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

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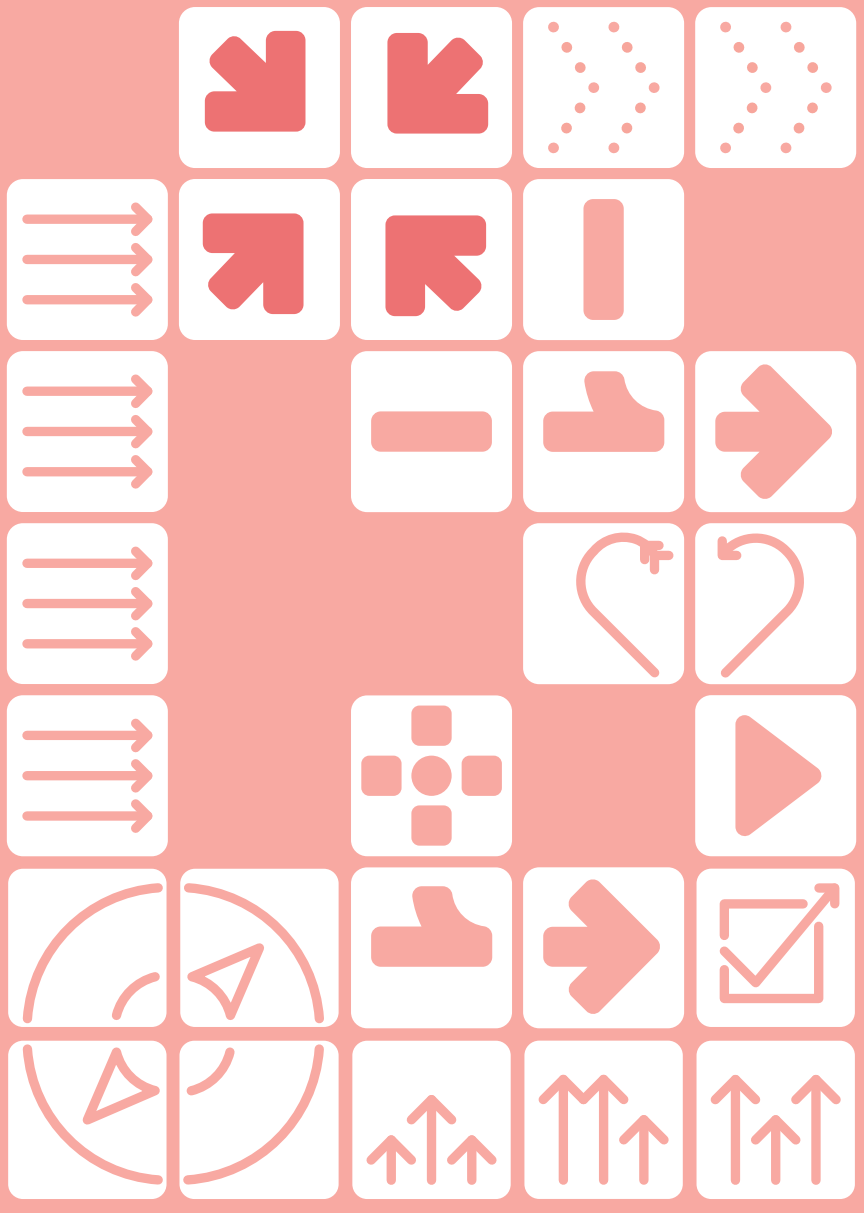
CHAPTER 9



General Discussion

General aim

Since their origination in 2008 Massive Open Online Courses have grown to be a popular addition to the higher education landscape. Enthusiasm for medical MOOCs combined with opportunity and desire to reuse these opulent courses led to integration into medical campus education. The research in this thesis focusses on understanding and optimizing in campus integration of medical MOOCs. The aim of this work is to find valuable directions for high quality teaching and learning in campus integrated medical MOOCs.

In this Chapter, first a brief overview of the main findings of each study will be provided followed by six general conclusions. These include three on high quality teaching and three on high quality learning. Next, strengths and limitations are considered, followed by practical implications and avenues for future research.

Overview of main findings

In our first study (**Chapter 2**) we identified and categorized teaching modes of 33 MOOCs. We then categorized the found teaching modes into social-epistemological dimensions. We found 29 teaching modes, of which three had not been reported as part of a MOOC before, and we found multifunctional teaching modes that were used for instruction as well as assessment. The study showed medical MOOCs are richer than previously described, even richer than other, non-medical MOOCs that had been systematically investigated previously (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 MOOC differs in variety and amount of teaching modes. The analysis of social-epistemological dimensions showed that many of the investigated courses focus on constructivist teaching modes and only a few focus on group learning.

In the following study (**Chapter 3**) we investigated the same 33 MOOCs, but now we focused on the instructional design quality of the courses by examining to what extent the courses met each of eleven relevant principles of instructional design (Latham & Seijts, 2016; Locke et al., 1988; Margaryan et al., 2015; Merrill, 2002). We found medical MOOCs eligible for integration to meet these principles in varying degree. The principles of *application*, *authentic resources*, *problem-centeredness*, and *goal-setting* were present in many of the courses; *activation*, *collective knowledge*, *differentiation*, and *demonstration* were present in less than half of the courses; and finally, *integration*, *collaboration*, and *expert feedback* were present in less than 15% of the courses. Some principles might not be compatible with the MOOC format, or are currently under exploration by the MOOC research community. Assessment of instructional design quality of a MOOC is thus desired before integrating in campus settings to make an informed decision about the integration design. For integration,

MOOC quality should be considered in relation to the quality of the existing campus education and the finalized integrated course. Additionally, while conducting this study we concluded that assessment of instructional design quality demands an experienced assessor and is time-consuming. More effective and efficient MOOC assessment methods are needed for the purpose of large-scale integration.

We then aimed to share what we had learned in practice by developing, implementing and integrating the MOOC "Clinical Kidney, Pancreas and Islet Transplantation" in campus teaching (**Chapter 4**). We found creating a new MOOC is a time-consuming activity which requires many resources. We also experienced our MOOC to be effective in use as integrated materials in a wide range of educational contexts, from undergraduate to post-graduate teaching, and many informal learners and formal students considered the MOOC as added value. Although no statistical comparisons were made in this study, differences seemed to exist in intentions for enrolment, and for participation in optional content between students from different MOOC integration designs.

To inform and assist other medical teachers in integrating MOOCs in campus education we then bundled our research findings and practical experiences in twelve tips for integrating MOOC content into classroom teaching (**Chapter 5**). Together, these tips guide teachers through: defining what content needs to be integrated; options in how to use a MOOC; searching for MOOCs; determining access possibilities for students; gauging credibility; considering free availability for enrolment and reuse; determining desired teaching modes; determining social-epistemological dimensions; aligning learning goals, teaching activities, and assessments in the integration design; providing clear instructions on enrolment; providing students with clear instructions on how to utilize the MOOC and its resources; and finally, determining the success of their MOOC integration.

Next we developed a mixed-methods research protocol to examine motivation, Self-Regulated Learning and goal-setting in different MOOC integration designs (**Chapter 6**). Five research questions were posed and the study was designed so that all questions could be answered with data from two surveys and one set of interviews. Three of these questions are answered by the study in **Chapter 7**, in which we aimed to determine motivation profiles of students learning in integrated medical MOOCs, to find out if different integration designs relate to different motivation profiles, and to determine differences in motivation precursors in different integration designs. First we found motivation factors to differ from motivation factors previously described in formal education in literature, however factors did resemble factors described in informal MOOC learning. Second we found six distinct motivation profiles based on three forms of motivation: Self-determined learners, highly self-determined learners, grade hunters, and teacher trusters who are moderately, highly or extremely trusting. We also found proportions of motivation profiles to differ significantly

between MOOC integration designs, and that MOOC integration designs satisfy and frustrate psychological needs significantly different.

Another research question from the protocol was answered in our constructivist grounded theory study (**Chapter 8**). The aim was to better understand acceptance and rejection processes of students that learn with assigned learning goals in integrated MOOCs. It yielded Assigned Learning Goal Acceptance Theory, a model that describes five areas of accepting or rejecting learning goals that students can flow through in a course. We have found that for accepting assigned learning goals in graded undergraduate courses the following elements play a role: 1) the perceived fit of learning goals as a tool with students' study strategies; 2) the level of explicit or implicit acceptance of content of learning goals depending on the student's strategies; 3) the level of acceptance that is based on considerations of usefulness, comprehensibility, and perceived constructive alignment of learning goals within a course; and 4) students' acquiescence to whatever is expected to pass the examination.

General conclusions for high quality teaching with integrated medical MOOCs

Medical MOOCs provide a wealth of opportunities for integration into campus, including options to offer high quality, innovative teaching (Chapter 2, 3, 4 and 6).

In this thesis we found medical MOOCs to offer 29 different teaching modes, many focused on constructivist teaching (Chapter 2, and summarized in table 1 of this Chapter). We also found medical MOOCs to have relatively high scores for instructional design quality (Chapter 3). Our own experiences showed that with one MOOC multiple integration designs could be realized to offer students innovative learning experiences (Chapter 4). Finally, we condensed the diversity of possibilities for MOOC integration designs to a set of decisions regarding 1) level of education, 2) degree of obligation, 3) ratio of online versus face-to-face teaching, 4) MOOC content addition to, or replacement of formal courses and 5) level of contact with other online learners in the MOOC (Chapter 6).

Table 1. List of available teaching modes in medical MOOCs and their social-epistemological dimension.

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***	

Note on meaning of abbreviations. OI: Objectivist-Individual; OG: Objectivist-Group; CI: Constructivist-Individual; and CG: Constructivist-Group.

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

Our findings contradict conclusions by Toven-Lindsey et al. (2015), who questioned the possibility to innovate higher education by using MOOCs, as they found predominantly objectivist teaching modes. This included the one medical MOOC they investigated. Similarly, our findings contradict result from (Kasch & Kalz, 2021), who also included four medically oriented MOOCs in their sample of 40, and found activities to be focused on

factual knowledge. With our findings concerning quality we were able to partly confirm the statement of Subhi et al. (2014) that medical MOOCs are of high academic standard. Only some MOOCs were pedagogically deficient as Doherty et al. (2015) claimed. Further, our findings corroborate the idea by Stracke et al. (2019) that MOOCs are very suitable to be viewed as Open Educational Resources and confirms it specifically for medical MOOCs: with the inclusion criteria for our studies we found a generous offering of MOOCs on a medical topic with free course content suited for students (Chapters 2 and 3). Would we have included basic science topics, which are relevant for medical school as well, the list would presumably be much longer. Medical teachers virtually have an extra database filled with well-structured and -presented activities to pick and choose from, often created by experts in their field. Also, all the previously described advantages of MOOC integration apply, see table 2. The fact that we found so many different teaching modes, including many focused on constructivist teaching implies that medical campus education could improve in quality through integration, as medical education tends to be somewhat traditional and focused on objectivist teaching (Cooper & Richards, 2017; Tang et al., 2018). We could thus further substantiate the claim of Goldberg and Crocombe (2017) that innovative teaching models for students can be an advantage of MOOC integration.

Although our findings imply MOOC quality should not have to hamper MOOC integration, we believe general MOOC quality will improve as this has been a focus of recent research efforts (Bozkurt, 2021; Stracke & Trisolini, 2021; Zhu et al., 2018), and medical MOOC quality might improve further as well. As quality of general MOOCs was found to be low in multiple studies (Lowenthal & Hodges, 2015; Margaryan et al., 2015), several quality frameworks to guide MOOC design and creation were developed (Aloizou, 2018). These frameworks aim to guide MOOC design and creation, to support quality of the final products and the processes to get there. They do this by listing steps and relevant stakeholders in the creation, implementation and evaluation phases. They can further enhance quality of future medical MOOCs by supporting creators to design based on quality criteria. For the instructional design principles *integration, collective knowledge, activation, demonstration, and some items of problem-centeredness* we found lower scores. For example for *demonstration,* only three MOOCs (9%) offered 'solutions to problems with a range of quality, from excellent examples to poor examples' (Chapter 3). This might be related to the potential causes provided by Margaryan et al. (2015): (1) MOOC instructors and designers may lack knowledge of the relevant quality criteria, learning theories or instructional design principles; (2) instructor and designers might be aware and incorporate these in face-to-face teaching but not in MOOCs; (3) institutional marketing concerns rather than pedagogical considerations drive instructors when offering MOOCs.

Table 2. List of advantages of MOOC integration described previously by [1]Doherty et al., 2015; [2]Sharma et al., 2014; [3]Sarkar and Bharadwaj, 2015; [4]Davies, 2013; 5Goldberg and Crocombe, 2017.

Advantages of medical MOOC integration
• access to topics typically not included in the curriculum[1]
• receiving education from institutions that not all students can travel to[1]
• improved understanding of subjects that are not common in the students' country of residence[2]
• the ease of creating a class once and running it multiple times, with no additional effort or cost[3]
• the possibility to avoid the cost and inconvenience of reaching a single location[4]
• the opportunity to use "exemplar" learning materials from experts in their respective fields, rather than each university creating its own[1,2]
• innovative teaching models for student learning[5]
• improved communication among international communities of medical experts and students[5]

Specifically for the principles with low scores due to the causes listed by Margaryan et al. (2015) the developed quality frameworks offer much potential as they can educate MOOC designers and instructors regarding the relevant criteria and principles. In addition, by offering quality labels, they impel use of the frameworks by MOOC creating institutions, as an enhanced reputation for teaching and learning is one of the reason for universities to create MOOCs (Haywood et al., 2015). For the principles of *goal-setting* and *differentiation* recent research offers new opportunities for implementation in online education. For goal-setting, attention has grown extensively in the last years, as a major part and driver for self-regulated online learning. Prompts and pre-tests are being incorporated in MOOCs to support goal setting and many platforms now ask for personal goals. For differentiation, the rise in possibilities with learning analytics is contenting. Currently many researchers experiment with using student data to offer a personalized learning path, which is the superlative to differentiated paths. Moreover, as Wei et al. (2021) proposed tailored assessment based on student motivation profiles, innovations that combine goal setting and personalized learning may be on the horizon as well. Contradictory to promising developments for most of the instructional design principles we investigated, two seem to remain troublesome: *collaboration* and *expert feedback*. Recently Kasch and Kalz (2021) investigated MOOC quality with a focus on interaction, including student-student and student-teacher interaction, and feedback in 50 MOOCs, of which four could be considered medically oriented. They too found *collaboration* and *expert feedback* remarkably underrepresented.

Different ways to integrate MOOCs have been reported previously (Israel, 2015; Robinson, 2016; Swinnerton et al., 2017). Through our experiences and rationalizations of MOOC integration, we discovered that ways to integrate MOOCs are possibly inexhaustible. With descriptions of MOOC integrations from case studies in the back of our mind we were able to condense MOOC integration to design choices on five levels (Chapter 6 and summarized in figure 1).

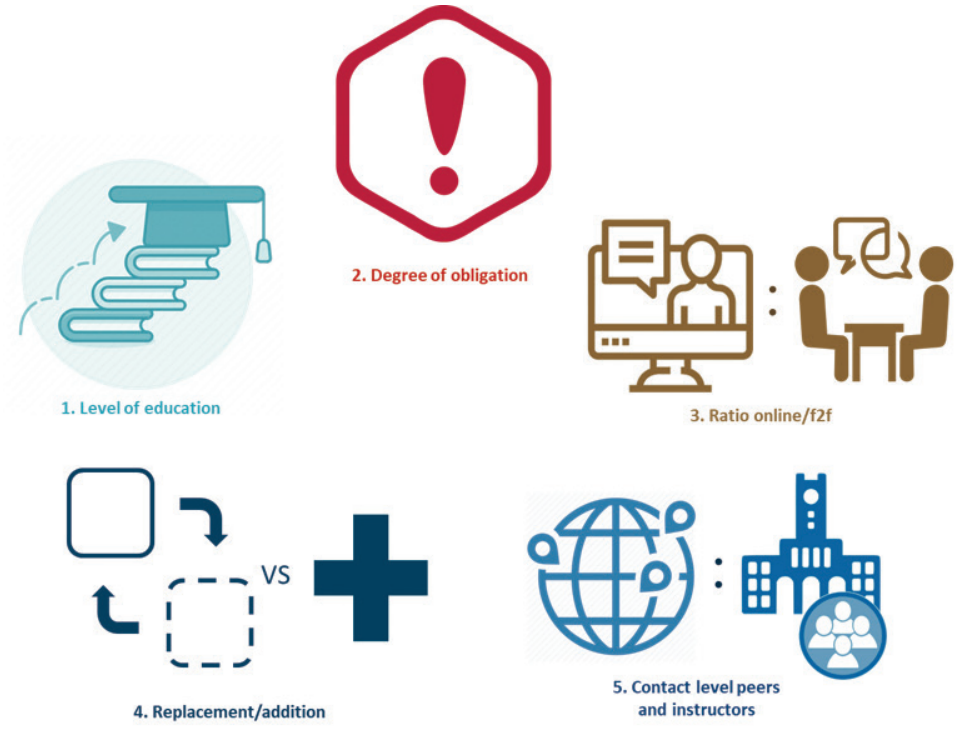


Figure 1. Relevant design choice levels for in campus integration of MOOCs.

These are: 1) the level of education, 2) the degree of obligation, 3) the ratio of online versus face-to-face activities, 4) use of the course as replacement or addition, and 5) the contact level with peers and instructors in the MOOC. Together, decisions on these levels characterize an abundance of options for MOOC integration in campus education. Different frameworks to characterize MOOC integration have also been developed, however as these are based on fewer characteristics, they yield fewer options. Pérez-Sanagustín et al. (2017) described integrated MOOC-based initiatives as a continuum of two factors: (1) institutional support to reuse an existing MOOC, and (2) curricular content alignment between the MOOC and the program. Four types of MOOC integration were conceptualized: MOOCs as a service when both are low, MOOC as a driver for integration when both are high, MOOCs as a replacement when the first is high and the second is low, and MOOCs as an added value when the first is low and the second is high. Alghamdi et al. (2019) coined the bMOOC model, a classification of ways to blend MOOCs into campus teaching, based on a literature review of 20 case studies. They found MOOCs can be used as an optional supplementary, or integrated. Integrated options focused on using MOOC content, using MOOCs as assessment with credit, and using MOOCs specifically for interaction. Cha and So (2020) described integration based on two factors, namely credit recognition and online learning. This led to three types of MOOC-integrated learning experiences: formal MOOC learning,

formal blended MOOC learning, and non-formal/informal MOOC learning. Clearly, MOOCs offer many options for integrating and also many options to classify and report integration. Concerning optimization of MOOC integration, we believe at least the five design choice levels of integration in figure 1, need to be described in every study, however other relevant levels might need to be added, based on the models by Alghamdi et al. (2019) and Cha and So (2020). Some recent MOOC integration studies are more advanced than previous case studies, comparing multiple designs (Cornelius et al., 2019; Larionova et al., 2018). However, similar to more recent case studies (Belenko et al., 2019; Corrado et al., 2021), they discuss the design levels of their integration only to some extent, and they do not systematically discuss the design levels as a contributing factor to their findings. In this regard, the search for what works when to seize the best opportunities MOOCs have to offer, seems to have only just begun.

Medical MOOCs do not all share one teaching mode profile or the same design quality principles, and so each course needs to be investigated separately before integration (Chapter 2, 3 and 5).

Through our studies we found medical MOOCs to differ considerably from each other specifically in their teaching mode profile (Chapter 2) and the instructional design principles that are present (Chapter 3). Although our findings were promising in the sense that many different teaching modes were found and instructional quality was quite acceptable comparing to previous studies, due to the disparity, each MOOC needs specific consideration prior to integration (Chapter 5).

Although different types of MOOCs including cMOOCs and xMOOCs had been described, MOOCs were said to characteristically contain video lectures, discussion forums and quizzes (Dandache et al., 2017; Hoy, 2014). Medical MOOCs were also described being all painted with the same brush: they were claimed to be of 'high academic standard' or 'pedagogically deficient', even though quality was never studied (Subhi et al., 2014). Granted, we found medical MOOCs indeed often include video lectures, discussion forums and quizzes. However, how many of each of these teaching modes were included differed greatly and additional teaching modes proved abundant and highly diverse (Chapter 2). In addition, we could only find similarities in quality for specific instructional design principles: nearly none of the MOOCs (0-6%) included *collaboration*, *expert-feedback* or *integration*, and nearly all MOOCs (97-100%) included *application*, *authentic resources*, *peer feedback* and activities building upon each other, as a part of *problem-centeredness*. All other principles and subitems were present in 12% to 76% of the investigated MOOCs (Chapter 3). MOOCs are thus to be investigated separately before integration to discern the teaching mode profile and quality, and design for improvements in the final integration design. For the practical enactment of this conclusion two challenges are present: MOOC assessment is demanding and for MOOC quality multiple different frameworks exist.

- *Demands for MOOC assessment.* In our experience, investigation of the instructional design of MOOCs, both teaching mode profile and quality, are rather demanding: experienced assessors and considerable time are needed. This might be the reason that only two studies that investigated MOOC quality included more than 40 MOOCs, while according to class-central, 50.000 currently exist (Kasch & Kalz, 2021; Margaryan et al., 2015). The assessment process currently needed to discern teaching mode profile and quality is bound to impede MOOC integration practices, and in need of an update. We have proposed two options that can ease MOOC quality assessment: (1) organized assessment by for example consortia of MOOC exchanging universities or MOOC platforms, so that many can benefit from the findings of a single assessor, and (2) teaching mode profiles and quality profiles can be shared by MOOC creators. A separate webpage or overview on the information page of each MOOC would be a great start, however including the information in the metadata would be even better as to enable specific searchers (Chapter 3).
- *Different frameworks for MOOC quality.* A possible obstacle in MOOC quality assessment is the diversity in assessment criteria and tools available (Aloizou, 2018). MOOC quality has been widely studied, often adopting a focus on instructional design (Stracke & Trisolini, 2021). Jansen et al. (2017) argued that MOOC quality can only be studied in relation to their design as execution of the course by the student can be different each time. The abundance in research has led to different quality assessment tools (Conole, 2013; Lowenthal & Hodges, 2015; Margaryan et al., 2015), Quality Frameworks for OER and Quality Frameworks for MOOCs specifically (Jansen et al., 2017; Stracke et al., 2018). For MOOC integration this is highly undesirable as it complicates the process of quality assessment: knowledge of multiple frameworks is needed and comparing quality based on different criteria and principles is difficult. For example: Kasch and Kalz (2021) report MOOC quizzes to mainly test factual knowledge. This is essentially the same as our finding that mostly objectivist assessment is present. A shared language, and a widely supported set of quality criteria and principles are needed to facilitate quality assessment.

MOOC integration practice is not an easy process and it demands time, several steps and specific knowledge (Chapters 2, 3, 4 and 5).

While our MOOC creation and integration proved to be of added value, the process to organize it took extended time, and required substantial financial investments and faculty commitment (Chapter 4). MOOC integration can also be realized by using an existing MOOC from another institution, and in this case MOOC selection requires employing search and evaluation strategies, which can also take considerable time (Chapter 2 and 3). To help others structure the process, we bundled our experiences and knowledge into twelve tips to describe a step-by-step approach for medical MOOC integration (Chapter 5 and summarized in table 3).

Table 3. Twelve tips summarized.

Twelve tips for medical MOOC integration summarized
1. Clearly define what content you want to include in your course
2. Determine the way you like to use the online materials
3. Search for MOOCs on the selected topic
4. Determine the availability of the specific MOOC and its contents
5. Gauge the credibility of the MOOC before deciding to integrate
6. Ensure the MOOC content is freely available to your students
7. Determine if the MOOC contains the desired teaching modes
8. Determine the social-epistemological dimensions of the course
9. Make sure you align the goals, the teaching activities, and the assessments
10. Provide clear instructions to students on how to enrol onto the MOOC
11. Provide clear instructions to students on how to utilize the MOOC and its resources
12. Determine the success of MOOC integration

Although many studies have described cases of MOOC integration as we have in Chapter 4, we found none describing the process clearly. In 2015 Yousef et al. did describe their implementation of a blended MOOC, however their project was quite ambitious and descriptions seemed research and development oriented rather than practical. Chen et al. (2019) described six steps to offer medical curriculums online including with MOOCs, however integration was not mentioned. In 2020 Virani et al. presented a model to test determinants of teachers' acceptance and use of MOOCs. They found that among other factors, perceived ease of use and content quality have major influence on the teacher's intentions to adopt MOOCs. In this regard, our step-by-step approach should promote acceptance and use of medical MOOCs for integration. With regard of tip 12, concerning assessment of success of MOOC integration, specific progress had been made that can inform practice directly: Wei et al. (2021) recently described all the ways that studies on MOOCs have assessed cognitive, behavioural, and affective learning outcomes, and the related instruments. We believe the study by Wei et al. (2021) can offer extremely valuable insight in finding fitting outcome measures and instruments for MOOC integration.

General conclusions for high quality learning with integrated medical MOOCs

Monitoring of autonomous motivation and use of self-regulation skills is essential for personalized support of effective learning in MOOC integration. Personalized motivation support may be targeted through specific integration designs (Chapter 6, 7 and 8).

EReeve et al. (2008) hypothesized a two tier condition which implies that after self-regulated learning skills have been learned, autonomous motivation is needed to use these skills (Chapter 6). We found six different motivation profiles of students, for which frequency of appearance differed significantly between three different integrated MOOC learning settings. Findings showed greater proportions of self-determined learners in integration designs A and C, which were voluntary undergraduate courses for credit in which the MOOC

was supplemented by an assignment or by 3.5 days of a face-to-face summer school, than in design B, where interaction activities in the MOOC replaced a week of face-to-face lectures in an obligatory undergraduate course of eight weeks (Chapter 7). In addition, precursors for autonomous motivation were reported to be significantly higher in integration designs A and C as opposed to design B (Chapter 7). Finally, we found self-regulated learning strategies related to goal setting may differ greatly between students in prescribed study systems (Chapter 8).

In the protocol in Chapter 6 one of the aims was to discern the relation between autonomous motivation and self-regulated learning. However, we have not yet been able to examine this relationship properly as new insights regarding cross-lagged panel analysis showed three timepoints of data are needed, while we collected data on two occasions (Hamaker et al., 2015). During a current research project to scope the secondary and higher education literature regarding this relation, we did find motivation and self-regulated learning are often described and measured simultaneously, or in each other's presence, hinting towards at least correlation (Hendriks et al., *in progress*). Although we have not specifically characterized the relationship yet, we do believe both autonomous motivation and self-regulated learning are highly important for effective learning in online settings, including integrated MOOC learning. The importance of self-regulated learning skills, specifically goal setting, in online learning and in broader higher education has been underlined in research frequently, as has the importance of autonomous motivation (Kizilcec et al., 2017; Littlejohn et al., 2016; Vanslambrouck et al., 2018).

To our knowledge, these investigations are the only ones considering these constructs in light of MOOC integration. It is important to note that motivation factors in integrated MOOC learning resemble selected motivation factors found in informal MOOC learning (Luik et al., 2019) rather than formal university learning (Vansteenkiste et al., 2009), online learning in university (Vanslambrouck et al., 2018) or learning in a medical curriculum (Kusurkar et al., 2013). Additionally, students in MOOC integration designs are less, and less positively motivated for learning in comparison to informal MOOC learners (Luik & Lepp, 2021), and so profiles of formally integrated MOOC learners are not similar to profiles of informal MOOC learners (Chapter 7).

Our findings regarding diverging and personal self-regulated learning strategy use are corroborated by Broadbent and Fuller-Tyszkiewicz (2018), who found five profiles of health students regarding self-regulated learning ranging from minimal regulators to super regulators. In addition, they found the super regulators to include significantly more online learners, which might indicate selection effects: students who are adequate self-regulators might prefer online learning and thus choose it more often, and/or students who are less advanced in self-regulated learning might steer clear of online learning. Nevertheless they

concluded: 'most group differences between online and on-campus students were small in magnitude, suggesting that in practice, online and traditional learner groups may not be noticeably different at the level of individual strategies in how they approach learning, but may be more easily discerned from the pattern of strategies they commonly employ.' We did not profile students based on goal-setting. However, we found specific strategies for goal setting and we found students describing their strategies as their 'style', and always approaching learning the same way in a prescribed study system, suggesting it is personal. Monitoring and moreover, profiling students based on self-regulated learning strategies, could be extremely profitable to offer tailored support (Araka et al., 2020).

Person-centred analysis such as profiling students has indeed been described recently, as a promising way to support online medical student learning and to inform differentiation or even personalization (Biwer et al., 2021; Kusurkar et al., 2021). Kusurkar et al. (2021) described three types of person-centred analysis and their advantages and disadvantages: cluster analysis, latent class analysis and Q-sort analysis. Among other parameters, sample size and type of data determine which analysis is most advantageous. Although clustering and profiling are useful methods to inform personalized learning, input variables for cluster formation should be well-considered and factor-analyses should be performed. We have found that several different instruments are used for measuring motivation and self-regulated learning as input for profiling students in recent online learning literature (Binali et al., 2021; Biwer et al., 2021; Luik & Lepp, 2021; Vanslambrouck et al., 2018). Sometimes constructs were intertwined in the used instruments. This could be the result of divers perspectives on and definitions of motivation and self-regulated learning in the literature (Hattie et al., 2020; Panadero, 2017). The measure has possible practical implications as we have found when we identified unexpected motivation factors, and so an instrument should be chosen with caution, informed by previous studies in similar contexts.

Profiling may in time also support teachers to apply motivation theories in their designs, which is much needed for the current and future educational landscape (Chiu et al., 2021). While many motivation principles and theories exist (Ryan & Deci, 2020), currently teachers may not be able to implement theoretical ideas to support motivation. In this regard, profiling may bridge the gap between theory and practice, as results in the form of profiles are often more recognizable for practice (Kusurkar et al., 2021). In theory person-centred analysis methods could be used by teachers, however as they require specific expertise and skill, acquired by only some teachers, intelligent automated options might be more suited. As learning analytics and intelligent learning and tutoring systems are investigated for personalized learning increasingly, including to optimize motivation, it is expected that implementable options will be readily available in due course (Kucirkova, Gerard, et al., 2021; Li & Wong, 2021). Until they are, our findings suggests that for MOOC integration, the specific design can inform what motivation profiles are present and thus which designs

demand specific motivation support. It should be noted though, that correlations between motivation profiles and integration designs need further investigation in other MOOC integration designs to generalize our results.

In this regard, McPartlan et al. (2021) recently also noted that when comparing motivation for students in online and face-to-face modalities in authentic settings, selection effects might occur. They found that demographic groups that described competing responsibilities (older, part-time students, women) performed worse in online settings than face-to-face courses, whereas demographic groups that did not select online courses for these reasons (younger, full-time students, men) performed just as well as their face-to-face peers. They reasoned: 'demographic variables such as age, gender, and ethnicity may be associated with student outcomes if they also happen to be associated with motivational processes that can directly influence student outcomes'. This underlines the idea that the design of a course can influence the selection of students especially by offering it non-obligatorily and in a specific modality, corroborating the correlation between integration designs and motivation profiles. As we described in Chapter 7, and Broadbent & Fuller-Tyszkiewicz, (2018) implied by mentioning selection effects, a possible explanation is that the shape of motivation influences the course students want to join. However, more research is needed.

Instructor trusting motivation is highly important for students in formal medical MOOC learning, and it may be the key to foster high quality motivation (Chapters 7 and 8).

We found instructor trusting motivation to have a prominent role in shaping motivation profiles in integrated MOOC learning, leading to three profiles that are characterized predominantly by trust in their teacher: moderately trusting, highly trusting and extremely trusting students (Chapter 7). Further, many students mentioned trust in the teachers and coordinators as a consideration for accepting the prescribed study system (Chapter 8).

Finding that trust in the instructor played such an important role was somewhat unexpected, as we used an instrument that, to our knowledge, had not yielded this factor before. The items that loaded together for the instructor trusting motivation factor originally were validated and were supposed to load with autonomous or controlled motivation (Black and Deci, 2000; table 4). However, our results were corroborated by motivation measures used in informal MOOC learning research (Luik et al., 2019), and our qualitative study offered further insight. Phrases from the interviews that supported the importance of trust in the instructor were: 'someone must determine the direction and the instructors and coordinators are the best candidates for this because of their experience' and 'I do not want to have the responsibility of deciding on the program to become a doctor' and finally, 'teachers do not look at learning goals either'. Although the last statement describes a reason not to use learning goals while we hope teacher would encourage using learning goals, the statement does supports the

idea that students look to their teacher for guidance and trust their strategies. Osueke et al. (2018) also found students to use learning goals in the way suggested by instructors, supporting the idea that students trust their instructors. Furthermore, Binali et al. (2021) found that a specific group of 'course-driven' online learners accepted new information based on authority as opposed to 'self-driven' online learners who checked new information with multiple sources or based acceptance of new information on personal understanding.

Teachers as role models with authority as a reason for trust also resonates with Vygotsky's *Zone of Proximal Development* where the teacher is the designated 'more knowledgeable other' (Vygotsky, 1978). For students this motivation might also partly be a proxy for autonomous motivation. Motivation for learning itself might be internalized or identified; students might reason 'learning and progressing in my studies is good for me and my future, and the teacher knows what to learn'. It seems students trust instructors to vouch for the reasons they have to learn something and how: it will help them during assessment, in clinical stages of their studies or in their future profession (Chapter 8). The assumption that learning is important for future clinical activities is already quite close to rationalizations that can lead to identified or integrated regulation of motivation. However, by trusting the teacher to oversee the significance of an assigned goal, the connection to students' own norms and values might be obstructed.

Table 4. Items for instructor trusting motivation and original factor allocation (Black and Deci, 2000).

Items for instructor trusting motivation	Original factor allocation
I have followed the instructor's suggestions for studying transplantation medicine online because it is easier to follow his/her suggestions than come up with my own study strategies.	Controlled motivation
I have followed the instructor's suggestions for studying transplantation medicine online because he/she seems to have insight about how best to learn the material.	Autonomous motivation
I have followed the instructor's suggestions for studying transplantation medicine online because I am worried that I am not going to perform well in the course.	Controlled motivation
I have followed the instructor's suggestions for studying transplantation medicine online because I would get a bad grade if I didn't do what he/she suggests.	Controlled motivation

Leaning heavily on the teacher to determine what needs to be learned or how, is per definition not self-determined and possibly an indication of low self-regulation: it resonates with wanting to succeed, and not having or wanting full responsibility yet. It is also somewhat contradictory to the academic mindset which is to critically review new information rather than to receive and accept. However, it does suit compliance to the hierarchical atmosphere in the hospital and the hidden curriculum in medicine (Lempp & Seale, 2004). Further, the objectivist ways of teaching that are still abundant in medical schools might add to the idea that there is an expert who knows everything, and students who do not. Finally, the

education students have had prior to starting medical school might affect their maturity in self-regulation and self-direction, and subsequently the amount of responsibility they take in their learning (Vosniadou, 2020).

As the self-regulatory skillset and self-determined attitude are needed in clinical stages of training and in the medical profession, it is desirable to have responsible and self-regulating medical students early on in the curriculum (Berkhout et al., 2018). Luckily, trust in the teacher also poses an opportunity to make students see the connection between the learning goals and personal values. Teachers can help students to truly accept goals and learning activities, explicitly and autonomously (Leone et al., 2019), and improve the quality of their motivation. It is important to underline that acquiescence is not acceptance and not an option to improve goal-setting practice: it is undesirable that students spend energy resisting implicit or explicit learning goals and then have to relent. In this regard, teachers might have a vital role in increasing the perceived usefulness of goal content by clarifying exactly how it will serve students in the professional role they are pursuing. Additionally, offering more constructivist teaching activities, for example by MOOC integration, might help some students to start viewing information as something to be constructed and discover their own voice in this process. It may help make students more prone to ask 'why' questions and become more autonomous and self-determined.

Goal acceptance may bridge theoretical desires to set goals personally and practical preferences to assign goals, not only in MOOC integration designs (Chapters 3, 6 and 8).

We found goal-setting to be described as important for self-regulated learning in MOOCs and other online learning settings (Chapters 3 and 6). However in medical MOOCs goals are assigned and in almost a quarter of our sample not even communicated to students (Chapter 3). In addition to MOOC integration designs, goals are also predominantly assigned in the undergraduate medical curriculum, making both prescribed study systems (Chapter 8). Students in a prescribed study system differ in strategies to accept and use the assigned goals (Chapter 8). Students that never use assigned learning goals, and students that do not use learning goals based on goal content can be assisted in their acceptance of goals by increasing comprehensibility of goals, perceived usefulness of goals and perceived interconnectedness of goals, activities and assessment (Chapter 8).

Table 5. Types of goal-setting classified based on their origin, and examples in education.

Type of goal-setting	Origin of the goal	Example in education
Personal	the person or group that is to pursue the goal	Students set their own learning goals
Joint	the person that is to pursue the goal and another person that will not pursue the goal but has interest in attainment	Students set goals with their teacher
Consultation	another person that will not pursue the goal but has interest in attainment	Teacher consult students on what they want or need to learn and sets goals for them
Tell and sell	another person that will not pursue the goal but has interest in attainment	Teacher sets the learning goals and inform students of them, explaining why they are important
Tell	another person that will not pursue the goal but has interest in attainment	Teachers sets the learning goals and informs students of them without a rationale

In education literature goal acceptance has been understudied. Goal-setting theory has identified different sources for setting goals, however it is silent on what source is best. The founders do state self-set goals are at the core of self-determination (Latham & Seijts, 2016). Sources of a goal classify goal-setting into five types: personal, joint, consultation, tell and sell, and tell (Latham et al., 1988; Roberson et al., 1999; summarized in table 5). Moving from the first to the last option, acceptance of the set goals by the person that is to pursue the goals is increasingly less assured, while acceptance of these goals is highly important (Erez et al., 1985; Latham & Seijts, 2016).

Our compiled findings on perceptions, considerations and use of learning goals of students in a prescribed study system yielded a model to understand the processes in accepting assigned learning goals (Chapter 8). These processes had not been previously described, however partial corroboration of our model can be found in the task value component of Expectancy-Value theory (Eccles, 1983; Eccles & Wigfield, 2002). This theory posits that a combination of people's expectations for success and subjective task value motivates achievement-related choices. It further differentiates task value into four elements: utility value (i.e., perceived usefulness for future goals), intrinsic value (i.e., personal enjoyment), attainment value (i.e., importance of doing well), and cost (i.e., competition with other goals). We found students perceptions regarding the value of learning goals to be closely related to their use of it. For example, use of the goals as a tool and setting personal goals was described as useful or not, which could be considered as perceived utility value. Further, using and setting goals were also described as enjoyable, which could be considered as an intrinsic value. Our findings revealed that students who feel resistant towards the prescribed study system but still participate, perceive they have no other option than participate if they want a career, which could be considered a description of attainment value. Similarly, all participants described that they would, in the end, acquiesce to whatever was expected of

them as they were adamant to pass the examination, even if they did not fully understand or agree with the expectation. Our practical implications to enhance perceived usefulness and interrelatedness between goals, activities and assessment, and enhance comprehensibility of goals to improve goal acceptance are also corroborated by literature, but only partly related to Expectancy-Value Theory. In this regard the need for perceived usefulness and perceived interrelatedness of goals, activities and assessment can be viewed as need for utility value, however is does not describe comprehensibility. Leone et al. (2019) recently did describe comprehensibility, and in addition interrelatedness of goals, activities and assessment, as highly important factors for converging identification of course objectives by faculty and students.

We found acceptance to be present for some students and others described it to be attainable. We therefore see learning goal acceptance as a potential bridge between the desire to set goals personally and the practical preference to assign goals, not only in MOOC integration designs, but in all prescribed study systems. That being said, for students to become self-regulated or even self-directed, it is important that they learn to have increasingly more say in their learning goals (Jossberger et al., 2010). This also means education will be increasingly more personalized. Kucirkova, Toda, et al. (2021) coined the 'agency paradox' to describe the tension in personalized education that arises through individual and collective agency in educational practice, adding designers as a third stakeholder, in addition to teachers and student. Many teachers and designers want to support individual students' choices, however these also need to be narrowed down to adhere to the shared curriculum. Higher levels of student participation in goal setting requires a dire balancing act of teacher-regulation and student-regulation, as they can get in each other's way and create destructive friction if both regulate too much or too little (Vermunt & Verloop, 1999). In this regard, students in the same cohort will rarely be all at the same self-regulated learning or goal-setting level, and the balancing act will thus need to be performed on differentiated levels by the teacher.

In addition to information about the level the student is in, clear task division of regulation between student and teacher is needed. For goal-setting, teachers might think that students will ask questions about the learning objectives if they need information, however this already requires self-regulated learning skills from the students. For a portion of the undergraduate students we have studied, it seems teachers are right to assign goals, however, in that case they are also responsible for supporting acceptance of the goals. Some students already set their own goals and might thus be ready for more responsibility. Similar to *Entrustable Professional Activities* (EPAs) that assess qualification of students to perform increasingly advanced clinical tasks (Cate, 2016), we propose *Entrustable Regulation of Learning Activities* could inform both student and teacher of the status quo in their journey of increasing agency, to full self-regulated and directed learning. *Entrustable Regulation of Learning Activities* could include subtasks of the planning, monitoring and reflection stages described by the self-regulated

learning models (Panadero, 2017), complemented with activities belonging to designing learning paths (Kirschner & Van Merriënboer, 2008). For example, in early stages students can help identify short term goals, based on the long term goals. In later stages, students could decide on how and by whom their academic goals should be assessed. Implementation could be challenging as transference of responsibility requires room for student agency in organizing education, also in early stages. However, the idea fits the cognitive path to self-regulatory skill needed for lifelong learning in today's society (Zimmerman & Kitsantas, 2005). Additionally, for EPA's implementation has also proved possible (Ten Cate et al., 2018). Support for self-regulated learning is thus not taking regulation out of students' hands, which might be about to happen in online settings (Araka et al., 2020). Using data to personalize learning unseen might also take something away from the student. In our opinion, creating personal learning goals, matching activities and testing oneself is an invaluable skillset, essential for medical professionals and lifelong learners.

Strengths and limitations

We identify three strengths for this thesis. First, teaching was approached in two ways in Chapter 2 and 3 and learning was approached in two ways in Chapter 7 and 8, strengthening the final perspective. In addition, by considering both high quality teaching and high quality learning in the approach to identify the added value of medical MOOC integration, MOOC integration design guidelines are more holistic. Second, the pragmatic research paradigm enabled us to implement methods and analyses needed to do groundwork for this specific problem. And third, research was driven by and conducted in highly authentic contexts. This means that considerations and ideas regarding major constructs mostly came from practice and were enhanced by theory, which we consider to be a strength when tackling a practical problem.

The research in this thesis also comes with some limitations. First, the studies described in Chapter 2 and 3 are time sensitive. As the number of medical MOOCs has grown extensively and availability and what is offered for free continually change, the determined inclusion criteria might offer more or different MOOCs for investigation if the studies were conducted now. In part, all research can be regarded as somewhat time-sensitive and in this sense we have to adopt the post-positivist stance that reality can only be known imperfectly. Luckily, our findings underline that what medical MOOCs have to offer is predominantly positive, and developments in the field of MOOC research make us believe that if the studies would be replicated today, results would be similar or more positive. Second, in Chapter 7 a possible selection bias may have occurred as response levels were not 100% and less motivated students may not have participated. In this regard, motivation profiles may in reality be somewhat different: mean scores for motivation factors could be lower, or an extra low motivation profile could be missing. It is possible that even less obligated MOOC

integration designs similar to design C need interventions that support motivation. One of our conclusions therefore is, that motivation should be monitored.

Practical implications

This thesis was instigated by a practical question: (How) can high quality teaching and learning be offered in campus-integrated medical MOOCs? Practical implications are thus of major importance. They can be divided into implications that will directly enhance MOOC integration and implications that will indirectly enhance MOOC integration.

Implications for directly enhancing teaching and learning in medical MOOC integration
Teachers interested in medical MOOC integration should:

- Follow the step-by-steps approach to structure the organization of MOOC integration (Chapter 5, summarized in table 3 in this discussion section)
- Use the availability of diverse teaching modes in the integration design to spark interest through novelty when possible
- Use social-epistemological dimensions to guide fitting integration (see figure 2)
- Evaluate the instructional design quality of the selected MOOC before integration
- Add activities to an integrated design to accommodate specific principles and upgrade quality if needed
- Assess MOOC integration success based on relevant outcome measures (see Wei et al., 2021)
- Ask for help - experienced MOOC integration teachers or designers of a MOOC are often highly enthusiastic about MOOCs, integration and sharing knowledge
- Monitor motivation and support it extensively in obligatory designs - for example by autonomy supportive interventions
- Share with students the information needed to support perceiving learning goals as useful, comprehensible, and aligned with activities and assessment, to aid assigned learning goal acceptance

Implications for indirectly enhancing teaching and learning in medical MOOC integration

- MOOC instructors and designers should share the teaching mode profile of their MOOC, and the criteria for quality they have taken into account
- MOOC platforms should accommodate relaying this information into metadata
- MOOC integration researchers should include the teaching mode profile and choices regarding design levels to aid overarching investigations concerning what works when
- MOOC integration researchers can use person-centred analysis such as profiling to inform differentiated or personalized improvement of designs

Figure 2. Practical directions for integrating teaching modes based on their social-epistemological dimensions.

		Epistemological dimension	
		Objectivist	**Constructivist**
		• 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. • Constructivist teaching modes require more advanced skills of the learner. They need to be able to assess the quality of different information sources (Huang, 2002), to navigate in less-structured teaching activities, and to 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 capable to take the role of facilitator (Huang, 2002).
Social dimension	**Individual**	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.	Individual-constructivist teaching modes are suited for analysing, evaluating or synthesizing tasks. For example, clinical reasoning problems. To do this individually, students need to be advanced cognitively, for example to order their information, and meta-cognitively, for example to know when to ask for help.
	Group	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.	Group-constructivist are very helpful to learn navigating in complex problem solving tasks. In many professional settings, combining information from multiple sources to construct a diagnosis is an individual task, but, conferring with peers will support learning to do so.

Future research avenues

Based on the research within this thesis, several avenues for future research can be identified, of which a few will be discussed below.

- First, the improvement of instructional design quality principles collaboration and expert feedback needs investigation. In MOOCs these might pose a problematic fit and research is needed to find solutions, for example in the directions of barriers and promotors of collaborative learning in MOOCs, or options for effective team formation (Sankaranarayanan et al., 2018; Sanz Martínez, 2022; Staubitz & Meinel, 2017; Wen, 2016) in regard to collaboration. For investigating expert feedback upscaling and outsourcing offer options (Balfour, 2013; Joyner, 2017; Toxtli & Savage, 2020), and in addition identifying which students need personal attention, through analysis of sentiment or tone in text (Schubert et al., 2018), or monitoring peer feedback results (McMichael et al., 2021), seems to be a promising avenue. However for MOOC integration specifically, best practices to upgrade integration designs should be investigated, for example, how to best implement instructional design principles missing in the MOOC by adding in campus activities or assignments.
- Second, conformity is needed on the criteria and principles that encompass instructional quality in MOOCs. In this regard, it is possible that for different purposes different

criteria must be considered. Assessment for informal MOOC learning might be more lenient towards principles that are difficult to implement than assessment for formal MOOC learning. An integration of the existing principles and criteria would be a good starting point, possibly extended by expert review, for example through a Delphi study.

- Third, future investigations into what works when for MOOC integration designs are needed. Specifically experiments are needed in which variables are altered one at a time. We suggest starting with studies into the effects of degree of obligation, as it may lead to scaffolded student and teacher roles or self-selection of students.
- Fourth, optimal instrumentation for measuring motivation in integrated MOOC settings should be studied. We selected an instrument previously used for formal learning, however factor analysis revealed instruments previously used for measuring motivation in informal MOOCs might have been more appropriate.
- Fifth, confirmability or refinement of Assigned Learning Goal Acceptance Theory in similar contexts is needed, and the role of teachers and instructors in goal acceptance processes needs further attention. Our studies revealed students rely greatly on their instructor for their motivation to learn in MOOCs, and that trust in their teacher is an important factor to accept learning objectives implicitly and explicitly. Positive or negative perceptions or actions of teachers surrounding learning goals, may thus greatly affect goal acceptance processes of students and need to be studied.
- Sixth and final, the idea of *Entrustable Regulation of Learning Activities* might provide a solution for the agency paradox and deserves further investigation.