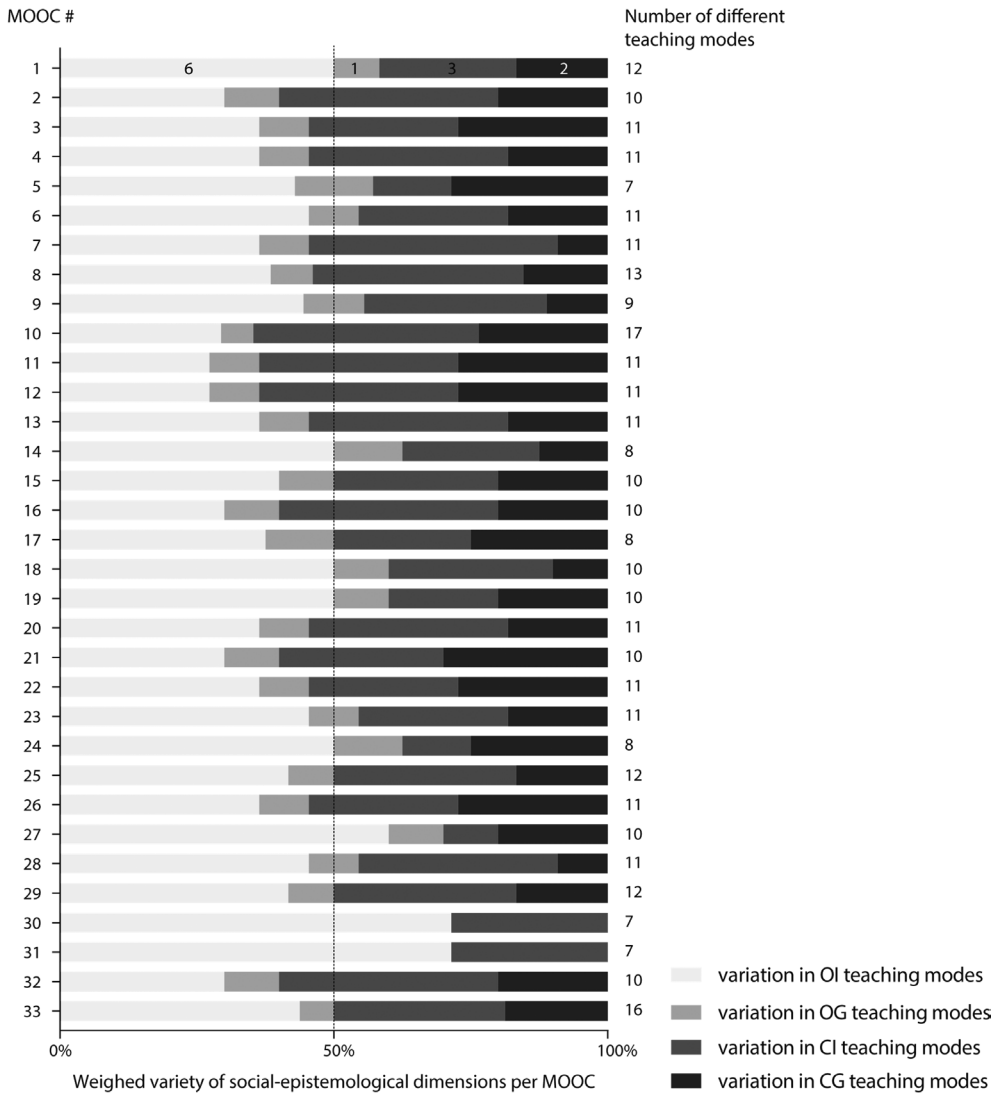


Figure 4. Weighed variety of social-epistemological dimensions.

The MOOCs in our sample seem to be oriented towards individual learning for both objectivist and constructivist teaching modes, which might be related to the asynchronous nature of this type of course. Prior research found that when learning online, student's perceived learning and student delivery medium satisfaction are highest in objectivist-group settings, followed by constructivist-group settings (Arbaugh & Benbunan-Finch, 2006). It is suggested that structure is most abundant in objectivist-group settings, as it is offered by both teacher and peers. Additionally, isolated online learning increases the likelihood that learners perceive the medium negatively and drop out (Willging & Johnson, 2009). The medical MOOCs might need to shift more toward group learning, which would be much more in line with the original idea of the first MOOCs: to connect and create knowledge in networks of people (Anders, 2015). Our findings support the description of a shift from MOOCs as more innovative, informal learning environments in their initial stage to more formal and traditional online courses nowadays, at least in the sense of the social dimension (Bradshaw et al., 2017). For connectivist learning to be implemented, medical MOOC instructors might still need more time for conceptual changes in their understanding, and so do students (Masters, 2011). Discussion boards are a component that is left from the original MOOCs but they do not seem to really fit into the pattern of formal learning yet, as campus students seem to hold back in posting on discussion boards of integrated MOOCs (Dandache et al., 2017; Swinnerton et al., 2017). Group learning is appropriate for more difficult tasks or working difficult problems and so fostering this teaching mode is desirable (Kirschner et al., 2008). Although we have found discussion boards to be more diverse in terms of use of prompts than previously described, participating in interaction in many cases is not compulsory, which means that only a few students interact with their peers. Discussion boards can be seen as informal and in many cases unstructured learning spaces, which are placed in a formal setting when integrated (Bradshaw et al., 2017). Accordingly, students might need more guidance and structure to use the discussion boards, for example in the form of specific prompts to introduce oneself or to respond to one or two posts of peers. However, a recent study found that viewing MOOC discussion board posts of other learners was most positively associated with course scores and entered peer reviews, even more so than posting (Chiu & Hew, 2018).

When integrating MOOCs, or parts of MOOCs, in campus teaching, epistemological and social dimensions matter and can offer guidelines. As previously mentioned, individual-objectivist teaching modes are effective for transfer of factual knowledge, for example epidemiological findings about diseases that might in a later stage support clinical reasoning. For more difficult concepts, for example the physiological concept of cardiac preload, group-objectivist teaching modes where students can work together on structured problems, are more appropriate. Objectivist teaching modes are frequently employed in formal medical educational settings. For learners and teachers both, this orientation might be most comfortable as learning is quite structured and both learner and teacher have specific, more traditional roles: teachers teach and learners learn (Bradshaw et al., 2017). Switching

to constructivist teaching modes is not only useful, but sometimes even mandatory when higher-order thinking skills are aimed at, as is the case with, for example, complex clinical reasoning problems. In many professional settings, combining information from multiple sources to construct a diagnosis is an individual task, but, conferring with peers might support learning to do so. Constructivist teaching modes require some more advanced skills of the learner. They need to be able to assess the quality of different information sources (Huang, 2002), and to be able to navigate in less-structured teaching activities and self-regulate (Anders, 2015; Bradshaw et al., 2017). Teachers need to be able to dedicate the time and energy that evaluations of constructivist learning demand and need to be capable to take the role of facilitator (Huang, 2002).

It needs to be noted that there is a difference between MOOC design (and desired behaviour) and learner behaviour as learners do not always use MOOCs the way they are designed (Littlejohn et al., 2016). An example of this is the possibility of pausing a MOOC video and discussing emerged questions regarding the subject matter with a peer. The designed activity of watching a video is very much individual-objectivistic, but through the learner's behaviour it has become a constructivist-group activity. In the current study, we have coded the design. This means the categorisation of teaching modes into dimensions should be seen as a starting point or guideline. It also means that both additional instructions and student behaviour can lead to a change in dimension, which might be very useful for integration purposes.

Future Research

For the use of MOOCs in medical education and especially in campus teaching many questions still exist. Future research can be focused in at least three directions. First, ways have to be found to efficiently locate suitable MOOCs and to assess their quality. Identifying suitable MOOCs can be done by subject for example, through online databases such as class-central.com or MOOC platform search tools. This can be time-consuming however, as not all courses offer a clear overview of learning goals and or content on their information page. One has to enrol to access this information, and depending of the starting date of the MOOC some content might still be unavailable. Additionally, when a MOOC has been selected for integration, one needs to account for quality (Clark et al., 2017). Research is needed to devise effective and efficient ways of selecting suitable, qualitatively sound MOOCs.

Second, expertise needs to be cultivated on how to integrate MOOCs optimally. Many different options exist in terms of integrating as a mandatory or optional component, blended or fully online course, and integrating as a replacement for existing activities or as additional materials. Some universal 'rules' for effective integration might arise from future research, but successful integration might also be dependent of context. Future research

thus requires describing context extensively, including an overview of the teaching modes profile of the MOOC under investigation.

Finally, MOOCs have been found to be successful learning environments for mainly self-regulated learners (Kizilcec et al., 2017; Littlejohn et al., 2016). It is no wonder that in an online setting with little tutor support certain skills are needed. For MOOC integration into medical campus teaching two questions then arise: How well are medical students equipped to learn in MOOCs in various integration settings, for example flipped classroom or fully online settings? And if they need support, how can we best assist them? Prior research has found medical students can have strong emotional responses when obstacles with e-learning materials are encountered, which might be counterproductive for learning (Reid et al., 2016) and so this topic requires our investigative attention. Research in these three directions should assist in effectively using medical MOOCs in formal medical education settings in the future.

Conclusion

Medical MOOCs contain a rich variety of teaching modes of which videos, discussion boards and multiple choice questions are used regularly. Prior research has indicated that MOOC teaching approaches focus mostly on objectivist views of knowledge; this study shows that in medical MOOCs constructivist approaches are also well represented. In all MOOCs, a focus on individual learning modes was found instead of group learning modes. This study offers direction for future medical MOOC integration practices and research.

Practice Points

- Medical MOOCs offer a great variety of instruction, interaction and assessment modes for integration into formal campus teaching.
- Medical MOOCs do not have a universal profile in terms of teaching modes as each differs in variety and amount of teaching modes.
- Constructivist teaching modes are readily available in medical MOOCs and can support educational innovation of formal campus teaching when integrated.
- Group learning is usually offered through optional participation on discussion boards.
- Social and epistemological dimensions of teaching modes can inform MOOC integration practices.

