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

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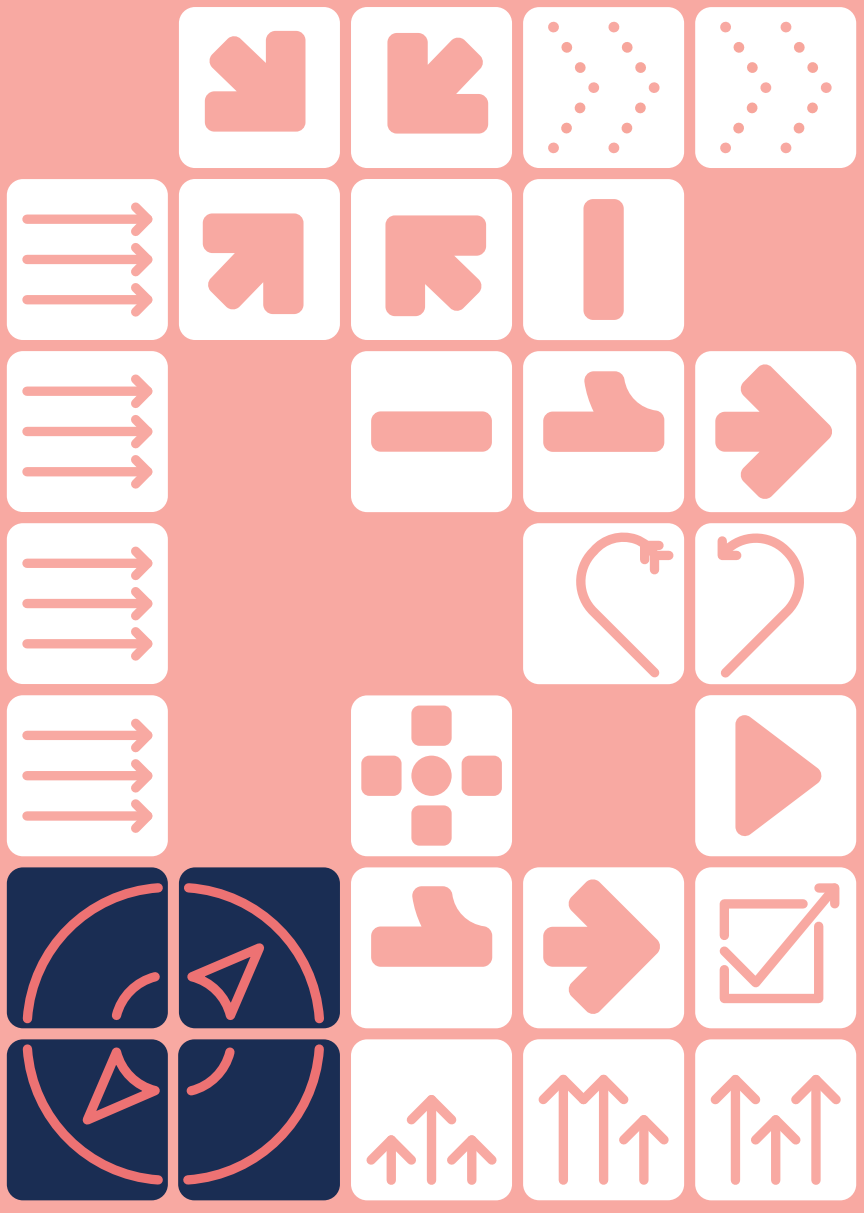
CHAPTER I



General Introduction

Introduction

Massive Open Online Courses (MOOCs) are, as the name suggests, *online* courses that can accommodate *massive* amounts of learners and are *open* to everyone. They are one of the most popular innovations in Technology Enhanced Learning worldwide (Bozkurt, 2021). MOOCs can be created, offered and followed on special MOOC platforms such as Coursera, EdX and Futurelearn. Medical MOOCs specifically are popular with a wide range of learners including (bio)medical students, professionals and patients and have grown in number extensively over the last few years (Berger et al., 2021; Liyanagunawardena & Williams, 2014; Longhini et al., 2021; Pottier et al., 2020). A review study in 2014 (Liyanagunawardena & Williams, 2014) identified 98 MOOCs available on Health and Medicine and a recent superficial search (February 2022) on health and medicine related MOOCs with search engine Class-central revealed 1959 courses available. Early expectations regarding the importance of MOOCs for medical education stated students to be able to 'increasingly complete requirements online' and for medical schools to 'either develop courses to be taken online or license courses from other schools'. More pessimistic predictions included MOOCs to only have small part in medical education as it encompasses more than only 'content delivery' (Harder, 2013). However unexpected, online learning became a critical resort for many (bio)medical teachers and students during the COVID19 pandemic (Kim et al., 2020; Skaggs, 2021; Stojan et al., 2021). With overflowing hospitals that were temporarily inaccessible for medical students and overextended medical professionals, teaching became an extremely challenging task, and consequently so did learning (Ardekani et al., 2021; Motte-Signoret et al., 2021; Stojan et al., 2021). During this period teachers and scholars learned a great deal about online teaching and learning and it is foreseeable that many innovations are here to stay in some form or other, now that we got used to them (Erlich et al., 2021; Furtner et al., 2021; Jiang et al., 2021; Lucey & Johnston, 2020). In this regard, use of MOOCs in formal medical education is likely to last and evolve further, and in need of attention from the research community (Longhini et al., 2021).

In this introduction we will first provide background information about MOOCs and the desire to integrate them into campus settings. This will be followed by a description of the problem we identified while integrating the medical MOOC 'Clinical Kidney, Pancreas and Islet Transplantation', the context we operated in, and the approach we adopted in our contribution to this problem. Then teaching and learning in medical MOOCs are operationalized to introduce the relevant terms for this thesis. This includes the identification of omissions in the literature regarding these terms. Finally, an overview of the research in this thesis is outlined and the adopted paradigm is discussed.

Medical Massive Open Online Courses

The first MOOC was developed to offer a different type of learning: connectivist learning (Siemens, 2004). In connectivism, learning starts when knowledge is activated by learners

connecting to and participating in the learning community. Learning communities are "the clustering of similar areas of interest that allows for interaction, sharing, dialoguing and thinking together" (Siemens, 2004). The idea for the first MOOC was thus that learning paths were not set by the instructors, but learners would, by connecting with each other and the instructors, create questions, answers and content to learn from (Fini, 2009). When learning within and from a community, there is more to learn when more learners join, and so the university course that would be the first MOOC was made *open* to anyone who wanted to join. To make the course accessible to a large number of learners it was *online* and free of charge. When other institutions, including Ivy League universities joined in the creation of MOOCs, the more traditional course format in which the learning path is set by the instructors was transferred to the MOOC context. Teaching was thus based on cognitive-behaviourist theories of learning, however the characteristics of massiveness, openness and absence of a fee were retained (Pilli & Admiraal, 2016). Since then, many different small changes have been made to create different types of courses out of the MOOC concept, for example Small Private Online Courses (SPOCs), however the main categories of the connectivist MOOC (cMOOC), where no path is set for the learner by the instructor, and the cognitive-behaviourist MOOC with a high dose of prescribed activities and structure (xMOOC), are still prevalent.

MOOCs are created by several types of institutions such as government organizations and museums, but mostly by universities. Over the years the concept has been adapted by universities, and MOOCs are created for different reasons than connectivist learning (Haywood et al., 2015). One reason to create MOOCs is to offer education to learners with limited or no access to high quality education, based on the idea that everyone should have access to quality education (Tang & Wang, 2017). For universities, another reason is to reach many potential learners. Universities aim for learners to get excited to join their institute through MOOCs (Howarth et al., 2017; Jansen et al., 2015). A third reason interweaves with the first two: institutions get the opportunity to provide the world with a snapshot of their expertise and improve their reputation, for example regarding innovative teaching (Haywood et al., 2015; Howarth et al., 2016). These reasons make institutions want to offer their best and so, often, MOOCs are heavily invested in. Many MOOCs have been produced by large teams with expertise on learning, technology and the topic to be covered (White & White, 2016; White et al., 2020). In combination with the specifically created MOOC platforms, most available MOOCs have a very high quality look and feel. As MOOCs became expensive to create but did not generate direct income due to their characteristic of being free, many MOOCs now offer a certificate for a minor fee. In addition, increasingly more frequent, MOOCs are offered partly for free, by for example charging a fee for access to the exams or for extended access to the course over time. Another way for universities to harvest from their investments is to reuse MOOCs in the campus curriculum.

Integration in Campus Education

Integration of MOOCS in campus has many advantages, including all advantages of online learning: 1) 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), 2) access to topics not normally available in the curriculum(Doherty et al., 2015), 3) access to education from institutions that not all students can travel to (Doherty et al., 2015), 4) enhanced understanding of topics not common to students' resident country (Sharma et al., 2014), 5) the opportunity to remove costs and inconvenience of getting to a single location (Davies, 2013), 6) enhanced communication among international communities of experts and learners, 7) innovative teaching models for student learning (Goldberg & Crocombe, 2017), and 8) the convenience of creating a course once and delivering it multiple times without extra effort or cost (Sarkar & Bharadwaj, 2015).

Many university teachers created a MOOC based on their existing university course, and integrated their complete MOOC or parts of it back into the campus curriculum. Later, MOOCs were even created with this dual purpose in mind (Israel, 2015). In addition MOOCs have been described as Open Educational Resources (OER), meaning whole MOOCs or parts of MOOCs have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions (Jansen et al., 2015; Stracke et al., 2019). Universities have also joined forces to increase this practice by establishing networks of institutions where students can enrol in MOOCs from other universities for credits (Website, 2018). MOOCs have been predicted to be a disruptive innovation, for example by unbundling of the higher education system (Wellen, 2013). Unbundling entails the division of formal higher education degrees into smaller parts, each with their own micro credential, so that students can amass the credentials they or their (future) employer desire (Ralston, 2021). In addition, this would ease career switches and lifelong learning. While unbundled higher education is not widely implemented for now, the idea and attention for it do indicate the impact MOOCs are thought to and may have on formal higher education in the future.

Problem and context description: the added value of medical MOOC integration

MOOC integration poses many exciting opportunities, however, at the start of our project many challenges were uncovered. Mostly, we wanted to explore how we could take advantage and optimally use MOOCs in campus education. For MOOC integration to be truly valuable, we decided, it must contribute to high quality teaching and learning, an opinion that is shared. Our main question at the start of this project was: Can MOOCs be used to offer high quality teaching and facilitate high quality learning in campus, and how?

At Leiden University Medical Center (LUMC), where this project was executed, multiple MOOCs have been created by expert teams. Two are offered live on Coursera since 2016:

Clinical Kidney, Pancreas and Islet Transplantation and *Anatomy of the Abdomen and Pelvis; a journey from basis to clinic*. Since 2019 multiple MOOCs on Population Health have also been created. Within LUMC these first two MOOCs were already being reused partly or as full courses, in different types of education including undergraduate, graduate and professional education. It quickly became apparent that within a design for MOOC integration many choices can be made, which could all influence the quality of teaching and learning. Guidelines for specifically medical MOOC integration were thus much needed to accommodate the wish to reuse these popular courses. In this thesis we focus on the integration of MOOCs for undergraduate students.

Although many previous studies had focused on MOOCs outside of formal learning, MOOC integration research was somewhat uncharted territory when this research project started in 2016. Mainly enthusiastic case descriptions from early adopters of MOOC integration existed, without uniformity on what information was relayed about the MOOC or the integration design (Israel, 2015; Robinson, 2016; Sarkar & Bharadwaj, 2015; Subhi et al., 2014). While experimenting with introducing MOOCs to campus students, many studies measured student satisfaction, pass rates or final scores (Israel, 2015), however how teaching was impacted was not examined and the impact on learning was only investigated as perceived by students (Swinnerton et al., 2017). In addition, MOOCs were described to always contain video lectures, discussion forums and quizzes (Dandache et al., 2017; Hoy, 2014; Robinson, 2016), however if and what other activities were available in medical MOOCs for integration was unclear. We set out to do groundwork, needed to make informed decisions about MOOC integration to support high quality teaching and learning.

High quality teaching with integrated medical MOOCs: instructional design

High quality teaching can mean different things in different contexts, however most experts would agree that for a high quality course the *instructional design* must make sense (Stracke & Trisolini, 2021; Van Merriënboer & Kirschner, 2001). The instructional design of a course can be summated as the blueprint for all the activities in a course and the order they are to be completed in. Logically there must be an idea underlying the activities and their linked accumulation, one that promotes learning for the desired outcomes ((Kirschner & Van Merriënboer, 2008). Especially in xMOOCs the designed curriculum resembles the taught curriculum to great extent as online courses tend to follow their prescribed structure and there is little room for different versions of performance or execution, as opposed to face to face courses (Lowenthal & Hodges, 2015). Additionally, as examining the instructional design can be done before integration, this is more desirable than evaluating course outcomes: students do not have to be exposed to a potentially ineffective course. In researching what medical MOOCs have to offer for high quality teaching we focused on four topics: 1) the offered teaching modes of the activities, 2) the social and epistemological dimensions of these modes, 3) relevant instructional design principles and 4) the practical side of coordinating MOOC integration.

Teaching modes represent the way the instructor or instructional designer has chosen to shape the activities in which the desired knowledge, skills and attitudes are taught and learned. They have previously been divided into modes of instruction, such as lectures or readings, modes of interaction, such as a discussion forum or a chat-box, and modes of assessment, such as multiple choice quizzes (Toven-Lindsey et al., 2015). If instructors want to integrate their own or another institution's MOOC content into formal on-campus teaching, it is important to know what teaching modes are offered, so that the incorporation into campus can be aligned with the desired outcomes. Characteristically medical MOOCs feature videos, forums, and multiple-choice questions (Dandache et al., 2017; Hoy, 2014; Robinson, 2016), but their teaching methods have not been systematically studied.

In addition to identifying the teaching modes available for each course, it is also important to consider their *social and epistemological dimensions*. When setting up a MOOC or its materials in a specific context it is important whether approaches are aimed at individual or group learning and whether knowledge is transmitted or constructed: these dimensions need to fit the difficulty level of the task and the learning skills of the student (Lou et al., 2001; Vrasidas, 2000). Arbaugh and Benbunan-Finch (2006) characterized these social and epistemological dimensions in their Teaching Approach Framework: teaching methods can be distinguished socially, as individual or group-oriented, and epistemologically, as objectivist or constructivist. These dimensions result in four possible combinations: 1) objectivist-individual; knowledge transfer from teacher to learner, 2) objectivist-group; knowledge transfer from teacher to group, 3) constructivist-individual; knowledge construction by a learner, and 4) constructivist-group; knowledge construction by a group. Toven-Lindsey et al. (2015) found that most of the educational strategies they studied, were associated with an objectivist view of knowledge, which was also the case for the single medical MOOC they included. This made them doubt if MOOCs really are revolutionary for higher education. As no other studies had been conducted regarding teaching characteristics in medical MOOCs specifically, it was unclear if the findings from Toven-Lindsey et al. (2015) were representative.

The quality of the curriculum will be influenced by the quality of medical MOOCs through integration in campus teaching, therefore MOOC quality should be assured (Clark et al., 2017). In total we selected eleven *instructional design principles* that are relevant, to assess quality before MOOC integration. Each of the eleven principles we consider are summarized in table 1. Five First Principles of Instruction for learning activities were identified by Merrill (2002). These principles are common to the various instructional design theories. A ten-principle framework to evaluate the instructional design quality of online courses was created when Margaryan et al. (2015) added a set of five principles focused on learning resources and learning support. Finally, as multiple studies emphasized the importance of promoting self-regulated learning skills in e-learning environments and each of these studies highlighted the importance of

focusing on course goals and personal goals in designing online learning environments, we added an eleventh principle based on Goal Setting Theory (Kizilcec et al., 2017; Latham & Seijts, 2016; Locke, 1996; Milligan & Littlejohn, 2016).

Table 1. Relevant principles. 1 Merrill, 2002; 2 Margaryan et al., 2015; 3 Locke, 1996; Latham and Seijts, 2016.

Principle	Learning is promoted when:
Problem-centered[1]	'learners are engaged in solving real-world problems'
Activation[1]	'existing knowledge is activated as a foundation for new knowledge'
Demonstration[1]	'new knowledge is demonstrated to the learner'
Application[1]	'new knowledge is applied by the learner'
Integration[1]	'new knowledge is integrated into the learner's world'
Collective knowledge[2]	'learners contribute to the collective knowledge'
Collaboration[2]	'learners collaborate with others'
Differentiation[2]	'different learners are provided with different avenues of learning, according to their need'
Authentic resources[2]	'learning resources are drawn from real-world settings'
Feedback[2]	'learners are given expert feedback on their performance'
Goal-Setting[3]	working on/setting measurable, difficult long-term goals, chunked into short-term goals. Committing to a goal and considering obstacles is essential.

Prior research into the quality of instructional design of MOOCs on various topics found that 'although they scored highly on organization and presentation, instructional design quality is low' (Margaryan et al., 2015). Other researchers found that none of the six science-, technology-, engineering- and mathematics-focused MOOCs they investigated would have passed an established instructional quality review for higher education (Lowenthal & Hodges, 2015). Literature about the quality of medical MOOCs showed ambiguous claims, with some articles stating that they are pedagogically deficient (Doherty et al., 2015) and others that they are of high academic standard (Subhi et al., 2014), however no systematic investigations had been done.

Although literature contained some information on how to create a MOOC (Demaree et al., 2014; Kellogg, 2013; Pickering et al., 2017), the *practical side of medical MOOC integration* had not been described. Through our practical and research experiences regarding MOOC integration we ourselves were on a steep learning curve. We found MOOC integration to encompass several steps, and to require specific knowledge. Practical information regarding MOOC integration was needed to help the community of teachers interested in and motivated for MOOC integration. Furthermore, in progressing the movement of MOOC integration, MOOC integration research could benefit as well. In this regard, we wanted to share our experiences.

High quality learning in integrated MOOCs

High quality teaching is pointless without high quality learning. Indicators of high quality learning can be defined in multiple ways: deep learning, prolonged retention, engagement, acquiring higher order thinking skills; the idea is that students truly understand and can use what they have learned for an extended period of time. This can regard knowledge, skills or attitude. Important factors for high quality learning, especially online, are motivation, self-regulated learning strategies and the act in which they overlap: goal-setting (Broadbent & Poon, 2015; Hartnett, 2016; Kawachi, 2003; Wong et al., 2019).

The relationship between *motivation* and learning outcomes has been substantiated in higher education, and medical education specifically (Dickinson, 1995; Hustinx et al., 2009; Kusurkar et al., 2011; Vansteenkiste et al., 2004). In short it can be said that highly motivated students often show higher engagement and more active learning strategies. However not only quantity matters, quality of motivation might be even more important. In this regard Self-Determination Theory distinguishes between quantity of motivation and quality of motivation (Ryan & Deci, 2000). One can be highly motivated, but when this motivation is only externally regulated, or controlled, it is considered low quality motivation (Vansteenkiste et al., 2009). Autonomous motivation is more internally regulated, and is associated with well-being, enjoyment, and academic achievement (Reeve et al., 2008; Ryan & Deci, 2000). The quantity is the sum of autonomous motivation and controlled motivation, while the quality of motivation regards the ratio between autonomous motivation and controlled motivation: low autonomous ang high controlled motivation equals low quality motivation and high autonomous and low controlled motivation equals high quality motivation (Vansteenkiste et al., 2009). Self-Determination Theory also postulates that in order to acquire autonomous motivation, a sense of autonomy, competence, and connection to others is psychologically required (Ryan & Deci, 2000). In educational contexts, these psychological needs can be satisfied or frustrated, thereby satisfying or frustrating autonomous motivation, which in turn affects the overall quality of motivation (Reeve et al., 2008; Vanasupa et al., 2010). Motivation to learn in integrated MOOC settings is thus a relevant outcome measure, even more so as in campus education extrinsic motivation is bound to be present as well, as it is more structured and compulsory (Bradshaw et al., 2017; Wellington, 1990). A review of the literature regarding motivation to learn in online settings concluded there is a 'need for research that explores motivation from a contemporary situated perspective, in 'real-life' online settings that includes consideration of a broad range of social and contextual influences' (Hartnett, 2016). For MOOC learning in informal settings motivation has been studied (Zhu et al., 2018), however as integration offers a very different context it unlikely that findings regarding motivation to learn in informal MOOCs can be generalized to formally integrated MOOCs.

In addition to the profits of enjoyment, well-being and academic achievement, autonomous motivation is thought to enhance *Self-Regulated Learning* (SRL) (Reeve et al., 2008). SRL is described by several models, however most agree on it being a set of metacognitive activities to 1) plan, 2) monitor, and 3) reflect on one's own learning (Panadero, 2017). It is generally agreed that more SRL strategies are required for online learning, as there is usually no teacher, tutor or mentor present (Kizilcec et al., 2017). Much research has focused on what processes are involved in SRL, followed by strategies to teach successful execution of SRL. Recent literature reviews suggest that many SRL processes including goal setting, monitoring, and evaluation during the planning phase can be supported by adding SRL prompts, feedback, or a combination of the two (Pérez-Álvarez et al., 2018; Wong et al., 2019). While SRL skills can also be successfully obtained online, this may not be enough for students to truly self-regulate their learning when using SRL strategies is no longer supported. Prominent motivation researchers suggested a two-tier condition for students to self-regulate: they must know how to, and they must want to do it for themselves (Reeve et al., 2008). This relationship has not been tested however. Recent literature suggests that efforts to support SRL in MOOCs focus on providing support for execution of self-regulated learning, rather than autonomous motivation to implement the learned skills (Pérez-Álvarez et al., 2018; Wong et al., 2019).

Goal setting is an important part of the planning phase of SRL and is described as an essential skill for MOOC learning (Kizilcec et al., 2017). It is thought to drive all other phases of SRL (Panadero, 2017). Students who personally set their learning goals are motivated more autonomously, set more ambitious goals, exhibit higher commitment and show greater affect when accomplishing or not accomplishing a goal (Latham & Seijts, 2016). Although goal-setting is preferably done by the person pursuing the goals, this is not always theoretically desirable or practically possible. First, goal setting requires skills, as set goals are best when articulated as measurable, difficult, long-term goals, which are then specified into short-term goals. Commitment to a goal and consideration of obstacles are essential (Latham & Seijts, 2016). Second, novice learners often do not know enough about a subject they are going to learn about to gauge what knowledge, skills and attitudes are essential, and thus what goals are relevant (Farrell, Bourgeois-Law, Buydens, & Regher, 2019). Third, giving direction to one's own learning also requires some maturity (Jossberger et al., 2010; Saks & Leijen, 2014). In practice this leaves joint goal setting and consultation of students about goals, if you want them involved in setting their own goals, which are very time consuming for a teacher and often nearly unattainable. Especially for larger numbers of student, as subsequent study activities and assessment need to be constructed in alignment with the learning goals (Biggs & Tang, 2011). In scenario's where primarily teachers are involved in setting the goals, acceptance by the student of the assigned goals is key (Erez & Kanfer, 1983). Difficulties with assigned learning goals and co-creating learning goals have been described in multiple studies in clinical learning contexts (Farrell, Bourgeois-Law, Buydens,

& Regher, 2019; Larsen et al., 2017), but we have not come across literature that describes learning goal acceptance in online learning. As courses where teachers decide the learning goals are plentiful, MOOCs as well as regular in campus courses, the acceptance of learning goals by students needs to be studied.

Research outline

This thesis focuses on what MOOC integration offers for high quality medical education and on challenges for learning that arise with integrating MOOCs. The aim of this thesis is to provide answers to the following questions:

1. What do medical MOOCs have to offer for integration? (Chapters 2 and 3)
2. What does creating and integrating a medical MOOC entail? (Chapters 4 and 5)
3. How can learning in integrated MOOCs be supported? (Chapters 6, 7 and 8)

In table 2 an overview of the conducted research can be found, including research questions and aims, research methods, and analyses for each chapter. The research in this thesis was conducted within the pragmatic research paradigm, meaning that two systems of philosophy and reality were implemented. Depending on what fitted the research question, constructivist or post-positivist stances were adopted, leading to qualitative, quantitative and mixed methods designs.

Table 2. Overview of included research aims/questions, methods and analyses.

Chapter	Research aim or question(s)	Research method	Analyses
2	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?	Document Analysis	Template analysis, descriptive statistics
3	To what extent do medical MOOCs meet the instructional design principles: problem-centeredness, activation, demonstration, application, integration, collective knowledge, collaboration, differentiation, authentic resources, feedback, and goal-setting?	Document Analysis	Template analysis, descriptive statistics
4	1. What are our experiences with developing a medical MOOC and integrating it into campus education? 2. How was the MOOC (integration) received by learners?	Case Report	Descriptive statistics
5	What steps are essential in integrating medical MOOCs into campus education?	Twelve Tips Article: practical tips based on theory, previous research, and own experiences	n.a.
6	1. Describe motivation profiles of medical students that learn in integrated MOOCs, and discern if motivation profiles are associated with specific MOOC integration designs; 2. Investigate how psychological needs of medical students are satisfied or frustrated in different MOOC integration designs; 3. Investigate the relationship between autonomous motivation to learn and use of SRL skills in an integrated MOOC; 4. Uncover processes that are involved in goal acceptance or rejection of medical students in integrated medical MOOC designs with assigned learning goals; 5. Identify obstacles medical students encounter when learning with assigned learning goals in integrated medical MOOCs.	Research proposal (mixed methods)	n.a.
7	1. What are motivation profiles of (bio)medical students in three different MOOC integration designs? 2. Do the three MOOC integration designs differ in students' motivation profiles? 3. How are psychological needs of students satisfied or frustrated in different MOOC integration designs?	Student Surveys (cross-sectional)	Twostep cluster analysis, multivariate analysis of variance, Chi square test
8	What processes are involved in goal acceptance or rejection of undergraduate students in integrated MOOC designs with assigned learning goals?	Interviews	Grounded theory approach: open, axial and selective coding