

Learn
STEM

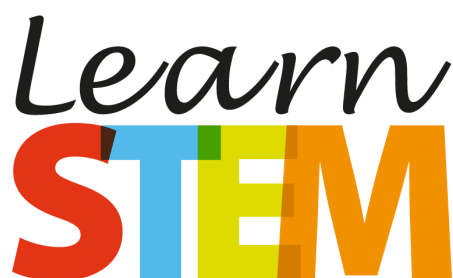
**The Design of
the Online Course
Innovative Pedagogy
for STEM Education**



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),
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Group of Schools Emidio Navarro (GSEN), Eekhout Academy (Eekhout)

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The Design of the Online Course Innovative Pedagogy for STEM Education

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Learn STEM

Learn STEM MOOC Week 2



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

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

Week 2 (from 2nd April 2020 to 15th April 2020)	Learner-centred STEM Education	
Responsible: OUNL - Contributors: Agora schools		
Learning objectives: <ul style="list-style-type: none"> • To reflect the phases for learners in innovative STEM education • To get to know projects of learner-centred STEM education • To explore innovative instruments and tools for learner-centred STEM education 	Learning activities: <ul style="list-style-type: none"> • To read the introductory text • To discover the content and videos • To fulfil the tasks and assignments • To join the live event • 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"> • Phases for learners in innovative STEM education • Projects of learner-centred STEM education • Instruments and tools for learner-centred STEM education 		
Timeplan for this week: <ul style="list-style-type: none"> • TUESDAY (2020-04-07): Live event starting at 16:00 UTC = 18:00 CEST (in Brussels) 		
Tasks and assignments for this week: <ul style="list-style-type: none"> • Analysing the four phases for learners in innovative STEM education • Discussing three projects of learner-centred STEM education • Testing innovative instruments and tools for learner-centred STEM education 		

Subsection 1:

Introduction to week 2

Welcome to week 2 of our Learn STEM Online Course!

Week 2 is focusing **Learner-centred STEM Education!**

Feel invited to watch the **introductory video** for week 2 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_Learners

Afterwards, you will find the overview of the **learning objectives and activities** of week 2.

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, 7th of April 2020, starting at 16:00 UTC = 18:00 CEST (in Brussels):

Here is the link to the **live online event of week 2:**
http://bit.ly/LearnSTEM2020_Week2_Live (it will open 30 minutes before the live event to allow testing of your connectivity, see all details in the section "Week 2 live online event")

Finally: Have you already completed all learning activities and tasks of the introductory weeks and week 1?

If not, there is still time to do it!

Subsection 2:

Video introducing week 2

Week 2 Learner-centred STEM education: www.youtube.com/watch?v=Ot6EpUaNO0

Video integrated

Subsection 3:

Overview of Learning objectives and activities of week 2

Unit 1:

Learning objectives of week 2

Our **learning objectives** of week 2 are:

- To reflect the phases for learners in innovative STEM education
- To get to know projects of learner-centred STEM education
- To explore innovative instruments and tools for learner-centred STEM education

These learning objectives are addressed by the learning activities of week 2 that are following on the next page.

Unit 2:

Learning activities of week 2

The week 2 consists of **three learning activities and tasks**:

1. Analysing the four phases for learners in innovative STEM education
2. Discussing projects of learner-centred STEM education
3. Testing innovative instruments and tools for learner-centred STEM education

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

Subsection 4:

1. Analysing the four phases for learners in innovative STEM education

Unit 1:

1. Analysing the four phases for learners in innovative STEM education

In this week, we are focusing on innovative STEM education from the perspective of the learners. Therefore, we start with an analysis of the four phases for learners in STEM education.

The Pedagogical Model Learn STEM comprises three elements as objectives: knowledge, skills and competences. Learners gain STEM knowledge and build STEM skills. Through reflection and repeated training, they build STEM competences based on processes of assimilation and accommodation.

As you know, the learning processes should be interdisciplinary and holistic for innovative STEM education. What is more, it should be processes going through iterative cycles. The four phases for the learners are:

1. Discover
2. Explore
3. Apply
4. Reflect



In the first phase "Discover", learners can and should gain motivation for their next steps. Learners can gain interest by themselves or teachers can prepare an environment that is attractive for learners to start with own self-regulated learning.

In the second phase "Explore", learners try to find out what are the special characteristics of their subject of research and how to explain them.

In the third phase "Apply", learners develop a generalisation of their explanations and adapt it for other fields and topics.

Finally, in the fourth phase "Reflect", learners critically think about their experiences and the fitness of their explanations and generalisations leading to a generic review and revision of all learning results in continuous improvement cycles.

Debate the importance of the four phases for the learners with your colleagues or with other participants here in the course using the discussion forum: Which phase is more important for you? And do you agree with the need of iterative cycles?

Add discussion: Week 2 - Four phases for learners

Subsection 5:

2. Discussing projects of learner-centred STEM education

Unit 1:

Introducing the projects of learner-centred STEM education

In this sub-section, we want to introduce you to several projects of learner-centred STEM education:

We hope that you can find interesting examples and identify practical ideas for your own learner-centred STEM education.

Please watch the videos on the following pages.

Unit 2:

Video 1: The Pine Race

Watch the video 1: "The Pine Race"

Unit 3:

Video 2: The Tiny House

Watch the video 2: "The Tiny House"

Unit 4:

Video 3: Microcomputer Programming

Watch the video 3: "Microcomputer Programming"

Unit 5:

Our task for you

Our task for you:

Which projects do you know or have you already explored and tested with your pupils?

Think about your own learner-centred projects that you have developed or used in your STEM education: What are good examples from your learner-centred STEM education?

Which learning tasks were most interesting for your pupils?

Please select good learner-centred projects with interesting samples of learning activities and tasks from your learner-centred STEM education.

Or describe them using our Case template from week 1.

Please upload and share them into the shared folder "Week 2 – Good practice examples and cases" that you can also find [here](https://surfdrive.surf.nl/files/index.php/s/8s3SWzVlokWFBep):

<https://surfdrive.surf.nl/files/index.php/s/8s3SWzVlokWFBep>

Share your views and discuss them with your colleagues or with other participants here in the course using the discussion forum (see below).

Add discussion: Week 2 - Discussing learner-centred projects

Subsection 6:

3. Testing innovative instruments and tools for learner-centred STEM education

Unit 1:

Our Inquiry Learning Package

In this sub-section, we want to introduce you to several innovative instruments and tools of learner-centred STEM education:

All innovative instruments and tools are openly and freely available and can be used without any costs (you only need internet access).

Some of them are offering the full access and all functionalities for free, most of them require your registration first and a few of them offer a version for teachers and educational purposes with limited functionalities but for free, too.

We hope that you can find and explore innovative instruments and tools for your own practice and learner-centred STEM education.

To get an inspiration, start with our collection of 12 good practice examples and cases for learner-centred STEM education that we have shared and published as "Inquiry Learning Package" that you can find in the shared folder "Week 2 – Good practice examples and cases": <https://surfdrive.surf.nl/files/index.php/s/8s3SWzVlokWFBep>

Which examples do you already know and which ones are new for you?

What are your findings if you compare these 12 examples?

And how can you use them in your own learner-centred STEM education?

In the following pages, you can find more innovative instruments and tools for learner-centred STEM education that are waiting for your exploration and analysis.

Our task for you:

When you have explored, analysed and compared our innovative instruments and tools for learner-centred STEM education, think about your own good practice examples and cases and your instruments and tools that you use for learner-centred STEM education. Please upload and share them into the shared folder "Week 2 – Good practice examples and cases" that you can also find [here: https://surfdrive.surf.nl/files/index.php/s/8s3SWzVlokWFBep](https://surfdrive.surf.nl/files/index.php/s/8s3SWzVlokWFBep)

Afterwards, please give feedback for at least one innovative instrument or tool for learner-centred STEM education that your peers and colleagues have uploaded and shared with you in the folder. Remember to refer to the name of the innovative instrument or tool. Share your views and discuss them with your colleagues or with other participants here in the course using the discussion forum (see below).

Finally: If you want, you can share your findings from the analysis of our own innovative instruments and tools for learner-centred STEM education in the discussion forum, too.

Add discussion: Week 2 - Discussing instruments and tools

Unit 2:

Online boards for collaboration

First, some online boards that you and your pupils can use for discussions and documentations (also for team member or group members who missed a meeting):

A very simple board without fancy features:

<http://board.net>

A stylish board with many options:

<http://padlet.com> (what we have also used in our live event in week 1)

Just for projections (e.g., by beamers) but very quick to design:

<http://classroomscreen.com>

And a simple collaborative whiteboard:

<https://bitpaper.io>

Unit 3:

Online tools for creating videos

Here, some online tools that allow you to produce your videos including free music, photos and more:

An easy tool for automatic creation of videos based on uploading text:

<https://lumen5.com>

A simple tool for writing your story and creating a video:

<http://textingstory.com>

An online tool for creating your interactive images, videos and virtual tours:

<https://www.thinglink.com>

And another online tool for creating explainer videos:

<https://www.mysimpleshow.com>

Unit 4:

Collections of different tools

Furthermore, a collection of diverse online platform for very different purposes:

A broad collection of interactive simulations for science and maths:

<https://phet.colorado.edu>

A broad collection of diverse apps:

<http://learningapps.org>

An online tool for creating your comics (free trial for 30 days)

<http://plasq.com>

Unit 5:

Kind reminder on our task for you

Finally, a kind reminder on our task for you:

When you have explored, analysed and compared our innovative instruments and tools for learner-centred STEM education, think about your own good practice examples and cases and your instruments and tools that you use for learner-centred STEM education. Please share and upload them into the shared folder "Week 2 – Good practice examples and cases" that you can also find [here: https://surfdrive.surf.nl/files/index.php/s/8s3SWzVIokWFBep](https://surfdrive.surf.nl/files/index.php/s/8s3SWzVIokWFBep)

Afterwards, please give feedback for at least one innovative instruments or tools for learner-centred STEM education that your peers and colleagues have uploaded and shared with you in the folder. Remember to refer to the name of the innovative instruments or tools. Share your views and discuss them with your colleagues or with other participants here in the course using the discussion forum (see the first page of this sub-section before our presentation of all instruments and tools or go directly to the discussion forum).

And remember: If you want, you can share your findings from the analysis of our own innovative instruments and tools for learner-centred STEM education in the discussion forum, too.

Subsection 7:

Live online event

Our live online event in week 2 is on Tuesday, 7th of April 2020, starting at 16:00 UTC = 18:00 CEST (Brussels):

Here is the link: http://bit.ly/LearnSTEM2020_Week2_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.timeanddate.com/worldclock/fixetime.html?msg=Learn+STEM+Online+Course%3A+Week+2+Live+Event&iso=20200407T18&p1=48&ah=1>

<http://www.worldtimebuddy.com/event?lid=2800866&h=2800866&sts=26436840&sln=18-19&a=show&euid=5b211483-74b2-c3d4-55df-c2759703c96c>

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

And here is **the recording of our live online event in week 2:**

http://bit.ly/LearnSTEM2020_Week2_Recording (will be published afterwards)

Thank you very much for your contributions!

Subsection 8:

Materials of week 2 and further reading

You can find all materials of week 2 in our shared online folders (<https://surfdrive.surf.nl/files/index.php/s/8s3SWzVlokWFBep>):

In folder "Week 2 – Good practice examples and cases":

The Inquiry Learning Package with 12 examples and cases for innovative learner-centred STEM education (following our Pedagogical Model Learn STEM) [= Stracke, C. M., van Dijk, G., Daneniene, J., Kelmelyte, V., Lisdat, F., Wesolowski, A., Barreiros, A., Baltazar, R., Simoens, W., Desutter, J., Pascoal, A., Rimkevičė, A., Spatafora, M., Cotovanu, A. M., & Spatafora, A. (2019). *Learn STEM. The Inquiry Learning Package for Innovative STEM Learning and Teaching*. Online available at www.Learn-STEM.org/Model]

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

In folder "Week 2 – 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).

Stracke, C. M. (2015). The Need to Change Education towards Open Learning. In C. M. Stracke & T. Shamarina-Heidenreich (Eds.), *The Need for Change in Education: Openness as Default?* (pp. 11-23). Berlin: Logos. doi:10.5281/zenodo.3735757 Retrieved from <http://opening-up.education/publications/stracke-c-m-2015-the-need-to-change-education-towards-open-learning>

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

In folder "Week 2 – Materials":

Our slides with the content of the week 2 for your download

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

And some recommendations for further reading:

Harlen, W. (Ed.). (2015). Working with Big Ideas of Science Education. Trieste: Global Network of Science Academics (IAP) Science Education Programme. Retrieved from: www.ase.org.uk/bigideas.

Schweisfurth, Michele (2019). Is learner-centred education 'best practice'? UNICEF Think Piece Series: Improving Classroom Practice. UNICEF Eastern and Southern Africa Regional Office, Nairobi. Retrieved from https://www.unicef.org/esa/sites/unicef.org/esa/files/2019-08/ThinkPiece_9_LearnerCentredEducation.pdf

Van Dijk, G., Delheij, A., French, M., Erin, H., Kodras, M., Miller, J., Wijnands, W. (2016). The Agile in Education Compass. Retrieved from: <http://www.agileineducation.org>

And finally, enjoy the following quiz at the end of week 2!

Subsection 9:

Your quiz in week 2

Unit 1:

Your quiz in week 2

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 2, we are using an online quiz that we have built using www.quizizz.com, enjoy! It offers you two quiz options: "Play" and "Flashcards": Try out which one you prefer! And you can repeat the quiz to go up in the rankings :-)

Here is the link:

www.quizizz.com/join/quiz/5e85bd63a75ec2001b19f576/start?from=soloLinkShare&referrer=5e455381ce42c8001cc4bb19

1. For teachers, learner-centred STEM education is ...
 - A. labour-intensive**
 - B. relieving
 - . leisure time
2. For learners, learner-centred STEM education is ...
 - A. expensive
 - B. boring
 - C. challenging**
3. The four phases of learner-centred STEM education are ...
 - A. Discuss, Explain, Act, Reflect
 - B. Discover, Explore, Apply, Reflect**
 - C. Discover, Explore, Act, Restore
4. The iterative progress of the Learn STEM phases ...
 - A. is strictly defined and offers exactly one pathway
 - B. allows just minimal changes and interpretations
 - C. is flexible and allows different pathways and options**
5. The Pedagogical Model Learn STEM can be used in ...
 - A. teacher-oriented shopping
 - B. learner-centred education**
 - C. parents-based workshop
6. How do like the Learn STEM Online Course?
 - A. Great!
 - B. Boring!

You may have wondered that, this time, our quiz is very short with only five questions and a final voting.

There is one simple reason for that: You can find so many online quizzes that you can re-use. Thus, in many cases, it is not necessary to develop your own quiz by yourself as you can re-use existing quizzes and/or base your own quiz on their questions.

In the following page, you can find some selected examples from www.quizizz.com.

Unit 2:

Examples for you

Here some examples from www.quizizz.com that we have used this week:

www.quizizz.com/join/quiz/5db048f1cb34c4001a377e8b/start?from=soloLinkShare

www.quizizz.com/join/quiz/5c293662877574001a3d9b21/start?from=soloLinkShare (focus on google services)

www.quizizz.com/join/quiz/57a65c26d86a80ce22420d54/start?from=soloLinkShare
(introducing a new design process)

www.quizizz.com/join/quiz/5d91ff8e19ca0f001a7d943a/start?from=soloLinkShare (mainly on engineering)

www.quizizz.com/join/quiz/5b18e9fc84c33f0019a668d8/start?from=soloLinkShare
(including Chinese)

And you can search for more quizzes on www.quizizz.com if you register (for free) and login.

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>

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Erasmus+

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