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Curriculum Development of Human Clinical Trials for the Next Generation of PhD Students and Early Career Researchers in the Medical, Science, Pharmacy and Health Professions

CHAPTER 12

TRAINING THE TRAINERS OF THE 21ST CENTURY

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1 Traditional and innovative teaching methods in health sciences

1.1 Introduction: a little bit of history spiced up with some theory

"The mediocre teacher tells. The good teacher explains. The superior teacher demonstrates. The great teacher inspires."
William A. Ward

"Children must be taught how to think, not what to think."
Margaret Mead

Until the end of the 19th century, it was a widely accepted view – in health education, and education in general – that teaching equals the transmission of knowledge. This meant that the teacher's role was to *tell and explain* what he *knows,* and the student's role was to *passively receive* and *memorize* what he *was told.* This teacher-centred, passive stance on learning was shaken by its core with the emergence of Jean Piaget' theory of cognitive development,[1] that stipulated that cognitive development is a constructive and active process during which one confronts the discrepancies between one already knows and what one perceives in the environment, and that the discovery of these discrepancies leads to an adjustment of one's ideas about the world. Another important brick in bringing about change in the learning landscape was the emergence of social constructivism[2] according to which knowledge is constructed *in interaction with others*. This has de facto led to an understanding that learning not only should move away from top-down teacher-centred methods, but that it should be a *collaborative* process led by *student cooperation.* This process was completed with more recent developments, from the 1950's on, that redefined the role of (bio)medical experts. There is a widespread consensus today that working in the biomedical field does not only require *biomedical knowledge but specific know-how and more generic, transferable life skills as well.* One of the most salient examples for that is the CanMEDS [3] model (see Figure 1 below).

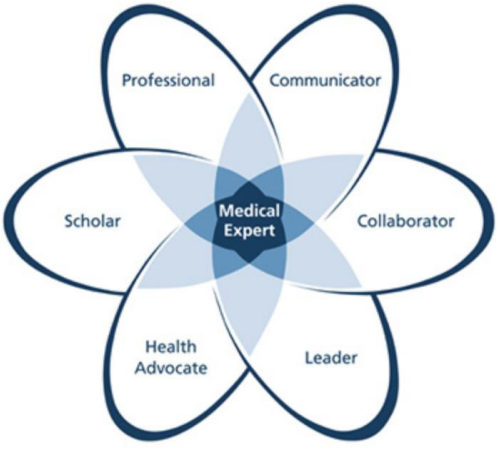

Figure 1: the CanMEDs model

[1] https://en.wikipedia.org/wiki/Piaget%27s_theory_of_cognitive_development
[2] https://en.wikipedia.org/wiki/Social_constructivism
[3] https://www.royalcollege.ca/en/standards-and-accreditation/canmeds.html

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This has led, especially in North America and Northern Europe, to a move away of from knowledge-based and the emergence of skill-based curricula in the biomedical field.

This chapter follows the same logic: in the first subchapter, we propose to provide a global, generic overview of both, traditional teacher-centered, passive learning methods, their advantages and disadvantages, and the different, more modern student-centered and skill-based methods and their pros and cons. The second subchapter adopts a practical approach and focuses on teaching know-how: the art of creating curricula and facilitating student learning, with a short final glance at the current emergence of digital tools in the learning space and autonomous distant learning formats, with the hope of training the trainers of the 21st century, able to inspire and make students think and act autonomously, using life-long professional and transferable skills.

1.2 Teacher-cantered, passive, content-based methods (formats, resources, pros, and cons)

1.2.1 How do teacher-centered methods work?

In a teacher-centered classroom, the teacher is the agent of learning, whereas students remain passive. The focus is on the teacher as a lecturer, and what he/she knows, in other words, the teacher is seen as a content expert. The students' role is to listen and to passively assimilate knowledge. The classroom tends to be quiet, and if there is interaction between teacher and student, it is initiated either by the teacher who verifies students' understanding of the explained material via exercises or guided questions or at best, by the students' asking questions from the teacher-expert, based on previously explained knowledge. In this learning space, learning is deductive, students work alone, and assessment is defined and done by the teacher.

1.2.2 Curriculum design in a teacher-centered approach

1. Defining content: the teacher-expert wonders what he knows about the concerned field and decides what the students need to know and chooses the content for class. His main question is: what do I know that the students need to know?

2. Defining learning activity: the teacher decides what activities and pedagogical resources will be used to transmit this content. The typical learning format is PowerPoint lecturing (small-group or lecture hall), completed by Q/A sessions and application exercises (f. ex. multiple choice questions, case-solving) serving to verify knowledge. The typical resources are PowerPoint presentations and complementary materials such as predefined, mandatory articles, chapters in a textbook, videos, images etc. It is worth noting that the fact of using modern digital contents (f. ex. videos, podcasts) or cases that verify the capacity to apply previously acquired knowledge, don't make a learning format student-centered or skill based. (See more on that in the next subchapter on student-centered, skill-based curricula.)

3. Defining evaluation: Once content and corresponding activities are designed, teachers ask themselves how they can test if students know what they have taught. Typical assessment tools are multiple choice questionnaires, and to a lesser extent, explanatory dissertations that need to contain certain predefined knowledge items.

4. Defining curricular learning objectives: The learning objectives of the whole curriculum are defined as a 4th step. The typical question teachers ask themselves when doing so is: what have *I* taught them in this unit? The answer to that then is transformed into general intended learning outcomes. (ILOs).

5. Defining class learning goals: Once the general learning outcomes are defined, the teacher allots specific learning outcomes (goals) to each class based on what they taught in class.

To recap what has been explained, look at Figure 2.

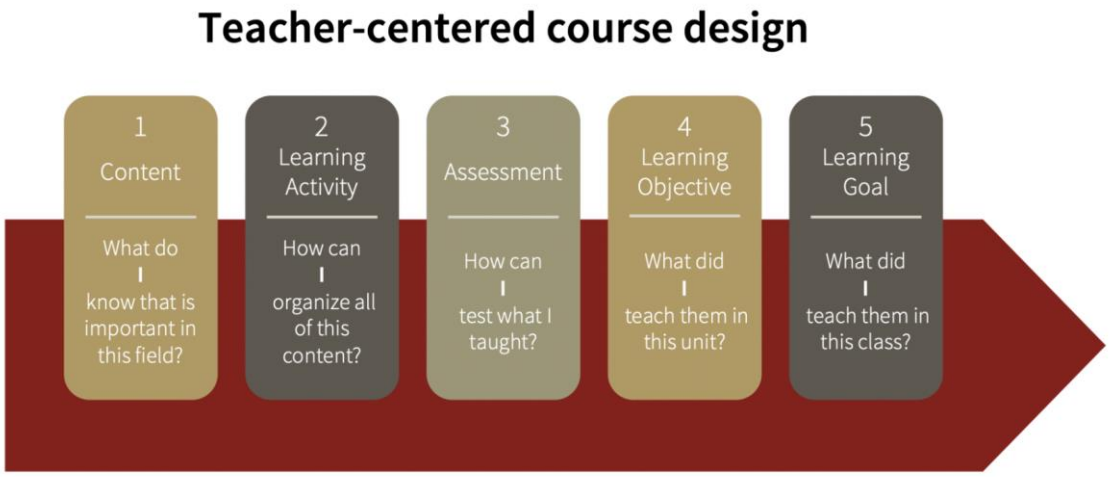

Figure 2: Teacher-centered course design[4]

1.2.3 Advantages and drawbacks

Even though teacher-centred methods are considered outdated today, they do have some advantages. One of them is the teacher's unique control over the classroom: the classroom is organized, quiet and everybody knows what their role is – the teacher speaks, and the students listen. This makes the teachers feel confident and in control, activities and assessment are fully pre-planned, and the teacher can be sure that if they say everything, the key points are covered.

However, it is understood today, that this method has plenty of disadvantages. In a teacher-centred classroom, students' attention solely depends on the teacher's charisma, and it is easy to see that there are no guarantees students actively listen and maintain attention. At the same time, it has been scientifically proven that listening doesn't equal understanding or the capacity to use acquired knowledge. Add to that that in the 21st century knowledge is readily available on the internet and in digital libraries and that 21st century learners are known for their reduced attention spans, and it is obvious why lecture halls and traditional small-group classrooms are empty. (If you want to read an interesting article on that, click on the following link.[5]) Moreover, the focus on the teacher, the passive learning method lacking the capacity to choose what one does, has been proven to reduce students' motivation and hence the effectiveness of their

[4] Retrieved from: https://teachingcommons.stanford.edu/teaching-guides/foundations-course-design/theory-practice/teacher-centered-vs-student-centered#:~:text=Student%2Dcentered%20mindsets%20view%20the,as%20passive%20and%20uniform%20vessels.
[5] https://www.statnews.com/2018/08/14/medical-students-skipping-class/

learning. This is all the more so, because a classroom where the focus is on the teacher's words tends to neglect individual students' needs and provides a standardized learning environment. This is extremely problematic, as the current scientific understanding is that each learner has their own preferred learning style, whereas in a teacher-centred classroom, everything is predefined by the teacher's capacity to explain and act, without any attention paid to the individual learner's needs. Finally, in a teacher-centred environment, there's very little room for students to collaborate or to act autonomously, hence life-long skills, such as teamworking, communication or critical thinking cannot be developed.

1.3 Student-centred, action and skill-based methods (action-, problem-, project- and challenge-based learning, simulations)

1.3.1 What is student-centred learning?

In a student-centred, action- and skill-based learning environment. While the teacher remains the authority figure in the classroom, his role is re-defined as that of a facilitator or coach, whereas the students have an active and collaborative role. The focus is not on what the teacher says but what the *students do.* The teacher's initial role is to provide students with a concept, challenge, or problem to solve and students are asked to demonstrate, explain the concept or surmount the challenge by proposing a solution, based on previous knowledge or knowledge acquired along the process via peer-to-peer learning or autonomous research. This also means that learners have some choice in which sources they want to use. In such a classroom, students are invited to interact and collaborate in pairs or teams. Student- and action-centredness also means that the teacher doesn't permanently control what students do: he/she provides feedback and guidance with appropriate questions – and by answering questions *initiated by students.* Assessment is also a collaborative action: students self-reflect on their own performance with the help of teacher feedback and guidance. This creates a dynamic, interactive classroom environment.

1.3.2 Student-centred-curriculum design

A student-centred curriculum design follows a backward design model.

1. **Defining Curricular Learning Goals:** as a first step, teachers ask themselves what students will be able to *do* at the end of the curriculum. This has nothing to do with what he knows: it is about what skills learners will possess and what tasks they'll be able to perform.

2. **Defining Intended Learning Outcomes for each lesson:** as a second step and in sync with general learning goals, each lesson's learning outcomes are defined in terms of what students need to be able to do at the end of each lesson.

3. Assessment: as a third step, assessment criteria are defined. The aim here is to measure progress – this can concern knowledge, know-how and transferable skills.

4. Defining learning activities: as a fourth step, classroom and outside classroom activities are designed in sync with learning goals and lesson outcomes, so that they are coherent with the form of assessment. The question here is: what do students need to do to progress towards the learning goals and to acquire skills?

5. Defining content: as last step, the teacher-facilitator chooses contents that can help students to perform the activities in class. In addition, depending on students' maturity and

study level, the teacher might choose to provide additional content to be used outside the classroom – or may choose the allow students to have a say in what additional material they wish to rely on.

Figure 3 (below), recaps the student-centred curriculum design process.

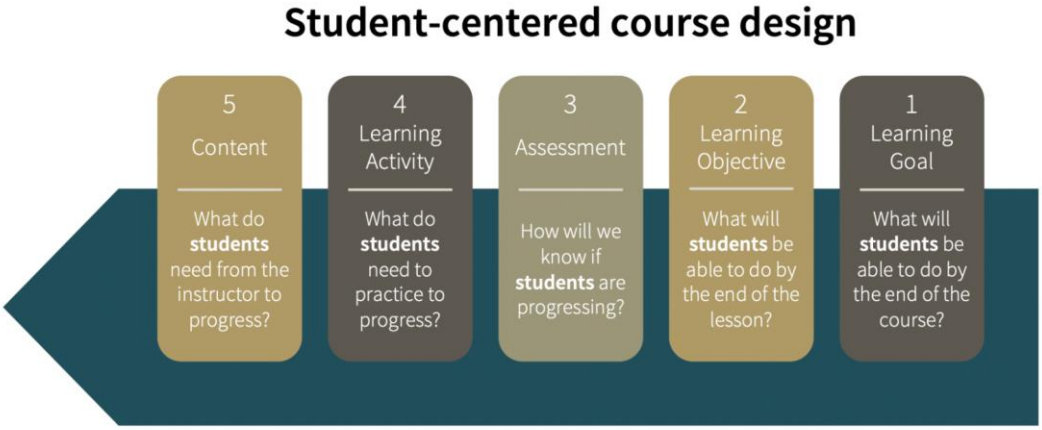

Figure 3: Student-centred curriculum design[6]

Students interested in the backward design can find a more thorough description thereof by clicking on the following link[7] and by watching the following video ("Grant Wiggins - Understanding by Design (1 of 2)")[8].

1.3.3 Advantages and drawbacks

A student-centred curriculum and classroom design might lead to a 'noisier' classroom and hence might bring about issues with classroom/group management. This in turn requires additional training for teachers used to traditional approaches and full control. Another concern linked to the lack of full control is making sure that key learning goals are fully covered for all students. Moreover, we have mentioned that individual learning styles of students might differ, and some learners might find it difficult to focus in a peer-to-peer learning environment and might prefer individual learning to collaborative learning styles. Finally, collaborative, student-centred, active learning requires rather small groups for it to be effective. (Ideal group size max. 6-8 students). This, logically, might trigger logistic difficulties and generate additional needs in terms of human (increased need for coaches/facilitators) and material (rooms) resources. This in turn requires political willingness and financial resources.

On the plus side, student-centred, collaborative learning empowers students and makes learning into shared experience between learners and teachers. The fact of having a say, the possibility of making choices about methods, resources used etc. and working together increases students' motivation. Moreover, because the focus is on what students do, there is

[6] Retrieved from: https://teachingcommons.stanford.edu/teaching-guides/foundations-course-design/theory-practice/teacher-centered-vs-student-centered#:~:text=Student%2Dcentered%20mindsets%20view%20the,as%20passive%20and%20uniform%20vessels.
[7] https://cft.vanderbilt.edu/guides-sub-pages/understanding-by-design/
[8] https://www.youtube.com/watch?v=4isSHf3SBuQ

scientific evidence that the 'learning while doing' experience reinforces long-term memorisation. At the same time, student-centred learning methods provide learners with life-long transferable skills, such as teamworking, critical thinking, reasoning, decision-making, time management, autonomous research – all which make them life-long learners and skilful employees in their respective professional fields, and active stakeholders in 21st century society.

1.3.4 Examples for student-centred methods

1. Problem-based learning

Problem-based learning (PBL) is a student-centred approach in which students learn about a subject by working in groups to solve an open-ended problem. This problem is what drives the motivation and the learning. It is widespread in health education, as it also allows for developing clinical reasoning skills, on top of the general positive outcomes linked to all student-centred methods. As an example, it is perfectly suited for undergraduate biomedical education where the intended learning outcome is for students to learn basic sciences in a contextualized manner while developing clinical reasoning skills. To understand the process of problem-based learning, watch the following video ("Problem-Based Learning at Maastricht University")[9] and have a look at Figure 4 here below.

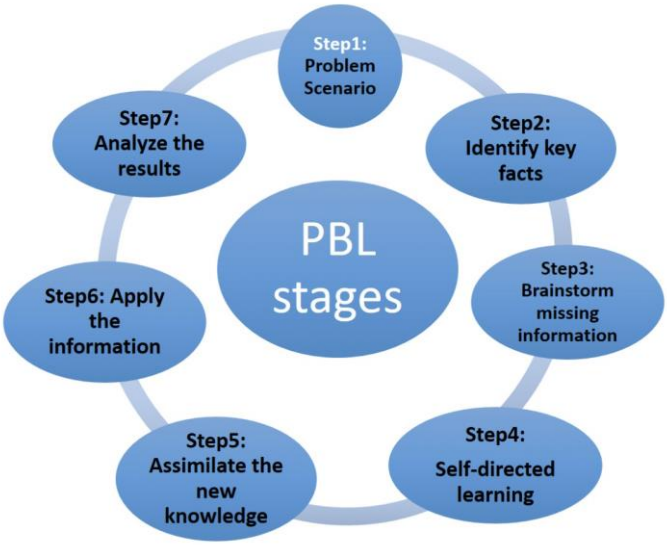

Figure 4: The steps of problem-based learning

If you are keen to learn more about the process and effectiveness of problem-based learning, we suggest you read the following article.[10] Its extended bibliography allows you to have a special focus on PBL in health education.

[9] https://www.youtube.com/watch?v=cMtLXXf9Sko
[10] Yew EHJ, Goh K. Problem-Based Learning: An Overview of its Process and Impact on Learning. Health Professions Education. 2016; 2: 75–79. doi: 10.1016/j.hpe.2016.01.004.

2. Project-based learning

Project-based learning is very similar to problem-based learning in that it starts with a problem that students need to analyse and solve as a team. The difference is that students are asked to provide a prototype (for example a device, an action plan) at the end of the iteration process which then needs to be tested in a life setting. In this case, the intended learning outcome is not "just" learning disciplinary and interdisciplinary knowledge and developing transferable skills, but also the creation of a tangible prototype. As an example, this method is perfectly suited to practical classes intended to develop student research skills. (Research-based learning). It can be very useful in graduate-level education preparing students for working in industry (f. ex. the pharmaceutical industry.)

3. Challenge-based learning

Challenge-based learning is a form of student-centred, collaborative and multidisciplinary learning method that emerged in the 21st century in which students devise solutions to real-life challenges using the design thinking methodology.[11] It is typically used to make students learn about sustainability challenges.

To learn more about this method, watch video "Explained: Challenge-based learning"[12] and "Challenge-based learning in practice (CBL)".[13]

4. Team-based learning[14]

Team-based learning (TBL) is a pedagogical strategy that engages student knowledge through individual testing and group collaboration. Following individual answers, students join teams and work through problems, appealing when they are incorrect. This process motivates students by holding them accountable to themselves and one another, while introducing them to a variety of thought processes devoted to a single problem. To increase motivation and introduce a fun gaming environment, instructors often group their students into teams and have them compete on various classroom learning tasks.

The strategy is flexible enough to be implemented in classes of varying sizes including large lecture courses, and students have reported growing in their creative thinking and oral communication through TBL (Huggins, et. al, 2015); a formalized version of the strategy can be found at the Team-based Learning Collaborative.[15]

Team-based learning typically follows a set procedure (adapted from the Team Based Learning Collaborative):

[11] https://www.interaction-design.org/literature/topics/design-thinking#:~:text=two%20lenses%20later.-,The%20Five%20Stages%20of%20Design%20Thinking,Ideate%2C%20Prototype%2C%20and%20Test.
[12] https://www.youtube.com/watch?v=MyiFPIJivPY
[13] https://www.youtube.com/watch?v=CFCSvvsPWUA
[14] Adapted from: https://poorvucenter.yale.edu/Team-Based-Learning#:~:text=Team%2Dbased%20learning%20(TBL),appealing%20when%20they%20are%20incorrect
[15] http://www.teambasedlearning.org/definition/

Figure 5: The team-based learning process[16]

1. Students complete pre-class readings and/or other assignments.
2. At the beginning of class, students complete an Individual Readiness Assurance Test (iRAT) to measure what they learned from their pre-class assignments. The goal of this assessment is to hold students accountable for the material.
3. After completing this assessment, students join with their team and complete a Team Readiness Assurance Test (tRAT) using a special scratch-off form called an Immediate Feedback Assessment (IF-AT) form.[17] When the team scratches off the correct answer they will see a star. If they scratch off an incorrect answer, they continue discussing until they have the right answer. Instructors may also consider designing conventional mini-quizzes on paper instead of using the IF-AT forms. In this case, instructors will need to provide the solutions after students respond.
4. Students next have the chance to appeal any questions they answered incorrectly.
5. The instructor provides a mini lecture on areas where the students are still having trouble.
6. Students engage with activities that apply and extend knowledge gained. Through their experiences with teamwork and knowledge gained through collaboration, the benefits of collaborative work during TBL can extend beyond the classroom.

The advantages of team-based learning are fairly similar to other active learning methods, (i.e. team working, increased motivation, heightened focus, better long-term memorization). Furthermore, given the more teacher-centred and guided nature of the method (i.e. teachers retain the role of the lecturing/answer-giving role, they provide the pre-class lecture), it is easier to provide standardized learning outcomes and results and align class content with intended learning outcomes. Moreover, for the same reason (i.e. heightened level of teacher-centredness and guidance), this method requires fewer human resources and logistic prowess. (i.e. team-based learning can even be put in place in lecture halls with a high number of students and some additional facilitators present.)

[16] Source: https://bmcmededuc.biomedcentral.com/articles/10.1186/s12909-020-02287-y/figures/1
[17] https://www.uc.edu/content/dam/uc/cetl/docs/IF-ATinstructions.pdf

If you are interested in learning more about TBL, explore the following sources[18] and the recommendations of the TBL Collective,[19] as well as the following article.[20]

5. Simulation

One of the most important steps in curriculum development is the introduction of simulation-based medical teaching and learning. Simulation is a generic term that refers to an artificial representation of a real-world process to achieve educational goals through experiential learning. Simulation based medical education is defined as any educational activity that utilizes simulation aides to replicate clinical scenarios. Although medical simulation is relatively new, simulation has been used for a long time in other high-risk professions such as aviation. Medical simulation allows the acquisition of clinical skills through deliberate practice rather than an apprentice style of learning. Simulation tools serve as an alternative to real patients. A trainee can make mistakes and learn from them without the fear of harming the patient.

To learn more about simulations, read the following article.[21]

2 Designing a skilled-based, interdisciplinary curriculum

2.1 Defining intended learning outcomes (ILOs)

ILOs describe what a student should be able to do by the end of a course. Students will be assessed on whether they can demonstrate the ILOs and therefore they must be stated specifically and clearly.

2.1.1 Requirements

The most important point is to make sure that ILOs align with students' previous knowledge and know-how level: they should represent a challenge and a possibility to learn but the challenge shall be feasible. (For example, you can't ask a first year medical student to perform an open-heart surgery, however, they shall be able to describe the anatomy of the heart.)

The ILO has to be measurable. (for example: you can't ask a medical student to understand how the heart works, because 'understanding' is not measurable, but you can ask them to describe how the electrical impulse is carried in the heart.)

For the ILO to be measurable and pitched at the right level, an appropriate action verb needs to be chosen.

ILOs can concern 4 domains:

[18] https://poorvucenter.yale.edu/Team-Based-Learning#:~:text=Team%2Dbased%20learning%20(TBL),appealing%20when%20they%20are%20incorrect
[19] https://www.teambasedlearning.org/definition/
[20] https://bmcmededuc.biomedcentral.com/articles/10.1186/s12909-020-02287-y
[21] Al-Elq AH. Simulation-based medical teaching and learning. J Family Community Med. 2010 Jan;17(1):35-40. doi: 10.4103/1319-1683.68787.

1. Subject-specific knowledge (f. ex. being able to explain the anatomical structure of the heart).

2. Subject-specific cognitive skills. These are about application and transformation of acquired knowledge for example by evaluation, appraisal, analysis, synthesis. (f. ex. evaluating the structure of a heart by using ultrasound).

3. Subject-specific practical skills (Know-how, for example, being able to perform a cardiac ultrasound).

4. Transferable skills. These are typically generic and subject-independent skills that can be used in any professional context. (Know-how-to-be.) Examples include multidisciplinary teamwork, time management, research literacy, digital literacy, critical thinking, written and oral communication, self-reflection.

	Level of Cognitive Ability	Simple Definition	Example Verbs
Increasing level of cognitive ability	Knowledge **Lower order thinking**	**Remembering information** *Can students recall and describe information to show what they know?*	Describe, Define, Identify, List, Name, State, Recall, Order, Recognise, Show,
	Comprehension	**Explaining Information** *Can students interpret and convey their understanding of information as well as just recall it?*	Discuss, Illustrate, Distinguish, Explain, Summarise, Extend, Review, Clarify, Interpret. Classify
	Application	**Use information in new ways** *Can students use a theory or information in different situations? Can students articulate the relevance of the information in other circumstances?*	Apply, Use, Choose, Demonstrate, Perform, Execute, Illustrate, Implement, Prepare, Modify, Solve, Write
	Analysis	**Distinguish different parts** *Can students identify and explain relationships between material? Can they break knowledge down into constituent parts and show how these relate to each other?*	Analyse, Investigate, Differentiate, Appraise, Debate, Breakdown, Calculate, Compare, Contrast, Relate, Test
	Synthesis	**Compile information into alternate solutions** *Can students take the elements of what they have learnt and put them together in a different way? Can they develop a plan or a proposal from set knowledge?*	Arrange, Categorise, Organise, Compose, Design, Construct, Explain, Develop, Manage, Rewrite
	Evaluation	**Defend ideas or concepts** *Can students make judgements about knowledge? Can they construct an argument or compare opposing views?*	Appraise, Assess, Argue, Defend, Support, Evaluate, Justify, Interpret, Measure
	Creativity **Higher order thinking**	**Produce new or original work** *Can students create a new product or point of view?*	Design, Invent, Construct, Assemble, Develop, Formulate, Generate; Produce; Write/Author

Figure 6: Some examples for action verbs to be used according to and levels of cognitive mastery[22]

Succinctly, a clearly written, targeted and comprehensive ILO shall be made up of 3 mandatory parts:

- an action verb describing what the student needs to be able to do,
- the subject material,
- the context of learning.

[22] Retrieved from: https://www.lboro.ac.uk/media/wwwlboroacuk/content/academicregistry/docs/programme-admin/ILOsGuidance.pdf

Here is an example for a subject-specific knowledge ILO with analysis (Figure 7).

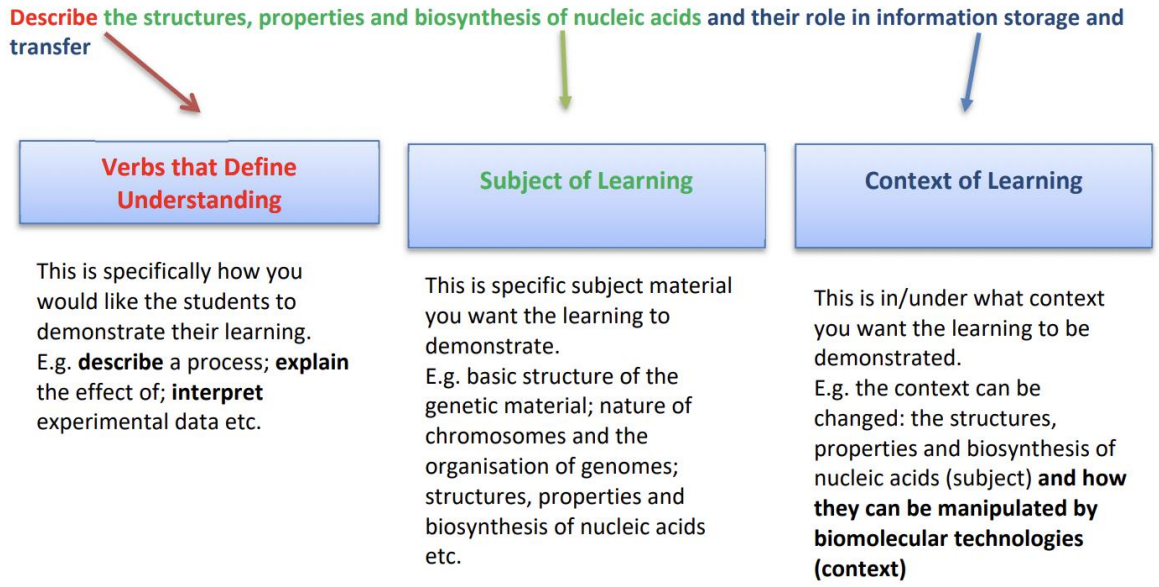

Figure 7: An example for an appropriate ILO[23]

Here are some additional examples concerning other types of ILOs:[24]

Subject specific cognitive skill:

Critically appraise the evidence concerning the associations between physical activity, sedentary behaviour and health outcomes in different population groups.
Critically evaluate the systems and practices in place that may reduce risk of injury across both sport and non-sport environments.

Subject specific practical skills:

Use a range of current laboratory measurement and analysis techniques relevant to the study of exercise physiology, sports nutrition and exercise for health.
Apply a range of pedagogical skills, models and teaching styles to promote effective learning and performance within the practical sporting/coaching context.
Plan a specific recovery strategy post-injury based on evidence and principals of a staged recover and return to activity/play for a given individual and situation.

Transferable skills:

Describe and record their own strengths and areas for development in relation to academic, professional and personal skills and selected elements of Personal Best.
Identify and set measurable goals for their own development.
Select and use appropriate IT packages for acquiring, processing and presenting different types of information.
Apply principles of good academic scholarship and ethical practice to their own work.
Identify and critically analyse information from a range of sources.
Communicate complex ideas clearly, accurately and concisely both verbally and in writing.

[23] Retrieved from: https://www.lboro.ac.uk/media/wwwlboroacuk/content/academicregistry/docs/programme-admin/ILOsGuidance.pdf
[24] Examples have been retrieved from: https://www.lboro.ac.uk/media/wwwlboroacuk/content/academicregistry/docs/programme-admin/ILOsGuidance.pdf

DISCUSSION BOARD
Imagine you are teaching a class at the medical/pharmacy faculty. Choose the level of studies. Write up 4 ILOs in the discussion board, according to the 4 above mentioned domains. Specify which course and which level of studies you've written the ILOs for.

2.2 Creating the assessment scheme

2.2.1 Formative vs. summative assessment

Assessment allows both instructor and student to monitor progress towards achieving learning objectives and can be approached in a variety of ways. **Formative assessment** refers to tools that identify misconceptions, struggles, and learning gaps along the way and assess how to close those gaps. It includes effective tools for helping to shape learning and can even bolster students' abilities to take ownership of their learning when they understand that the goal is to improve learning, not apply final marks. It can include students assessing themselves, peers, or even the instructor, through writing, quizzes, conversation, and more. In short, formative assessment occurs throughout a class or course, and seeks to improve student achievement of learning objectives through approaches that can support specific student needs.
In contrast, **summative assessments** evaluate student learning, knowledge, proficiency, or success at the conclusion of an instructional period, like a unit, course, or program. Summative assessments are almost always formally graded and often heavily weighted (though they do not need to be). Summative assessment can be used to great effect in conjunction and alignment with formative assessment, and instructors can consider a variety of ways to combine these approaches. Figure 8 recaps the differences between the two.

	Formative assessment	Summative assessment
Grading	Usually not graded	Usually graded
Purpose	Improvement: to give feedback to instructor and students about how well students understand specific material	Judgment: to derive a grade, and to allow students to work intensively with course material
Focus	Very focused on whether students have acquired specific skills or information	Less focused on specific skills or information; instead, allows students to demonstrate a range of skills and knowledge
Effort	Requires little time from instructors or students; simple; done in class	Requires more time from instructors and students; complex; done outside of class

Figure 8: The difference between formative and summative assessment[25]

Both types of assessment can vary across different dimensions, such as:

[25] Retrieved from: https://citl.indiana.edu/teaching-resources/assessing-student-learning/summative-formative/index.html

- Informal / formal,
- Immediate / delayed feedback,
- Embedded in lesson plan / stand-alone,
- Spontaneous / planned,
- Individual / group,
- Verbal / nonverbal,
- Oral / written,
- Graded / ungraded,
- Open-ended response / closed/constrained response,
- Teacher initiated/controlled / student initiated/controlled,
- Teacher and student(s) / peers,
- Process-oriented / product-oriented,
- Brief / extended,
- Scaffolded (teacher supported) / independently performed.

It is your choice which one you opt for. What determines your choice is your **intended learning outcome.** For example: if you work with a small group and you observe that there are recurrent conflicts because of inappropriate communication between team members, you might want to opt for a brief, formative, immediate, end-of the class, informal, spontaneous, peer-to-peer feedback combined with teacher feedback that focuses on the learning process. Whereas, for example, for an end of curriculum final assessment in gynaecology for undergraduate students, your assessment is going to be formal, pre-planned, delayed, teacher-initiated, product-oriented extended format. The exact format of your exam depends not only on your ILOs, but it also has to be aligned with learning activities. For example, if your curriculum is case based, the final exam can be too, however, if most of your learning activities and resources are knowledge-based, you'll have to come up with multiple choice or essay type exam that solely verifies knowledge acquisition.

Here are some examples for assessment.

Table 1: Some examples for assessment

Formative	Summative
In-class discussions	Instructor-created exams
Clicker questions (tick-the-box questions)	Standardized tests (MCQs, short answer questions)
Low-stakes group work	Final projects
Weekly quizzes	Final essays
1-minute reflection writing assignments	Final presentations
Homework assignments	Final reports
Surveys	Final Grades

DISCUSSION BOARD[26]

PART I.

Read the section about objective testing[27] and then assess the following multiple choice questions. Say why they work and why they don't.

In the following examples of effective and ineffective MC questions, students explore potential energy, or the energy that is stored by an object.

Example 1

Potential energy is:

a) the energy of motion of an object.
b) not the energy stored by an object.
c) **the energy stored by an object.**
d) not the energy of motion of an object.

Solution

In this question the good stem is clear, brief, and presents the central idea of the question through positive construction. However, the distractors are confusing: b) and d) are written in negative constructions that force students to reinterpret the stem, while c) and d) have overlapping, inconsistent content that confuses and tests reading comprehension over content recall. Finally, choices do not move logically by grouping content, failing to visualize and test larger concepts for students.

Example 2

Potential energy is not the energy:

a) **of motion of a particular object.**
b) stored by a particular object.
c) relative to the position of another object.
d) capable of being converted to kinetic energy.

Solution

In this question the poor stem contains the word "not," which fails to identify what potential energy is, and tests grammar over student understanding. However, the good distractors are written clearly, cover unique content, and follow a logical and consistent grammatical pattern.

Example 3

Potential energy is:

a) the energy of motion of an object.
b) **the energy stored by an object.**
c) the energy emitted by an object.

Solution

In this example both the stem and the distractors are written well, remain consistent, and test a clear idea.

[26] Adapted from: https://poorvucenter.yale.edu/MultipleChoiceQuestions
[27] https://citl.indiana.edu/teaching-resources/assessing-student-learning/test-construction/index.html

PART II.
In subchapter 2.1, you were asked to write four ILOs for an imaginary class. This time, based on the ILOs, create one multiple-choice question with five items related to the same class. State the ILO your multiple choice is testing.

2.2.2 Authentic assessment

The assessment of modern 21st century curriculum – whether it's a formative or summative form - evaluates students' complex learning, that is knowledge and skill acquisition. (cf. the 4 types of ILOs). This is what we call "authentic assessment". The criteria for an authentic assessment are, that it

- is realistic,
- requires judgment and innovation,
- asks the student to "do" the subject,
- replicates or simulates the contexts in which adults are "tested" in the workplace or in civic or personal life,
- assesses the student's ability to efficiently and effectively use a repertoire of knowledge and skills to negotiate a complex task,
- allows appropriate opportunities to rehearse, practice, consult resources, and get feedback on and refine performances and products.[28]

Here is a comparative table between traditional tests and authentic tasks.

[28] Wiggins, Grant. (1998). Ensuring authentic performance. Chapter 2 in Educative Assessment: Designing Assessments to Inform and Improve Student Performance. San Francisco: Jossey-Bass, pp. 21 – 42.

Typical tests	Authentic tasks	Indicators of authenticity
Require correct responses	Require a high-quality product or performance, and a justification of the solutions to problems encountered	Correctness is not the only criterion; students must be able to justify their answers.
Must be unknown to the student in advance to be valid	Should be known in advance to students as much as possible	The tasks and standards for judgment should be known or predictable.
Are disconnected from real-world contexts and constraints	Are tied to real-world contexts and constraints; require the student to "do" the subject.	The context and constraints of the task are like those encountered by practitioners in the discipline.
Contain items that isolate particular skills or facts	Are integrated challenges in which a range of skills and knowledge must be used in coordination	The task is multifaceted and complex, even if there is a right answer.
Include easily scored items	Involve complex tasks that for which there may be no right answer, and that may not be easily scored	The validity of the assessment is not sacrificed in favor of reliable scoring.
Are "one shot"; students get one chance to show their learning	Are iterative; contain recurring tasks	Students may use particular knowledge or skills in several different ways or contexts.
Provide a score	Provide usable diagnostic information about students' skills and knowledge	The assessment is designed to improve future performance, and students are important "consumers" of such information.

Figure 9: Traditional tests vs. authentic tasks[29]

[29] Retrieved from: https://citl.indiana.edu/teaching-resources/assessing-student-learning/authentic-assessment/index.html

Here are some examples for authentic tasks:

Nursing	Provide a case study of a patient and ask students to assess and create a plan of care
Business	Develop a business/marketing/sales plan for an imaginary (or real) company in a student's area of interest.
Computer Science	Troubleshoot a problematic piece of code; Develop a website/app to solve a particular problem and/or meet a set of criteria
Psychology	Examine/critique a case study from multiple theoretical positions
Public Affairs or Service Learning Courses	Consider how a community agency might be impacted by a particular challenge (budget cuts, infrastructure outage, public health crisis, etc.)
Biology/Chemistry	Draw a diagram of how a process works, indicating what happens if X occurs
History	Engage in a role play of a particular event in history; Describe what might have happened if one element of a historical event had changed.

Figure 10: Examples for authentic tasks [30]

DISCUSSION BOARD
Under 2.1 you've come up with ILOs for an imaginary class, and in the previous exercise you've created a multiple-choice question for the same class. This time, come up with an authentic task and explain how it fits your ILO.

2.3 Creating curriculum content

For the sake of this chapter, we have opted for focusing on student-centred, collaborative methods. As discussed in subchapter one, this requires creating a suitable "problem-situation" / "problem-statement, either in the form of a case to interpret and solve (problem-based learning) or in the form of a project (project-based learning) to create. What both problem and project-based curricula have in common, is that class content starts with an initial 'problem situation'.

[30] Retrieved from: https://citl.indiana.edu/teaching-resources/assessing-student-learning/authentic-assessment/index.html

Figure 11 gives you an overview of what a good problem-situation looks like:

#	KEYS FOR A GOOD PROBLEM STATEMENT	LOOK IF THE SITUATION
1	Real World	Describes real-life professional or student life situation or mission
2	Achievable	Allows to achieve the stated ILOs with reasonable effort considering prior knowledge
3	Challenging	Is open and begs for a solution and the resources are attractive
4	Curiosity	• Clearly indicates in what capacity students are supposed to handle the situation • Includes references to a wide variety of sources (realistic data, videos and films, press articles, ...)
5	Autonomy	Allows students to make choices about: • solution (not unique) • the way to proceed • the resources to use • the way to present the solution
6	Collaboration	Engages the group as a whole: • variety of resources • expression of different points of view • contradictory opinions • need for different points of view
7	Learning	gives all the necessary information to enable students achieve the ILOs

Figure 11: The criteria for a good problem-statement [31]

For a more detailed explanation, watch the following video ("La rédaction d'un bon sujet / d'une bonne situation de projet").[32] (Warning: the video is in French but it's possible to have English subtitles with it.)

[31] Raucent B, Milgrom E, Jacquemot C, Maufette Y, Nagy V. What's PBL and how to put into practice?. Presses Universitaires de Louvain. 2023.
[32] https://www.youtube.com/watch?v=MYmfjA5QOg4&list=PLtQ9KSt7Ox2IeUsPrAm4RKKjbIX45DN_B&index=26

2.3.1 Example for a good problem statement

The following example is retrieved from a second-year medical curriculum in endocrinology.

ILOs

- Apply the anatomy, functional histology, and the physiology of the adrenal glands to the case.
- Recontextualize the Cushing Syndrome: epidemiology, etiology, semiology, diagnosis, diagnosis, treatment.
- Interpret the socio-psychological consequences of mental disorders, stigmata and intercultural differences etc. using the scientific literature.

THE CASE

Mind and body

Ming, a 36-year-old Chinese waitress from Singapore was brought to the emergency department of a general hospital with a 3-day history of mania, persecutory delusions, and suicidal ideation; she also had a 6-month history of disrupted sleep, hypervigilance, and somatic symptoms. Otherwise, her past medical history was unremarkable. During her doctor-patient interview with the psychiatrist, she explained that some of her clients were agents of the Russian secret police who had been following and poisoning her in the restaurant by hiding thought- detecting devices into the hot-and-sour shrimp soup because that's where the taste is unrecognizable. Her physical exam on admission to the psychosomatic ward identified a moon- shaped face, exophthalmos, and purple striae on her legs, so it was suspected that the acute psychiatric symptoms were secondary to an adrenal gland disorder. Elevated plasma cortisol and adrenocorticotropic hormone (ACTH) and identification of a mass on her left adrenal gland on the computed tomography (CT) scan of her abdomen confirmed the diagnosis. Low dose quetiapine (75-125 mg/d) and alprazolam (0.4 mg/qn) were prescribed to control the psychotic symptoms and improve her sleep. After a series of consultations with a multidisciplinary team, surgical removal of a benign ACTH-independent adrenal tumor, her cortisol and ACTH levels returned to normal and her psychiatric symptoms gradually diminished over a one-month period, at which point she was discharged. Low-dose quetiapine was continued for 2 months after discharge and then discontinued; by this time her psychiatric symptoms had completely disappeared. Ming was both happy and relieved, especially, because the owner of her restaurant had decided not to fire her, given that she wasn't *really* mentally ill.

DISCUSSION BOARD

Read the case above and explain why it suits the criteria for a good problem statement / why it doesn't.

Solution to be discussed in class.

DISCUSSION BOARD

In subchapter 2.1, you have created ILOs for an imaginary class. In 2.2 you have imagined evaluation schemes. Now, write a fitting problem-statement (case) and explain how it fits your ILOs.

While this subchapter opted for training students for content creation of student-centered, collaborative methodologies, the realities of 21st century university life require that students be able to hold interactive lectures. Here[33] are some basic tips on how to make your lecture interactive, and on the following link, you find more advanced methodologies[34] on interactive lecturing.

Be aware, that writing the perfect ILOs + problem statement is not enough. Additionally, you need to provide:

- Fellow teachers with a detailed description of a 'fair copy', that is intended learning outcomes and pedagogical instructions ("Teacher's manual") that can also include additional resources
- Students with instruction and potential sources of information

2.4 The roles of the teacher in the modern classroom

Moving away from the traditional expert lecturer role, the teacher's role becomes that of a facilitator of learning and a mentor, in charge of creating a safe, non-judgmental space for students so that they feel encouraged, and free to get creative.

To be efficient, the teacher's got three key tools:

- Observation ("Outils du tuteur l'observation"),[35]
- Questioning ("Outils du tuteur le questionnement"),[36]
- Feedback ("Outils du tuteur la rétroaction").[37]

Click on the links above to understand how these work. (Warning, the videos are in French, but they come with English subtitles.)

2.5 Using digital tools in blended learning

As an introduction, watch the following video ("What is…Blended Learning?") on what blended learning is,[38] then read the following article on the types of blended learning,[39] and finally, click on the following link to learn about digital classroom tools.[40]

2.6 Creating a MOOC

The number of MOOCs, or Massive Open Online Courses has grown exponentially in recent years. These interactive online courses allow learners to access a huge amount of educational content on countless subjects, generally with little to no entry requirements, and often entirely free of charge. With many top schools like Harvard, MIT, or Yale offering their own

[33] https://www.beaglelearning.com/blog/steps-to-make-lecture-interactive/
[34] https://www.cmich.edu/offices-departments/curriculum-instructional-support/explore-teaching-and-learning/explore-instructional-methods/lecture-hall-learning/interactive-lecture
[35] https://www.youtube.com/watch?v=AXZmPi0JP-k
[36] https://www.youtube.com/watch?v=Hrz4_8Q_kEg&t=1s
[37] https://www.youtube.com/watch?v=0rchRHICkr0&list=PLtQ9KSt7Ox2IeUsPrAm4RKKjbIX45DN_B&index=16&t=6s
[38] https://www.youtube.com/watch?v=-bwhR1ZKGRE
[39] https://www.learnupon.com/blog/what-are-the-6-blended-learning-models/
[40] https://www.acadecraft.com/blog/digital-education-tools-for-teachers-and-students/

courses, MOOCS are very effective to help scaling career development and corporate eLearning**.**

Here are the steps to creating your MOOC.

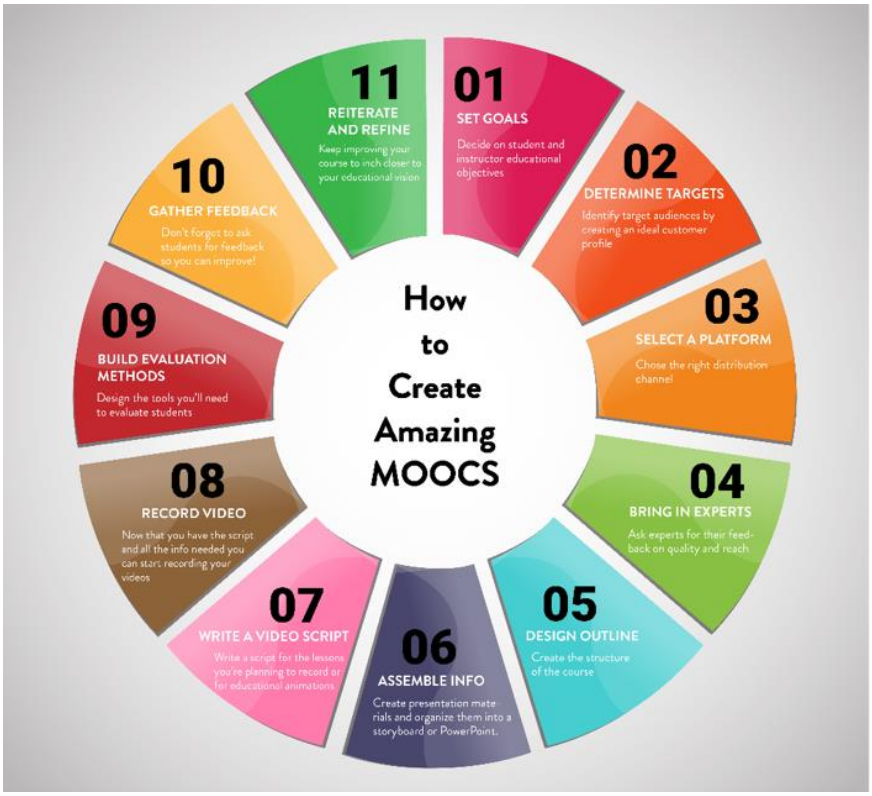

Figure 12: The steps to creating a MOOC[41]

1. Set educational goals

Just like in any curriculum design, you need to predefine you ILOs. However, the online format restricts the potential ILOs – it is easy to see that while MOOCs are perfectly adapted to knowledge and cognitive skill acquisition, they are less adapted to acquiring practical skills. (e.g., Can you de facto learn how to do sutures in a MOOC? No, you can online learn about suture types and observe how they are performed – but you need to actually practice doing it IRL to become proficient.)

2. Determine the target audience

Another fundamental step is to figure out the target audience. One method of achieving this is by creating a learner persona. What do they need? What might their learning outcomes be? It may also be worth considering their demographics. We already know that 80% of users have a degree,[42] and that the average age is between 25 and 35. What more can you find out?

[41] Retrieved from: https://rapidmooc.com/blog/10-steps-to-creating-an-amazing-mooc/
[42] https://edtechmagazine.com/higher/article/2013/12/80-percent-mooc-students-already-have-college-degree#:~:text=The%20Penn%20researchers%20sent%20the,percent%20had%20some%20graduate%20education

3. Select a MOOC platform

Next up, it's time to decide on a platform. It's best to use something readily available than go out on your own here. The main platforms are edX,[43] Coursera,[44] and Udemy.[45] (click on the links to check them out) It's worth looking at each one individually to see how your educational visions align. For more detailed information on each platform offering, check out the comparison table here.[46]

4. Build a team

You won't be able to create a MOOC on your own: you'll need subject matter experts (SME) who'll provide you with ideas for course content and help you design your ILOs. At the same time, instructional designers (ID) will provide you with expertise in online course design, digital tool use and assessment.

5. Design the course structure

Before jumping into production, we're going to create the course structure. That means elaborating the structure (usually 10–12 course modules), the key concepts and deciding how you'll deliver the information. It's likely that your chosen MOOC provider will have their own set format that they want you to follow. This certainly isn't a bad thing as it simplifies the task, offering guidelines on videos, quizzes, discussion boards, polls, etc. This ensures cohesion all around the board, which is surely helpful for your students. Just bear in mind your target audience and learning outcomes throughout this process as discussed above.

6. Assemble the information

Now we're really getting into the nitty-gritty of things. This phase is quite a big one and clearly too broad to fully delve into in this article. Here, you'll create all your presentation materials, whether text, photos, icons, graphics, infographic content, or animations. You'll then put all these materials together to summarize the course in a succinct manner. This can be done via a storyboard or a PowerPoint presentation. Learn more about the best way to produce and gather contents with Microsoft 365 in this article.[47]

7. Write a video script

In order to optimally engage your students, you're going to want effective video content. Video helps your content being more engaging as it conveys tone and emotion more effectively than written text. As it is often the case, first go back to your initial goal. Remind yourself of your target audience, what the learning outcomes are and what your purpose is in creating this MOOC. More practically, it's about creating an engaging and captivating narrative. For more information on script creation, you can head to Coursify.me's article on the subject.[48]

This preparatory work includes creating the teleprompter text. Very helpful for any kind of speech (except for improvisation), it helps focusing on your body language and avoiding the

[43] https://www.edx.org/search
[44] https://www.coursera.org/browse
[45] https://www.udemy.com/
[46] https://www.mooclab.club/pages/mooc_comparison_2018/
[47] https://rapidmooc.com/blog/why-use-rapidmooc-with-the-microsoft-365-suite/
[48] https://blog.coursify.me/en/how-to-create-a-video-script/

verbal tics. Rapidmooc[49] provides a smart digital teleprompter feature. Find out how you can get most of it here.[50]

8. Record video

It's time to record the videos for your course. There are a few ways you can go about this. You can either produce the video yourself, using a webcam and uploading the videos to YouTube, or you can go the more professional route, with high-quality video, numerous cameras, lighting equipment, crews etc.

9. Build means of assessment

With the bulk of the work out of the way, it's time to design the tools you'll need to evaluate students. Quizzes and tests are the primary method for assessing knowledge. Make sure, however, that they are well integrated in the course structure, and that they are relevant and well written (see chapter 2.2 on that). Depending on the platform, this may vary in practice, however there are numerous informative guides that explain how exactly to go about this step. For example, check out edX's free course[51] on using their course-authoring tool, edX studio.

10. Gather feedback

You should also check to see whether you met your performance indicators in terms of the number of students enrolled, the no-show rate, course completion rate, etc. These metrics are often offered by your MOOC provider and can be invaluable. Perhaps most importantly, get feedback from your students! This is a sure-fire way to find out what worked well and what needs to be improved.

11. Reiterate and refine

In fact, if your MOOC is successful, you can expect to update it regularly as you find new ways to flesh out content. You'll also need to maintain a continuous dialogue with your students and implement their feedback you'll have gathered in the last step.

[49] https://rapidmooc.com/blog/10-steps-to-creating-an-amazing-mooc/
[50] https://rapidmooc.com/blog/how-to-use-the-digital-prompter-and-never-be-stressed-about-reading-your-text-again/
[51] https://www.edx.org/learn/design/building-a-course-with-edx-course-v1-edx-buildwedxnew-2024-t1