Building an inclusive classroom – a blended course in Nuclear Medicine

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Abstract

Nuclear medicine (NM) has been taught in the medical program at the University of Bergen (UiB) since 2006. The new curriculum "Medisin 2015" introduced e-learning/blended learning based on UiB's new learning management system (LMS) https://mitt.uib.no, while at the same reducing lectures and face-to-face (F2F) teaching.

This forced a major redesign of the existing course in NM. As the new blended course in NM shifts focus from teacher-centric content delivery towards active student participation, this has important implications for teacher-student interaction. Learning needs to be staged as a collaborative effort promoting open discourse.

In the following we describe how we re-revaluated and redesigned the existing course in NM and present preliminary results based on initial student feedback.

Keywords

1. Introduction

As modern higher education is shifting from a content-centred approach to a learning-centred approach in order to promote deeper and more lasting learning outcomes (Fink 2013 p. 31), traditional lectures are gradually replaced by active learning units (Fink 2013 p. 114). As focus is directed away from pure content delivery towards the learning activity, creating a classroom that fosters participation, engagement, and mutual respect becomes an important task for the teacher.

This shift in focus equally applies to face-to-face (F2F) teaching as well as to the online environment, or their combination, so-called blended teaching. Regardless of the teaching platform, teaching and learning have a social dimension. In the context of learning, this social dimension has a deeper meaning. "Ideal educational transaction is a collaborative constructivist process that has inquiry at its core. Social interaction and collaboration shapes and tests meaning, thus enriching understanding and knowledge sharing. (…) The emphasis is on enquiry processes that ensure that core concepts are constructed and assimilated in a deep and meaningful manner." (Garrison and Vaughan 2008 sec. 370). "In a discipline of inquiry, participants acquire the attitudes and skills to become critical thinkers and to continue their learning beyond the narrow scope and time limit of a formal educational experience." (Garrison and Vaughan 2008 sec. 421).

In the following article I describe how I set out to redesign the existing course in nuclear medicine (NM) for medical students at the University of Bergen. Initially, I responded to the challenges posed by a new curriculum and evolving teaching technology. As I got more deeply interested in academic pedagogy, I became increasingly aware that teaching is more than the competent application of teaching technology for efficient knowledge transfer. I would like to share this experience with a wider audience.

2. The challenge

Nuclear medicine (NM) is one specialized branch in the course in medical imaging (http://uib.no/radionett/nuklear). While the Section of Radiology at the University of Bergen (UiB) includes four professors (one full time, three part-time) and four associate professors teaching radiology, teaching

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staff for NM is limited to one part-time professor (the author) who has taught NM at UiB since 2006 with the assistance of one staff physician at the NM/PET-centre between 2015 - 2017 (Haslerud et al. 2017).

The new medical curriculum at the Faculty of Medicine at UiB, "Medisin 2015" reduced F2F teaching time for NM by 25 % while at the same time doubling the group sizes for all teaching units. The full 6-year master programme in human medicine at UiB now includes two 45-minute plenary lectures on NM in the 5th term, and three interactive teaching units of 90 minutes each in the 5th term (introduction to NM), 8th term (NM in endocrinology), and 10th term (NM in oncology). In combination with increased group sizes, the new curriculum represents a considerable challenge to the teaching staff: whereas the old curriculum had provided multiple contact points with the students in the 3rd and the 6th year, the new curriculum reduces F2F interaction with the students to a single occasion, each one year apart.

Establishing an inclusive classroom that fosters learning is a major challenge when meeting the students only for 90 minutes once a year. Most works on college teaching typically refer to courses that span at least half a term with some 5 or 10 F2F sessions (Barkley 2010; Fink 2013), thus a fresh approach with input from many sources was needed.

3. Opportunities

While cutting time and resources allotted to F2F teaching, the new medical curriculum introduced the Learning Management System (LMS) Canvas (http://canvas.instructure.com; https://mitt.uib.no) as a new online learning environment.

Having to overcome the constraints on F2F teaching imposed by the new curriculum, I saw the potential benefits of modern LMS such as Canvas (https://mitt.uib.no) and Moodle (Haslerud et al. 2017) for my teaching. UiB course UPED632 conducted by Assoc. Prof. Robert Gray and Garrison and Vaughan's introduction into blended learning (Garrison and Vaughan 2008) both made me aware that blended learning is more than the adept application of modern teaching technology.

Garrison and Vaughan base their analyses of teaching and learning on the "Community of Inquiry" (CoI) framework. Successful teaching rests on the triad of intellectual presence, teaching presence, and social presence. Intellectual presence means that students focus their mind on the subject matter under study rather than on meandering on other issues or checking their social media account. Teaching presence denotes timely formative feedback from the teacher. Social presence is based on feeling supported by the teacher and the group. Only when all three components are present, will significant learning be fostered (Garrison and Vaughan 2008 sec. 438).

This concept has important consequences for conducting courses, both in a F2F and online learning environment: "Students in a community of inquiry must feel free to express themselves openly in a risk-free manner. They must be able to develop the personal relationships necessary to commit to, and pursue, intended academic goals and gain a sense of belonging to the community." (Garrison and Vaughan 2008 sec. 452) An important aspect in the context of a medical curriculum is that norms guiding the interaction between instructor and students can also serve as model for the interaction between physician and patient.

4. Redesigning my teaching

Based on the CoI framework and Dee Fink's concepts of planning higher education, I started redesigning the course in NM under the new curriculum in spring 2017. My initial work focused on the middle section of the course in the 8th term, "NM in endocrinology", while I at the same time made incremental changes in the last iteration of NM for 3rd year medical students under the old curriculum.

Ever since I started teaching NM at UiB in 2006, I had a strong focus on basing my F2F teaching on real-world problems (Biermann 2016). I carefully select a limited number of relevant patient cases, which I present using original NM image processing software in interactive format using a set of two video projectors. I define the clinical problem at hand and then ask selected members of the classroom audience – usually the student who is in possession of the laser pointer that I provide to the audience – questions about the projected material. The students can raise their own questions or observations which I then try to answer or explain in an appropriate manner. I like to call this format Socratic questioning.

This format has a number of advantages: (1) Clinical cases, like stories, tend to captivate an audience (Barkley 2010 sec. 2273; Lang 2016 p. 182). (2) Using cases to demonstrate fundamental principles promotes higher cognitive functions (Lang 2016 p. 95). (3) A lively classroom discussion tends to engage students, especially if positive emotions are invoked (Lang 2016 p. 182).

(4) I personally find cases captivating, which for me is a good way to maintain teacher engagement (Barkley 2010 sec. 1746). (5) Showing cases gives me an opportunity to communicate enthusiasm, an important ingredient in successful teaching (Lang 2016 p. 186). (6) Projecting genuine NM image data on a large screen in the interactive format provided by dedicated NM software (Biermann 2016) is considerably more engaging than projection of ready-made slides in a presentation program such as Microsoft Powerpoint™. While teaching the students NM software skills for analysing NM images is not practicable in most teaching contexts, students can ask the teacher to navigate to a different point in a volume or to change the colour scales to look at a specific finding or even perform these tasks themselves if asked to come forward to the podium.

As my pedagogical understanding deepened, I began to see limitations of my established teaching architecture: (1) About half the time in my old F2F courses was spent lecturing since most students lacked foundational knowledge despite the introductory lectures. (2) Only a minority of the students volunteered their opinions – the ones that were given the laser pointer and the occasional articulate student who then dominated the classroom discussion. The vast majority of the students were silent, and I had no way of assessing their engagement as the teaching went on. (3) Active teaching aiming for higher cognition was not optimally aligned with the examinations, which were multiple choice questions (MCQ) based on faculty regulations. (4) Students were interacting mainly with the instructor – the potential of peer instruction (Lang 2016 p. 156) was unharnessed. (5) Students were not visible as social beings (Lang 2016 p. 178).

In the following I describe how I set out to address the above issues in the redesign of my course. After outlining my approach, I present preliminary results in terms of student feedback and evaluations.

4.1 Flipped classroom

Spending time lecturing because of lack of student preparation means less time for interacting with my students as learners and as social beings ("teaching and social presence").

To relieve my F2F teaching from the transmittal of foundational knowledge, I implemented elements of a "flipped classroom" (Barkley 2010 sec. 2279; Lage et al. 2000). To this end, I redesigned my online lectures from the ground up. My original lectures from 2006 were animations of full-scale lectures – 45 minutes at a time. While the occasional student still watches these lectures, I split up the lectures into thematically self-contained units of maximum 10 minutes' viewing time. The web lectures were produced with new authoring tool (http://ispring.com), so that they can be perused on any internet-compatible device – be it a personal computer or a mobile phone – both on-line and off-line, based on student preference and convenience.

Borrowing from team-based learning (TBL), I complemented the lectures by short matching MCQ quizzes on https://mitt.uib.no as pre F2F readiness assessment test (RAT). The MCQ are about key points of the lecture. To commit students to perform the exercise, I set up a mandatory assignment in the LMS for all students about to attend a given F2F instruction with a deadline of midnight before. Once a relevant subset of students is assigned a task, the Canvas LMS contains a convenient function of sending a personal message to every student who has performed the assignment as well as sending a message to students who have not. Two weeks before F2F instruction, I send the first students to pass the assignment a short congratulatory message. I also ask the first adaptors if the questions were appropriate in relation to my on-line lecture. I then send the students that have not yet taken the test increasingly direct reminders. This gives me the opportunity to strike acquaintance with at least some of the students before our F2F meeting. At the beginning of the F2F session, I briefly review the result of the RAT before launching into the first teaching cases.

4.2 Student feedback

The challenge in presenting a case on a large screen in front of a large audience is that the approach is teacher-centric and only few students will volunteer to take part in the class wide discussion if not actively prompted by the instructor.

The online environment provides alternative avenues of communication. Most LMS such as Canvas and Moodle provide modules for discussion forums. Garrison advocates the active use of online discussion forums to allow students to post questions or issues regarding the pre-class materials, the F2F session, or post F2F assignments (Garrison and Vaughan 2008 sec. 2029). While the strength of the F2F classroom is its spontaneity, the strength of online learning lies in the opportunity for reflection and rigor (Garrison and Vaughan 2008 sec. 620). An advantage of online over F2F discussion is that it may appeal to students with different learning preferences. However, with one

carefully prepared exception, I have not had any success in starting an online discussion on https://mitt.uib.no in any of my courses.

Brookfield advocates the use of anonymous feedback forums such as TodaysMeet.com (Brookfield 2017 p. 106). Anonymous feedback lowers the threshold for posting one's opinion. I am using https://backchannelchat.com, which is both cheaper and technologically more advanced. An anonymous live chat channel can easily be inserted into Canvas content pages via iframes. The Moodle LMS has an anonymous "Feedback" activity which can be used for student satisfaction surveys, which can easily be integrated into https://mitt.uib.no via the Learning Tools Interoperability (LTI) protocol.

Brookfield also recommends keeping an active feed open even while F2F instruction is taking place. The instructor can then check the incoming messages in a break in the teaching session and if necessary adjust the pace of her teaching. I have encouraged anonymous electronic feedback under my most recent F2F teaching sessions, and received useful responses on several occasions.

4.3 Didactic alignment

A constant challenge in teaching NM was that the examination (a short written test with 5 MCQ) was trivial compared with the subject matter that had been taught. This improved when the examination became electronic based on 20 questions on https://vurdering.uib.no in autumn 2016. The system is now being replaced with a national MCQ database (https://mcq.medisin.ntnu.no), which only allows questions with one correct choice among three to five alternatives; multiple true-false questions (Haladyna 2004 p. 83) are not supported. Under the new medical curriculum, every term is concluded by a comprehensive MCQ examination based on the national MCQ database infrastructure. Unfortunately, the number of questions on NM is so limited (one, at most two) that it is impossible to draw any conclusions as to the quality of the teaching.

I have therefore created post-F2F assignments on https://mitt.uib.no that use more advanced MCQ design than the national database allows, and in which every alternative, both correct and incorrect, is commented so that students receive instant formative feedback. To have students train retrieval of foundational knowledge (Lang 2016 p. 22) I group questions on different levels: Foundational knowledge on level 1, higher reasoning/application on level 2. Each level can be attempted unlimited times, and the highest result is telling.

The next higher levels is unlocked when the student has obtained at least 80 % of points on the lower level. On each attempt, questions are presented in random order. To help engage proficient students who might find some questions too trivial I routinely ask them to point out questions or explanations that are faulty or misleading.

A new feature of the curriculum "Medisin 2015" is the Objective Standardized Clinical Examination (OSCE). "OSCE is a performance-based examination in which examinees are observed and scored as they rotate around a series of stations according to a set plan. Each station focuses on an element of clinical competence, and the learner's performance with a real patient, a simulated patient, a manikin or patient investigation is assessed by an examiner." (Harden et al. 2016 p. 1). In the OSCE pilot arranged with 40 student volunteers at the end of the 3rd year in November 2017, NM contributed a station with a virtual patient. Each student was asked to demonstrate the pertinent findings in a positron emission tomo¬graphy/computed tomography (PET/CT) of a patient with lung cancer using dedicated NM software. For the preparation of the OSCE examination the author programmed an interactive tutorial on https://mitt.uib.no that taught the students the use of the software and supplemented it with five anonymized cases in the national NM teaching database (Haslerud et al. 2017). For each of the five cases, the same standardized set of seven MCQ questions was presented in the LMS. Students could work with the material on their own on one of two student computers attached to the hospital network or meet at the NM/PET-centre at specified times when they would receive tuition by the author or other nuclear physicians including residents in groups of 1 – 3 students. Again, I asked students for feedback and comments in case of errors in the teaching material.

4.4 Peer instruction

Except for the newest teaching material for the OSCE at the end of the 3rd year, peer instruction is underused in the present course of NM. Handling organ-specific NM software requires considerably greater expertise in NM than can be expected from a medical student. Thus, more advanced visualization and processing steps need to be performed on a large screen in front of the entire audience. Also, the required infrastructure, i.e. a set of workstations with the required NM software, is so far only available at the NM/PET-centre.

However, I have discovered clinically relevant questions based on simple 2-dimensional images, which still require higher levels of reasoning and

are well suited for small-group discussions in a TBL-like setup. One such question is assigning the most appropriate treatment for thyrotoxicosis based on clinical information, thyroid scintigraphy, and thyroid ultrasound. I have now prepared a new set of exercises based on existing teaching material for the 8th term utilizing https://socrative.com as classroom response system (Bruff 2009 p. 14) which I am going to launch in early 2018.

4.5 The student as a person

The development of a learning community within a course assumes that the participants are known to each other. Garrison advocates that students should post a short biography and ideally a digital image of themselves. In addition, they suggest the use of "icebreaker" activities that help support collaboration within a course (Garrison and Vaughan 2008 sec. 1911). Unfortunately, the NM course format with single teaching units separated by intervals of up to one year does not lend itself to this latter approach.

5. Results

The following section is mainly based on voluntary student feedback, solicited either by the instructor or the faculty.

5.1. Flipped classroom

Allocating repetition of foundational knowledge to the new online lectures was favourably received by the students. This was the main reason for the Faculty of Medicine to award the 2017 Teaching Quality Price (Studiekvalitetsprisen) to the redesigned course of NM.

Sending repeated personal messages to students that had not taken the pre-F2F activity induced 69 out of 79 students (87 %) to perform the activity. In subsequent similar courses participation rates were similarly high. Under the F2F instruction, lively discussions ensued. In previous course the maximum preparation yielded by about the third of the students had been the perusal of my lecture notes.

5.2 Student feedback

Only some of my repeated attempts to obtain student feedback have been successful. Simply opening a discussion forum in the LMS saying "Post your questions" has never bourn results in any of my courses.

The most fruitful forum so far was the anonymous forum on course MED8 (NM in endocrinology) with a total of 22 posts. The first student posted: "I think the web lecture and the accompanying test were good. The lecture can be stopped and started again, and the test forces one to process the information one has just received." One student mailed me that he had difficulties understanding the difference between scintigraphy and PET. I posted the question in the forum and answered it there, which prompted a laudatory response by another student. A third student confirmed the observations of the first student and added that it was helpful to be able to use the teaching tools at home. She also wrote that it was very good for her learning that I had uploaded training questions for the MCQ exam at the end of the 8th term. However, she remarked that parts of the actual F2F presentation were too fast for her comprehension. I responded that I will address these issues in the next iteration of the course. Another student, who tellingly chose the nickname "nuclear medicine", claimed that the F2F teaching on NM had been the best had heard on NM so far, but suggested that the course section on parathyroid imaging should also have been accompanied by an introductory web lecture. An active discussion with "nuclear medicine" ensued in which he/she pointed out inconsistencies in my teaching materials, which I promptly corrected.

As my interest in feedback has transpired to my students, I have begun to receive personal correspondence via the messaging system on https://mitt.uib.no or university mail. I have made it a habit to respond promptly. In case of one student, an increasingly personal discourse ensued. When I asked the student in one of my later mails why she would send her observations to me but not post in a forum, be it open or anonymous, she replied that she had deep respect for academic staff (a comment which I found intensely flattering) and that she had problems speaking up publicly, even in my course. She admitted that she used to sit in a back row and was happy each time the laser pointer passed her. This episode illustrates the importance of using different feedback channels and not just rely on the single medium of classroom discussion in F2F teaching. Even though the student apparently never will speak up in any of my courses, her written observations on the medical programme

in general and my teaching in particular have provided me deep insights.

The challenge with unsystematic feedback via forums and/or messaging systems is that only the most motivated students respond and that there is no benchmarking in comparison to other courses in the same curriculum. Anonymous surveys address this problem. The most detailed feedback that I ever received in any of my teaching projects was the anonymous survey conducted with the Moodle anonymous "Feedback" activity integrated into https://mitt.uib.no, which I will present in the next section.

Use of an electronic anonymous feedback solution by the faculty administration has for the first time in my tenure at UiB resulted in rich free text student feedback on the course in endocrinology and endocrine surgery in the 8th term. Students were generally happy with the teaching but heavily criticised the MCQ exam at the end of the term. NM, which forms a small part of this course, was commented on only by a single student who remarked that the e-learning materials on https://mitt.uib.no were a good preparation for the end of term MCQ exam. Since the examination only included a single MCQ on NM which was answered correct by 80 % of the students, this electronic survey provided the most useful feedback on my teaching through an official channel.

5.3 Didactic alignment

Providing one of 13 OSCE stations in the OSCE pilot in November 2017 with 40 volunteer students in the 6th term gave us the chance to experiment with a new teaching format. The anonymous survey arranged within one week after the examination when the exam scores were known to the students provides a unique comparison between different courses. 18 out of 40 students replied.

89 % of students fully agreed that the OSCE examination was relevant to their future profession. 11 % fully agreed and 50 % partially agreed that the scoring at the stations was fair ("rettferdig"). Only 1 student agreed and 3 (17 %) partially agreed that the teaching the required skills before OSCE was good. 15 out of 18 students rated that the NM station as very good whereas the three next best stations received 11 votes each. 9 out of 13 stations needed improvement in the eyes of at least one student (range 1 – 12). Only 4 stations escaped criticism, NM being one of them. In a free text comment, a student lauded the teaching material preparing the students for the NM station as exemplary.

5.4 Peer instruction

Peer instruction has been a contributing element why the OSCE preparation for the NM station was well received by the participating students. The use of a TBL-design with a class response system is planned for early 2018.

5.5 The student as a person

Only once was I able to incite a fruitful online discussion on https://mitt.uib.no, this after careful preparation in a course under the old curriculum in which I met the students on three occasions within a short time. I projected a photo of my very untidy office at the hospital alongside Albert Einstein's and asked my students "What message do I send out with my office?" They responded to my unexpected autobiographic disclosure ("My way of showing people how good I am at work – otherwise I would have been fired long ago!") with open amusement. Only then I was able to penetrate the students' armour and ask them: "What is the message that you send out when you don't have a profile picture on https://mitt.uib.no? You would never think of doing so on Facebook. Not having a profile picture sends out the message that you do not care. Is this the impression you really want to give to your instructors?" A lively discussion ensued F2F. Student answered that they did not care to upload their profile picture since there was a lack of meaningful content on https://mitt.uib.no. The discussion continued online with a total of 22 post by students and faculty members on the potential of e-learning. Best of all, all persons taking part in the online discussion upload a profile picture before posting.

6 Discussion

Teaching is more than the adept use of the latest teaching technology. Bain defined outstanding teaching as "helping students learn in ways that made a substantial influence on how those students think, act and feel. The actual classroom performance did not matter…" (Bain 2004 sec. 95).

While both the old and the new course of NM at UiB heavily rely on high-end teaching technology, this is to a large part necessitated by the subject domain. Teaching is about learning, and pedagogy should dictate.

Garrison's framework of "Community of Inquiry" (CoI) has been seminal for my teaching ever since I took an active interest in university pedagogy. According to this model successful teaching rests on the triad of intellectual presence, teach-

ing presence, and social presence (Garrison and Vaughan 2008 sec. 438). I found this framework very helpful in analysing my day-to-day teaching but also regarding questions of teaching design.

Intellectual presence/content delivery. At the level of teaching content, my teaching has shifted toward depth rather than coverage. As the body of medical knowledge is undergoing increasingly rapid transformation, it becomes more important to teach the principles underlying a field rather than factual details that can be readily looked up online from a mobile device.

Teaching presence. Successful learning is dependent on prompt formative feedback delivered to the group and the individual student. When confronted with large groups, responses programmed in the LMS can give timely feedback to the students as their learning activity unfolds.

Social presence. Brookfield's *Becoming a critically reflective teacher* has opened my eyes to the social dimensions of teaching (Brookfield 2017). The teacher must be visible and present as a person and a role-model. Autobiographical disclosure exposing the teacher's own vulnerabilities can be helpful as a way of connecting to the students, inviting them to open up in turn. Brookfield's four lenses – students's eyes, colleagues' perception, personal experience, and theory (Brookfield 2017 p. 59) have helped shape my teaching practice. Based on Brookfield's recommendation I have made it a habit to have colleagues from my own department or other disciplines attend my F2F teaching – often with very surprising results. Having a peer observer in the audience has the added benefit that it raise the stakes to teach well on that particular day.

Linked to all three domains is student engagement. Barkley promotes the "Expectancy x value" model. The effort people are willing to expend on a task is the product "product of the degree to which they expect to be able to perform the task successfully (expectancy) and the degree to which they value the rewards as well as the opportunity to engage in performing the task itself (value)." (Barkley 2010 sec. 472) On the level of content, this means that the teacher must set realistic expectations. The object of the course is to teach to teach medicine to medical students, not NM to future NM specialists. On the level of feedback, nearly correct responses must also be rewarded. This can be a challenge when designing MCQ as the "correct" answer to a poorly designed MCQ is often based on fine semantics. Good and robust MCQ are important as was illustrated by the responses from the students at the end of the recent course in endocrinology/endocrine surgery in the 8th

term. On the social level, teachers need to try to "establish supportive relationships and cooperative/collaborative learning arrangements that encourage students to adopt learning goals instead of performance goals" (Barkley 2010 sec. 465) A benefit of engaging students is that students will spend their attention on the subject matter rather than disruptive social behaviour, promoting an inclusive classroom.

Students' eyes is the first and most important of the four lenses that Brookfield applies to learning (Brookfield 2017 p. 59). Student feedback is central. Unfortunately, there is no mandatory system for student feedback in Norwegian Higher Education. Thus, all student feedback, be it solicited by the instructor or the faculty, is voluntary. I have launched discussion forums in relation to all my teaching ever since the advent of LMS, but scarcely ever got a response. I have been more successful since going over to anonymous feedback (Brookfield 2017 p. 106). No matter which model one favours, the teacher must inspire trust in the students and earn it, otherwise students will not respond out of fear to upset the instructor. In my conversations in the various feedback channels students generally proffered critical remarks only after they had received polite and constructive answers from me about less contagious questions. To shorten this loop, I will keep the discussions from the last iteration of "NM in endocrinology" stand in the forum so that the fresh students can see how previous students' criticism helped shape course content and organization. Student feedback has an even deeper significance in a context of learning: In a vast meta-analysis on empirical studies on learning, the learning activity with the most effect on student learning was when student reflected on their own learning (Hattie 2010).

Redesigning of the course of NM is work in progress. To keep my effort manageable, I will continue to focus most innovations on the course part "NM in endocrinology" in the 8th year. I just launched a new web lecture on parathyroid imaging, and I am planning to introduce peer-instruction based on the classroom response system *Socrative* (https://socrative.com). Since more than one response system is impracticable, I will try to use Socrative also for anonymous student feedback under the F2F instruction.

Brookfield devotes a whole section of his book on how to sell teaching innovation to the institution (Brookfield 2017 p. 239). Biggs and Tang refer to two different organizational climates in institutions, Theory X and Y (MacGregor 1960). Theory X holds that "attendances need to checked at every lecture, invigilated examinations must

make up most of the final grade, self- and peer-assessments are quite out of the question, deadlines and regulations need to be spelled out with sanctions imposed for failing to meet them." (Biggs and Tang 2011 sec. 1325) Teachers operating on theory Y will hold that students do their best work when given freedom and space to use their own judgement. As Biggs sees it, the truth is in the middle. While a pure Theory-X environment will be intolerable to the students, an all-Theory-Y environment would be impossible to run efficiently. When implementing changes to the course I have occasionally met initial resistance from the faculty administration. Usually I usually been able to reconcile differences when I could support my initiatives based on pedagogical literature, and a constructive dialog with the faculty ensued at all levels. A still unresolved issue is course organization in the LMS. Under the new curriculum, each term is one "course" (or "emne") in the LMS. As instructors compile more e-learning materials on https://mitt.uib.no, courses become increasingly difficult to navigate. At present, there is no technological solution how an LMS can handle courses with so much content. A potential solution could be to make course content collapsible in from of "module groups", which would however represent a new feature in Canvas. In my opinion, the only solution feasible at the current level of technology is to split up each term into smaller thematic units, e. g. endocrinology/endocrine surgery (also including NM) in the 8th term. I am well aware that this will pose major organizational challenges. For example, student accounts for each component course in a given term need to be synchronized.

Limitations. The course redesign outlined in this article is work in progress as the new curriculum will be fully implemented not before 2019. The only evidence that I can provide for claiming success of my revised teaching strategies is voluntary feedback solicited mostly by myself. This evidence is obviously biased. Also, because of the anonymous design or for reasons of confidentiality, this student feedback cannot be correlated with student performance. However, I have previously argued that there is sufficient evidence that student satisfaction is a valid surrogate parameter for assessing teaching (Haslerud et al. 2017). Even though I constantly try to assess my teaching through all four of Brookfield's lenses including published evidence, my views are necessarily subjective. While some of the issues in course design are specific to the domain of medical imaging, I hope that many other elements will be of interest to other disciplines, such as how to foster student feedback.

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