

Learn
STEM

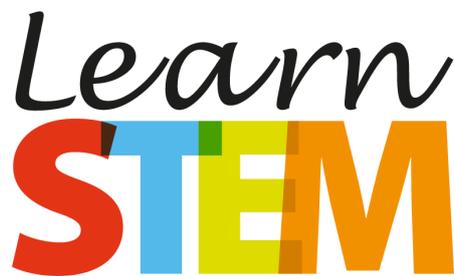
**The Design of
the Online Course
Innovative Pedagogy
for STEM Education**



Learn STEM

Innovative STEM learning in schools

The Design of the Online Course Innovative Pedagogy for STEM Education



<http://www.learn-STEM.org>

Coordinator:

Open University of the Netherlands (OUNL)

Project Partners:

Agora, Roermond (Agora), Kaunas Science and Technology Park (KSTP),
Kaunas Simonas Daukantas Progymnasium (KSDP), Association Effebi (Effebi),
Technical University of Applied Sciences Wildau (TUASW), Madan Park (Madan),
Group of Schools Emidio Navarro (GSEN), Eekhout Academy (Eekhout)

Project number: 2017-1-NL01-KA201-035232



Learn STEM

The Design of the Online Course Innovative Pedagogy for STEM Education

Authors:

Christian M. Stracke	(Open University Netherlands, Heerlen - OUNL)
Guido van Dijk	(Agora Roermond School, Netherlands - Agora)
Jurate Daneniene	(Kaunas Science and Technology Park, Lithuania - KSTP)
Vaiva Kelmelyte	(Kaunas Science and Technology Park, Lithuania - KSTP)
Fred Lisdat	(Technical University of Applied Science Wildau, Germany - TUASW)
Anita Wesolowski	(Technical University of Applied Science Wildau, Germany - TUASW)
António Barreiros	(Group of Schools Emido Navarro, Almada, Portugal - GSEN)
Rui Baltazar	(Group of Schools Emido Navarro, Almada, Portugal - GSEN)
Wim Simoens	(Eekhout Academy Kortrijk, Belgium - Eekhout)
Jo Desutter	(Eekhout Academy Kortrijk, Belgium - Eekhout)
Joke Lippens	(Eekhout Academy Kortrijk, Belgium – Eekhout)
Alcino Pascoal	(Madan Park of Science and Technology, Caparica, Portugal – MP)
Alma Rimkevičė	(Kauno Simono Daukanto Progimnazija School, Lithuania - KSDP)
Mario Spatafora	(Effebe Association, Rome, Italy - Effebe)
Ana Maria Cotovanu	(Effebe Association, Rome, Italy - Effebe)
Alessia Spatafora	(Effebe Association, Rome, Italy - Effebe)

Please cite as:

< Stracke, C. M., van Dijk, G., Daneniene, J., Kelmelyte, V., Lisdat, F., Wesolowski, A., Barreiros, A., Baltazar, R., Simoens, W., Desutter, J., Lippens, J., Pascoal, A., Rimkevičė, A., Spatafora, M., Cotovanu, A. M., & Spatafora, A. (2020). *Learn STEM. The Design of the Online Course Innovative Pedagogy for STEM Education.*



Published under the open and free Creative Commons License: "Attribution (CC-BY)", the full licence is online here:

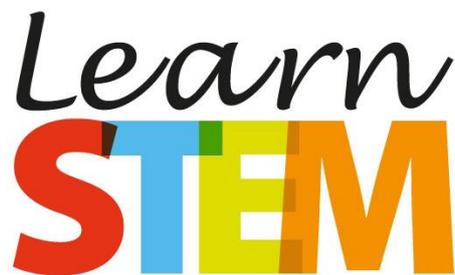
<<https://creativecommons.org/licenses/by/4.0/>>



With the support of the European Commission

Learn STEM

Learn STEM MOOC Week 4



<http://www.Learn-STEM.org>

Please cite as:

< Stracke, C. M., van Dijk, G., Daneniene, J., Kelmelyte, V., Lisdat, F., Wesolowski, A., Barreiros, A., Baltazar, R., Simoens, W., Desutter, J., Lippens, J., Pascoal, A., Rimkevičė, A., Spatafora, M., Cotovanu, A. M., & Spatafora, A. (2020). *The Learn STEM Online Course: Innovative Pedagogy for STEM Education. Week 4.*

Published under the open and free Creative Commons License: "Attribution (CC-BY)" - The full licence is online here: <<https://creativecommons.org/licenses/by/4.0/>>



Based on: <Stracke, C. M. (2018). *MOOC Design Template*. [Retrieved from www.mooc-quality.eu]>

Week 4 (from 23rd April 2020 to 29th April 2020)	Innovative STEM Assessment	
Responsible: Eekhout - Contributors: Effebi		
Learning objectives: <ul style="list-style-type: none"> • To understand the different ways in assessment • To know the main goals of an assessment • To develop an own pallet of assessment-tools 	Learning activities: <ul style="list-style-type: none"> • To read the introductory text • To discover the content and videos • To join the live event • To fulfil the tasks and assignments • To complete the quiz • To check the references if interested in further reading 	
Topics of this week, the topic experts and their availability: <ul style="list-style-type: none"> • Why do you assess? • Who will assess? • What to assess? • When and ways to assess? • Assessment tools • Wrap up 		
Timeplan for this week: <ul style="list-style-type: none"> • TUESDAY (2020-04-28): Live event starting at 16:00 UTC = 18:00 CEST (in Brussels) 		
Tasks and assignments for this week: <ul style="list-style-type: none"> • Get familiar with the topics of the week through the live event and provided materials • Start or join a working group • Complete the quiz of this week 		

Subsection 1:

Introduction to week 4

Welcome to week 4 of our Learn STEM Online Course!

Week 4 is focusing **Innovative STEM Assessment!**

Feel invited to watch the **introductory video** for week 4 on the following page.

If you cannot see it in your browser, here is the direct link for the introductory video:

https://bit.ly/LearnSTEM2020_Assessment

Afterwards, you will find the overview of the **learning objectives and activities** of week 4.

And for each learning activity, we are proposing **learning tasks** that you can complete, also in collaboration with your colleagues and other online learners here.

And do not forget our first live online event on Tuesday, 28th of April 2020, starting at 16:00 UTC = 18:00 CEST (in Brussels):

Here is the link to the **live online event of week 4**:
http://bit.ly/LearnSTEM2020_Week4_Live (it will open 30 minutes before the live event to allow testing of your connectivity, see all details in the section "Week 4 live online event")

Finally: Have you already completed all learning activities and tasks of the other weeks?

If not, there is still time to do it!

Subsection 2:

Video introducing week 4

Week 4 Assessment: www.youtube.com/watch?v=R4uLeLy6TMg

Video integrated

Subsection 3:

Overview of Learning objectives and activities of week 4

Unit 1:

Learning objectives of week 4

Our **learning objectives** of week 4 are:

- To understand the different ways in assessment
- To get to know the main goals of an assessment
- To develop an own range of different assessment tools

These learning objectives are addressed by the learning activities of week 4 that are following on the next page.

Unit 2:

Learning activities of week 4

The week 4 consists of **three learning activities and tasks**:

1. Discussing the key questions of innovative STEM assessment
2. Analysing the four aspects of innovative STEM assessment
3. Testing innovative assessment instruments and tools

These learning activities are offered and described in details in the following sub-section together with specific learning tasks.

Subsection 4:

1. Key questions of innovative STEM assessment

Unit 1:

Key questions of innovative STEM assessment

Assessment is a fundamental step in the learning process but can be too often done without much thought, either because it is mandatory in the educational system, or because it is believed to be of secondary importance. This is why teachers should always ask themselves questions on their assessment methods and tools, and specifically, they should ask themselves the following questions:

- Why do you assess?
- Who should do the assessment?
- What do you assess?
- How do you assess?

Before starting reading the content of this week, think about these questions and try to answer them. Debate them with your colleagues or with other participants in the course using the discussion forum.

Add discussion: Week 4 - Key questions of assessment

Subsection 5:

2. Analysing the four aspects of innovative STEM assessment

Unit 1:

Why do you assess?

The first question that teachers should ask themselves is about the reasons for assessing pupils in the first place. They may seem quite obvious, but there are different opinions on the matter, and it is best to approach the assessment process with a clear concept in mind about the objectives of the assessment.

The aim of the evaluation is to check whether the learners have achieved the set objectives. On the one hand, evaluation relates to the decision whether the learning results of a pupil are sufficient to succeed.

On the other hand, evaluation activities can also be used to inform the pupils and the educational team about the progress made and any difficulties encountered. In that way, the evaluation aims to support and guide the learning process.

Comparison of learners cannot be the goal of the evaluation. Therefore, evaluations should never be used to create a ranking and putting one learner against all the others. One of the goals of the evaluation should be to allow pupils to compare themselves to themselves, and see the progress made. This way of assessing is empowering the learners and contributes to the creation of a mindset of continuous growth.

Moreover, a good assessment is also useful for a teacher to improve own lessons and actions. It gives the teacher an idea of their effectiveness in the learning process and the opportunity to make adjustments to their lessons and actions and to improve them.

Unit 2:

Who should do the assessment?

"Who is responsible for the activity of assessing the learners?" is another central question in the assessment process that does not have only one answer.

We can observe five different kinds of assessments, depending on the person realizing the evaluation:

- self-evaluation
- teacher evaluation
- co-evaluation
- peer evaluation

- external evaluation

Specifically, we speak about **self-evaluation** when the pupils evaluate their own work and are also involved in determining the evaluation criteria. Positive aspects of this kind of assessment are that the pupils usually can be very good in assessing themselves, while on the other hand, even the best evaluation systems can be fooled. A self-evaluation can be both quantitative or qualitative. In the quantitative assessment, the pupils could be asked to grade themselves, and therefore, they will need criteria to establish the grade. The pupils should be included in the process of setting the criteria so that they can become more responsible of the whole evaluation process. In a qualitative assessment, pupils should try to answer open questions, such as the following:

- What was successful?
- What did bother you?
- How much are you interested in this topic?

That can help them to be more aware of their learning process and the success of their personal learning methods.

Self-assessment can be very effective for the learners in promoting the learning process, according to John Hattie's meta study "Visible learning", especially when combined with powerful feedback.

Latest assessment approaches strive for a stronger integration of evaluation and educational events and give learners their own responsibility in the evaluation process.

In recent years there has been a shift towards more learner-oriented and authentic evaluation activities: That forms an important addition to the more traditional evaluation activities.

However, there are also benefits coming from the most traditional assessment method, the **teacher evaluation**: Teachers have followed the entire learning process very closely and therefore, they are better suited to evaluate the results of that process.

Moreover, a teacher can have a broader overview of the entire development of the learners' skills and competences: A teacher has usually followed their path for a long time, and knows their strengths and challenges.

Furthermore, there are many different ways for a teacher to evaluate pupils, as we will see in the next paragraphs, so teacher evaluation should not be taken as a rigid and narrow definition, but more as a broader category that comprises different evaluation methodologies.

A middle ground between the two previous methods of assessments is called "**co-evaluation**". It is based on the idea that assessment can come from an agreement between the teacher and the learner, and that the results from such a consultation are more valid than results from just one of the two evaluation parts.

There are many ways in which a co-evaluation can be done: through a conversation whose aim is explicitly to gather feedback from the learner, or by comparing the evaluation of teacher and learners, made separately and previously.

With the adoption of this kind of assessment, the teachers can assume the role of coaches. When teachers act as coaches, they have a huge impact on the development of the learners'

skills and competences. They can challenge the learners on their own level and assess these progresses.

The learners can also be made more responsible through the use of **peer evaluation**, a method of assessment in which the learners are responsible for evaluating the other learners according to predetermined criteria (set up by the teacher, an educational team or in consultation).

Moreover, it can be used to let the learners evaluate a team collaboration. It can be highly effective in some specific circumstances and can lead the pupils to feel more responsible of the assessment process.

But it should be used carefully, being aware of interpersonal likes and dislikes, and trying to always emphasise an honest approach.

Finally, the last category of assessment is the **external evaluation**. This happens when an external expert is called upon to take the task of evaluating the learners.

The external evaluator could be either an expert in a specific field or a stranger in the everyday school life, such as a parent. It can be perceived as more objective, and in this way it may give more relevance to the final assessment of a project.

However, a clear agreement on the weight of this external evaluator is necessary, to avoid that the weight of this external score may overrule the total assessment of the project.

To summarize, the most traditional assessment method is the evaluation done by teachers who evaluate the pupils, but it is a good practice to also let the pupils evaluate themselves, eventually together with the teacher, and the other learners.

Through a mix of different evaluation methods, a more positive assessment can be achieved, and the teacher can obtain additional feedback on the learning process, while the pupils can become responsible of their own learning.

Unit 3:

What do you assess?

The Recommendation of the European Parliament and of the Council of the 23rd of April 2008 on the establishment of the European Qualifications Framework for Lifelong Learning (EQF) defines the results of a learning process as divided into three groups: Knowledge, Skills, and Competences. Their definitions are as follows:

- Knowledge is the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study;
- Skill is the ability to apply knowledge and to use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive or practical;
- Competence is the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development.

One instrument commonly used to assess these three characteristics of the learning process is an assessment matrix (also called assessment table or assessment grid), in which indicators related to knowledge, skills, and competences are linked to grades. Teachers can have an assessment matrix for each unit they need to assess as well as for each of their classes and subjects. In the matrix, there will be grades according to the national system and the descriptors of the grades in terms of knowledge, skills, and competences.

That means, an assessment matrix can be filled in with information related to a specific subject, unit, and also tailored for a specific age group.

Moreover, the object of the evaluation can also be other elements of the pupils' activities during the learning process, such as the behaviour, the engagement, and the attitude. Assessing also these aspects can create a positive atmosphere as the learners know that their commitment to learning and the level of engagement in a class can be valuable.

Unit 4:

How do you assess?

Moreover, it is important that the way in which the evaluation is conducted is consistent with the learning activities carried out by the learners.

Evaluation is not only used for awarding points or a diploma (*summative evaluation*), but also to support the learners during the learning process (*formative evaluation*).

An evaluation can be based on the end product (*product-based evaluation*) and can give also a reflection of how the learning process went (*process-oriented evaluation*).

In this section you get familiar with these four evaluation approaches. And you will get some inspirations for all four assessment types.

Summative evaluation

By default, an education is concluded with a final evaluation aiming to decide whether or not someone "has passed". For this form of evaluation, the summative evaluation, information is usually collected over longer periods. It is essential that this is an assessment of the learner. In some countries, the formative assessment is done by the government by central organized exams.

Some typical ways to summatively assess your learners in STEM learning:

- Final projects and portfolios (see an example below)
- Interviews
- Essays
- Presentations (develops speaking/ public speaking skills)

Formative evaluation

Formative evaluation is not so much intended to decide whether a person has "passed", but rather to inform the learners about their own knowledge, skills and competences to compare with the expectations and requirements of the educational team or the study program. Crucial is that learners receive feedback on their strengths and weaknesses and have the opportunity to practice, make mistakes, to remedy, etc. In addition, the educational team receives through formative evaluation information about the need to come back to specific learning content or to maybe adjust the STEM learning or lesson.

Formative assessment in STEM learning:

- is relevant and integral for effective teaching in STEM subjects
- understands different strengths and levels of knowledge, skills and competences
- improves STEM teaching and makes the learning process more interesting, successful and engaging
- is a systematic and continuous process
- includes feedback about learning
- identifies the gap between a learners current knowledge, skills and competence level and a desired learning goal

Product-based evaluation

Product-based evaluation refers to the most well-known form of learner evaluation, namely the evaluation in which it is checked whether a learner made a product that is fulfilling the expectations. So it is only viewing at the final result.

The evaluation of a design-task depends on what a teacher wants to observe as a result of the learners.

- Complexity: it should be within the learners knowledge and skills abilities
- Creativity: it should encourage a learners creativity and divergent thinking
- Goal-based: it should attain the learning objective
- Appeal: project should lead to self-discovery of information

Criteria set up for a product-based assessment identify what really counts in the final product and output.

For example, learners needs to "Design and produce the musical instrument"

Criteria might be:

- Quality (sound quality, instrument quality)
- Creativity (fancy looking, attractive, ...)
- Recyclable materials used
- Aesthetics of the instrument
- Interdisciplinary knowledge used

Example of a product-based assessment in STEM learning:
"What is the weight that a bridge you designed can carry?"



Process-oriented evaluation

Process-oriented evaluation, on the other hand, refers to the systematic gathering of information about the lesson or the learning process. Therefore, it does not concern the final result of this learning process, but mainly looks at the way in which the objectives were pursued and achieved.

Process-oriented assessment is performance-based and concerned with the actual task performance rather than the output or product of an activity. It evaluates the performance of a task and does not emphasize the output of the activity or the product.

This assessment aims to know what processes a person undergoes for a given task.

It measures authentic tasks such as activities, exercises and ways of problem solving, how learners apply their knowledge.

For example, using a mind map to solve a problem in STEM.

Characteristics of process-oriented assessment:

- Deep reasoning and understanding skills are needed
- No single correct answer
- Involved sustained work
- Includes engaging ideas of importance and substance
- Teacher wants to see learners ability of critical thinking and problem-solving skills

Example of a process-oriented assessment:

Working with a Worksheet, following the process of the STEM work, see as an example:
<https://studylib.net/doc/8745621/popsicle-bridge---tryengineering>

Popsicle Bridge



Student Worksheet: Design Your Own Bridge

You are part of a team of engineers who have been given the challenge to design a bridge out of up to 200 popsicle sticks and glue. Bridges must be able to hold a specific weight (your teacher will decide what the weight goal will be for your team). The bridge must span at least 14 inches in length. But, it must be longer than 14 inches because when it has been constructed, it will be placed between two chairs so it is at least one foot above the floor for a weight bearing test. In addition to meeting the structural and weight bearing requirements, the bridge will be judged on its aesthetics as well, so be creative! And, you are encouraged to use the fewest number of popsicles possible to achieve your goal.

◆ Planning Stage

Meet as a team and discuss the problem you need to solve. Then develop and agree on a design for your bridge. You'll need to determine how many popsicle sticks you will use (up to 200) -- and the steps you will take in the manufacturing process. Think about what patterns might be the strongest....but you are also being judged on the aesthetics of your bridge! Draw your design in the box below, and be sure to indicate the number of sticks you anticipate using. Present your design to the class. You may choose to revise your teams' plan after you receive feedback from class.

Subsection 6:

3. Testing innovative assessment instruments and tools

Unit 1:

Plickers

There is no doubt that digital forms of assessment are increasingly popular in modern-day classrooms. In many cases, they require pupils to have access to devices such as iPads, Chromebooks, smartphones, or laptops. However, with Plickers, this is not the case.

What is Plickers?

[Plickers](#) is a powerfully simple tool that lets teachers collect real-time formative assessment data without the need for pupils' devices.

To use Plickers, pupils are provided with answer cards (which can be easily printed and distributed). Then, using the web-based Plickers, as well as the iPhone or Android Plicker app, teachers can scan pupils' responses, and immediately have the ability to assess their understanding and gather data. To see a demonstration of Plickers in action, check out the [video](#).

Read more on <https://www.teq.com/news/formative-assessments-with-plickers/>

Unit 2:

ZipGrade

[ZipGrade](#) is a free to use tool for a fast assessment.

It can be used for a pre-knowledge test, using closed questions.

As a teacher you can automatically give a score after a quick scan, pupils gets immediately feedback on the answers. There is the opportunity to give weights on each questions.

Look at this [video](#) to see a quick overview of the ZipGrade tool.

Unit 3:

Badgecraft

Badgecraft.eu

In education, badges usually are meant to provide recognition for a skill that has be learnt in some place. Such badges include links that provide extra information about the skill that

is recognized, information about the entity that issues the badge, and the rules for getting the badge. I.e. a badge can be traced back to the institution that issued the badge and it should precisely tell what it is meant for. Educational badges have an issuer (institution that testifies), the earner (learner) and a displayer (site that displays a badge).

According to the Mozilla Badge:

- A badge is a digital representation of a skill, learning achievement or experience.
- Badges can represent competencies and involvements recognized in online or offline life.
- Each badge is associated with an image and some metadata. The metadata provides information about what the badge represents and the evidence used to support it.
- Learners can display their badges online and can share badge information through social networks.

The canvas:

The canvas is a simple, well-structured template for you to determine the various inputs required to create a digital badge. More importantly, you can use it to determine if a badge under consideration for development adds value to your organisation, planned eLearning initiatives, and users.

This template outlines a number of sections that should be carefully considered, researched and validated before completion. Gathering qualitative data to justify the creation of your digital badge is the most practical way of ensuring its longevity and acceptance.

The template addresses the following core needs for your Digital Badge Strategy:

- **Criteria:** What does the user need to do to achieve the badge? Can it be represented by completion of a single online course, multiple courses, or is a blended learning solution required?
- **Skills & Knowledge:** What particular skills does the badge represent? Does the online material (or blended program) reflect these skills adequately?
- **Behaviours:** What behaviours should the badge encourage?
- **Evidence:** What deliverables are required to meet the criteria? Will the digital badge/users have access to online learning transcripts/completions data? How will this work for blended learning solutions?
- **Value Proposition:** What benefits will the badge provide to users? Why should they care if they achieve it or not?
- **Endorsers:** Who will recognize the badge?
- **Channels:** Where do users gain knowledge of your badge and its existence? How will it fit within the current (planned) online learning delivery environment (LMS or LCMS)?
- **Award:** Who will award the badge and how?
- **Users:** Who is your badge for? Why should they care?
- **Learning Pathways:** How will the badge exist and relate to other online learning courses? Are there multiple achievement levels for the badge?
- **Resources & Sustainability:** What resources are required to create your badge? Who will do the work and own the badge in the future? Will instructional designers be involved in the badge design & creation process? How and when will evaluation of

badges take place? Will badge design and evaluation take place at the same time as the online course design and evaluations?

All of the above aspects need to be carefully considered. However, there are a number of key areas that should be researched and considered to help decide whether the badge is of value in the first place. If you are struggling to get the data needed to complete these, or find that the costs (resources, time, investment, etc.) are outweighing the perceived value of the badge, you should reconsider continuing.

Look at this [video](#) for more explanations.

If you want to be inspired by more assessment toolkits: look at www.STEM.org.uk

Subsection 7:

Live online event

Our live online event in week 3 is on Tuesday, 21st of April 2020, starting at 16:00 UTC = 18:00 CEST (Brussels):

We are very pleased to announce that we will welcome another external expert from the leading international association online learning:

- **Torunn Gjelsvik** from the **International Council for Open And Distance Education (ICDE)**: <https://www.icde.org>

She will introduce the ICDE initiatives for open and distance learning including the latest project to support online learning and teaching from home in the covid times.

Here is the link: http://bit.ly/LearnSTEM2020_Week4_Live (it will open 30 minutes before the live event to allow testing of your connectivity)

Please allow to use your microphone and camera (if you want to be visible) when joining the meeting. All browsers should work (but not in all former versions), best results are currently with Google Chrome.

Due to changes of winter and summer times in many time zones, we had to change/correct the timing relations, we hope that the following are currently correct (please note that time zones will change only on next weekend, therefore it is not valid for all weeks):

16:00 UTC (Coordinated Universal Time) = 09:00am PDT (California) = 11:00am **CDT** (Mexico capital) = 11:00am EST (Columbia & Peru) = 12:00am EDT (NYC) = 12:00 AST (Bolivia) = 13:00 ART (Buenos Aires) = 13:00 BRT (Brasilia) = 17:00 WEST (London) = 18:00 CEST (Brussels) = 18:00 CAT (South Africa) = 19:00 EEST (Athens) = 19:00 MSK (Moscow) = 19:00 EAT (Nairobi) = 21:00 PKT (Islamabad) = 21:30 IST (New Delhi) = 23:00 ICT (Bangkok/Jakarta) = 00:00am+1 CST (Beijing) = 01:00am+1 JST (Tokyo) = 03:00am+1 **EADT** (Sydney) = 05:00am+1 **NZDT** (Wellington).

You can check your own timezone using the following online services:

<https://www.thetimezoneconverter.com/?t=18%3A00&tz=Brussels&>

And here is **the recording of our live online event in week 4:**

http://bit.ly/LearnSTEM2020_Week4_Recording (will be published afterwards)

Thank you very much for your contributions!

Subsection 8:

Materials of week 4 and further reading

You can find all materials of week 4 in our shared online folders (<https://surfdrive.surf.nl/files/index.php/s/IBIcN3cyMGJzhnp>):

In folder "Week 4 – Good practice examples and cases":

Stracke, C. M., Tan, E., Texeira, A., Pinto, M., Vassiliadis, B., Kameas, A., Sgouropoulou, C., & Vidal, G. (2018). *Design and Quality of Online Courses. The Checklist for Beginners*. Online available at www.mooc-quality.eu/online-courses-checklist-beginners

Stracke, C. M., Tan, E., Texeira, A., Pinto, M., Vassiliadis, B., Kameas, A., Sgouropoulou, C., & Vidal, G. (2018). *Design and Quality of Online Courses. The Quality Criteria for Experts*. Online available at www.mooc-quality.eu/online-courses-quality-criteria-experts

You are most welcome to add your good practice examples and cases to this shared folder!

In folder "Week 4 – Literature":

Stracke, C. M., van Dijk, G., Fasen, J., Lisdat, F., & Simoens, W. (2020). A Holistic Pedagogical Model for STEM learning and education inside and outside the classroom. In *HCI International 2020 Conference Proceedings. Springer Lecture Notes in Computer Science (LNCS)*. (accepted, in print).

You are most welcome to add your preferred and recommended literature to this shared folder!

In folder "Week 4 – Materials":

Our slides with the content of the week 4 for your download

You are most welcome to add your preferred and recommended materials to this shared folder!

And some recommendations for further reading:

Clarke, N., (2019), *Leren zichtbaar maken met Formatieve evaluatie* (3e ed.). Rotterdam, Nederland: Bazalt.

<https://knowingbelievingdoing.wordpress.com/the-power-of-self-and-peer-assessment/>

http://learn-stem.org/wp-content/uploads/2019/03/20190301_Learn_STEM_Inquiry_Learning_Package_v10.pdf

<https://www.kdg.be/onderzoek-en-expertise/formatieve-evaluatie-een-toolbox-vol-inspiratie>

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.532.4&rep=rep1&type=pdf>

Links to other websites:

<https://aka.ms/morselessonplan>

<https://medium.com/@samosley01/how-to-create-digital-portfolios-a4dc3968cf4d>

<https://www.edutopia.org/article/3-tools-creating-digital-portfolios>

<https://studylib.net/doc/8745621/popsicle-bridge--tryengineering>

<https://www.youtube.com/watch?v=wuknwtTN-Xg>

<https://get.plickers.com/>

<https://www.stem.org.uk/community/groups/410051/cohort-13-assessment-toolkit/454776>

<https://www.zipgrade.com/>

<https://www.youtube.com/watch?v=liasPl1O5vg>

<https://www.badgecraft.eu>

<https://youtu.be/Y1DjAxfJQM>

And finally, enjoy the following quiz at the end of week 4!

Subsection 9:

Your quiz in week 4

Each week ends with a quiz:

Do not take it too seriously, it is not an exam but more entertainment to test what you can remember.

Therefore, we will offer you different types of quizzes in each week to explore their differences and advantages.

Here in week 4, we are using again the built-in quiz from the open edX platform, enjoy!

1) The aim of the assessment process is:

- **to check if learners have achieved the objectives of the course (correct)**
- to compare the learners with each others
- to reward the best learners and punish the worst ones

2) Can self-evaluation be quantitative?

- Yes, but only on the basis of criteria set by the teachers.
- **Yes, if the learners are involved in the process of setting criteria for the evaluation. (correct)**
- No, it is only done on the basis of qualitative open questions.

3) Co-evaluation is defined as:

- the evaluation process is a combination of all possible methods
- the learners assess their peers or classmates
- **the assessment comes from an agreement between the teacher and the learner (correct)**

4) Which is the biggest advantage of teacher evaluation?

- teachers cannot be fooled
- **teachers have followed closely the entire learning process (correct)**
- teachers are more strict in applying the assessment criteria than pupils

5) Peer evaluation has the advantage to make the learners more responsible, and can be very effective in some circumstances, but there are risks to avoid:

- **interpersonal likes and dislikes among the learners can influence the assessment and make it less objective (correct)**
- the learners do not have the ability to evaluate each other
- learners are more prone to give higher grades to their peers or classmates

-6) Which is the main advantage of an external evaluation?

- External experts are more knowledgeable than the teachers.
- **External experts are usually more objective. (correct)**
- External evaluation is faster.

7) Skills can be of two types, according to the European Qualifican Framework:

- soft and hard

- easy and hard
- **cognitive and practical (correct)**

8) What is a competence?

- **the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development (correct)**
- the ability to apply knowledge and to use know-how to complete tasks and solve problems
- the level of expertise of a person in a specific field of study or work

10) Formative assessment is:

- A. Learner evaluation at the end of the project.
- B. Learner evaluation during the project, several times. (correct)**
- C. Learner evaluation during the process, once over a long period.
- D. Evaluation of the product.

11) Exams are an example of a:

- A. formative assessment
- B. summative assessment (correct)**
- C. process evaluation
- D. product evaluation

12) Assessing the process is important for:

- A. gathering a learner score
- B. guiding the learning of the learner (correct)**
- C. building a holistic image of the learner (correct)**
- D. scaffolding the learner (correct)**

About Learn STEM, the European Alliance for Innovative STEM learning in schools:



We need innovative and better school education in Science, Technology, Engineering and Mathematics (STEM) as key sectors for our future life, work and society. The European Alliance **Learn STEM** focuses their interrelation and integration in cross-disciplinary and reflective STEM education and pedagogical methodologies. Main goal of **Learn STEM** is to improve the quality and efficiency of STEM learning in secondary schools. Consequently, **Learn STEM** is increasing the pupils' interest in STEM and building STEM competences. Therefore, **Learn STEM** designs and provides pedagogical methods and tools for secondary schools to explore and solve real life questions. Thus, **Learn STEM** supports and contributes to the key objective of the European Education and Training 2020 Strategy (ET 2020) that fewer than 15% of 15-year-olds should be under-skilled in reading, mathematics and science.

Moreover, the **Learn STEM** project also addresses the need to enhance knowledge of and about science as a precondition to prepare Europe's population to be actively engaged, responsible citizens as well as conversant with the complex challenges facing society. In the PISA study 2015, most students expressed a broad interest in science topics and recognised the important role that science plays in their world; but only a minority reported their participation in science activities. In addition, teachers still declare they need more professional development linked to tailoring, diversifying, and innovating teaching practices. Thus, **Learn STEM** is strengthening secondary schools' capacity to develop skills in subjects such as science, technology, engineering and mathematics through innovative and interactive pedagogical methods and approaches. Therefore, **Learn STEM** designs and provides practical instruments and online tools for secondary schools and their teachers and pupils to explore and solve real life questions.

Under the leadership of the coordinator Dr. Christian M. Stracke from the Open University of the Netherlands, **Learn STEM** brings together nine Partners from six European countries. They are collaborating for innovative STEM education and have developed the [Learn STEM Pedagogical Model](#), the [Inquiry learning package](#), a [teacher training programme](#) and an [online course](#). These instruments are tested, evaluated and continuously improved in close cooperation with hundreds of STEM experts and school teachers. All **Learn STEM** results and achievements are openly and freely available on the **Learn STEM** website online:

<http://www.Learn-STEM.org>

Learn STEM Contact:

Coordinator: Dr. Christian M. Stracke
Organization: Open University of the Netherlands
E-Mail: christian.stracke@ou.nl



Learn STEM has been funded with support from the European Commission. This communication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.