

*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)

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

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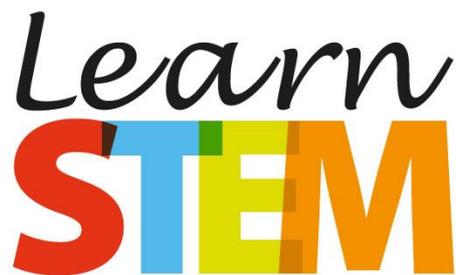
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With the support of the European Commission

# Learn STEM

# Learn STEM MOOC Week 1



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

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

<b>Week 1</b> (from 26th March 2020 to 1st April 2020)	<b>Innovative STEM Learning</b>	
<b>Responsible: Lithuanian partners - Contributors: OUNL</b>		
<b>Learning objectives:</b> <ul style="list-style-type: none"> <li>• To understand characteristics and phases of innovative STEM education</li> <li>• To reflect the Pedagogical Model Learn STEM</li> <li>• To improve your own STEM education</li> </ul>	<b>Learning activities:</b> <ul style="list-style-type: none"> <li>• To read the introductory text</li> <li>• To discover the content and videos</li> <li>• To join the live event</li> <li>• To fulfil the tasks and assignments</li> <li>• To complete the quiz</li> <li>• To check the references if interested in further reading</li> </ul>	
<b>Topics of this week, the topic experts and their availability:</b> <ul style="list-style-type: none"> <li>• Innovative STEM education</li> <li>• The Pedagogical Model Learn STEM and its key characteristics</li> <li>• Your own STEM education</li> </ul>		
<b>Time plan for this week:</b> <ul style="list-style-type: none"> <li>• TUESDAY (2020-03-31): Live event starting at 16:00 UTC = 18:00 CEST (in Brussels)</li> </ul>		
<b>Tasks and assignments for this week:</b> <ul style="list-style-type: none"> <li>• Exploring main characteristics and requirements for innovative STEM education</li> <li>• Discussing the Pedagogical Model Learn STEM and its implementation</li> <li>• Analysing units of your own STEM education</li> </ul>		

## Subsection 1:

### Introduction to week 1

Welcome to week 1 of our Learn STEM Online Course!

Week 1 is focusing **Innovative STEM Education!**

Feel invited to watch the **introductory video** for week 1 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 Innovation](https://bit.ly/LearnSTEM2020%20Innovation)

Afterwards, you will find the overview of the **learning objectives and activities** of week 1.

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, 31st of March 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 Week1 Live](http://bit.ly/LearnSTEM2020%20Week1%20Live) (it will open 30 minutes before the live event to allow testing of your connectivity, see all details in the section "Week 1 live online event")

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

If not, there is still time to do it!

Subsection 2:

**Video introducing week 1**

Week 1 Innovative STEM education: [www.youtube.com/watch?v=FZQKgc03b1Q](http://www.youtube.com/watch?v=FZQKgc03b1Q)

Video integrated

### Subsection 3:

## Overview of Learning objectives and activities of week 1

### Unit 1: Learning objectives of week 1

Our **learning objectives** of week 1 are:

- To understand characteristics and phases of innovative STEM education
- To reflect the Pedagogical Model Learn STEM
- To improve your own STEM education

These learning objectives are addressed by the learning activities of week 1 that are following on the next page.

### Unit 2: Learning activities of week 1

The week 1 consists of **three learning activities and tasks**:

1. Exploring main characteristics and requirements for innovative STEM education
2. Discussing the Pedagogical Model Learn STEM and its implementation
3. Analysing units of your own STEM education

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

## Subsection 4:

### **1. Exploring innovative STEM education**

#### Unit 1: Before we start: First questions

Before you start scrolling and reading through the content of this week, we invite you to answer the following three questions:

1. How would you define STEM? Do you consider STEM as a cluster of different subjects or more as the full integration of subjects?
2. What kind of opportunities or pitfalls did you encounter while teaching STEM?
3. Has STEM teaching evolved and improved your (general) teaching method? If so, how?

Share your ideas on these questions and discuss them with your colleagues or with other participants here in the course using the discussion forum.

#### Unit 2: Video on technology in the future

Watch the video below (the video titles mean: "World without Technology: No future").

If you cannot see or run the video, then you can watch it directly in YouTube:

<https://www.youtube.com/watch?v=Vi53WzYF6hY>

#### Video integrated

Debate the importance of STEM with your colleagues or with other participants here in the course using the discussion forum.

## Subsection 5:

### 2. Discussing the Pedagogical Model Learn STEM

#### Unit 1: The Pedagogical Model Learn STEM

Please read the "Pedagogical Model Learn STEM", you can download it here: <http://learn-stem.org/model>

The main intentions and objectives of the Pedagogical Model Learn STEM are summarized as follows:

We all understand that learners need to build and continuously improve strong competences and abilities related to science, technologies, engineering and mathematics (STEM) in order to be competitive in the 21st century work environment. Teachers, thus, need a different way of teaching so as to develop learners' profound knowledge, skills and competences in team work, rational thinking and investigative and creative work which they can use not only in class but also in all areas of life. The Pedagogical Model Learn STEM comprises a general framework for improving learning and teaching of Science, Technology, Engineering and Mathematics (STEM) in schools.

Learn STEM is based on educational theories and positions and focuses mainly on the following five characteristics of the learning process:

Complex  
Process-oriented  
Holistic  
Practical  
Social



Please write a brief comment about your understanding of the five characteristics. Share your views and discuss them with your colleagues or with other participants here in the course using the discussion forum.

## Subsection 6:

### **3. Analysing your own STEM education**

Think about your own STEM education: What are good examples from your lesson plans and learning tasks for your pupils?

Please select good practice examples and cases with interesting samples of learning activities and tasks from your own STEM education.

If you have them available and at hand, then you can directly work with them. If not, then you can use our template "Learn\_STEM\_TTP\_Annex\_1\_Case\_template\_v10.doc" to describe your good practice examples and cases: It is the Annex 1 of our Teacher Training Programme (TTP) that we have developed for face-to-face workshops and that we are currently evaluating (you will find the final version of our Teacher Training Programme on our Learn STEM website soon). You can find the template in the shared folder "Week 1 – Pedagogical Model Learn STEM" that you can find [here](https://surfdrive.surf.nl/files/index.php/s/SPbXJlJstB1sRpN): <https://surfdrive.surf.nl/files/index.php/s/SPbXJlJstB1sRpN>

Have a look on your good practice examples and cases now: How much are they following and realizing the principles of innovative STEM education?

Take advantage of our Checklist for the Pedagogical Model Learn STEM: It is the Annex 2 of our Teacher Training Programme (TTP). You can also find it in the shared folder "Week 1 – Pedagogical Model Learn STEM": <https://surfdrive.surf.nl/files/index.php/s/SPbXJlJstB1sRpN>

Check your good practice examples and cases and clarify whether all five characteristics are covered by your examples and cases.

And you can get inspiration from our collection of 27 good practice examples and cases for innovative STEM learning that we have shared and published as "Annex 1 of our Pedagogical Model Learn STEM" that you can also find in the shared folder "Week 1 – Good practice examples and cases": <https://surfdrive.surf.nl/files/index.php/s/SPbXJlJstB1sRpN>

What are your findings if you compare these 27 examples with your own cases?

If you have analysed and maybe improved your own good practice examples and cases, then please upload and share them into the shared folder "Week 1 – Good practice examples and cases" that you can also find [here](https://surfdrive.surf.nl/files/index.php/s/SPbXJlJstB1sRpN): <https://surfdrive.surf.nl/files/index.php/s/SPbXJlJstB1sRpN>

Afterwards, please give feedback for at least one good practice example or case that your peers and colleagues have uploaded and shared with you in the folder. Remember to refer to the checklist. Share your views and discuss them with your colleagues or with other participants here in the course using the discussion forum.

Finally: If you want, you can share your findings from the analysis of your own examples and cases and their comparison with our collection in the discussion forum, too.

## Subsection 7:

### Live online event

**Our live online event in week 1 is on Tuesday, 31st of March 2020, starting at 16:00 UTC = 18:00 CEST (Brussels):**

Here is the link: [http://bit.ly/LearnSTEM2020\\_Week1\\_Live](http://bit.ly/LearnSTEM2020_Week1_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) = 10:00am **CST** (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/fixtime.html?msg=Learn+STEM+Online+Course%3A+Week+1+Live+Event&iso=20200331T18&p1=48&ah=1>

<http://www.worldtimebuddy.com/event?lid=100&h=100&sts=26426880&sln=16-17&a=show&euid=3c716d97-a445-6fc4-612d-ea7f8355597c>

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

And here is **the recording of our live online event in week 1:**

[http://bit.ly/LearnSTEM2020\\_Week1\\_Recording](http://bit.ly/LearnSTEM2020_Week1_Recording)

Thank you very much for your contributions!

## Subsection 8:

### Materials of week 1 and further reading

You can find all materials of week 1 in our shared online folders (<https://surfdrive.surf.nl/files/index.php/s/SPbXJlJstB1sRpN>):

In folder "Week 1 – Pedagogical Model Learn STEM":

**The 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 Pedagogical Model for Innovative STEM Learning and Teaching*. [Open Access] Retrieved from <http://www.Learn-STEM.org/Model>]

**The Case template** (Annex 1 of our Teacher Training Programme) [= 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 Teacher Training Programme. Annex 1: Case template for STEM projects*. [Open Access] Online available at [www.Learn-STEM.org/Model](http://www.Learn-STEM.org/Model)]

**The Checklist for the Pedagogical Model Learn STEM** (Annex 2 of our Teacher Training Programme) [= 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 Teacher Training Programme. Annex 2: Checklist for the Pedagogical Model Learn STEM*. [Open Access] Online available at [www.Learn-STEM.org/Model](http://www.Learn-STEM.org/Model)]

In folder "Week 1 – Good practice examples and cases":

**The 27 good practice examples and cases for innovative STEM learning** (Annex 1 of 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 Pedagogical Model for Innovative STEM Learning and Teaching. Annex 1: Good Practice Examples of Innovative STEM Learning*. [Open Access] Online available at [www.Learn-STEM.org/Model](http://www.Learn-STEM.org/Model)]

In folder "Week 1 – Literature":

Stracke, C. M. (2014). How Innovations and Competence Development support Quality in Lifelong Learning. *The International Journal for Innovation and Quality in Learning (INNOQUAL)*, 2(3), 35-44. [Open Access] doi:[10.5281/zenodo.3608669](https://doi.org/10.5281/zenodo.3608669)

Stracke, C. M., van Dijk, G., Fasen, J., Lisdat, F., Wesolowski, A., Simoens, W., Desutter, J., Lippens, J., Rimkevičė, A., Daneniene, J., Kelmelyte, V., Baltazar, R., Barreiros, A., Pascoal, A., Spatafora, M., Cotovanu, A. M., & Spatafora, A. (2019). A Holistic Pedagogical Model for STEM education in schools: Its Design and Evaluation through Mixed Methods Research with Surveys and Interviews. In *Proceedings of Learning Innovations and Quality (LINQ) 2019, EPiC Series 2* (pp. 40-48). [Open Access] doi:[10.29007/t43b](https://doi.org/10.29007/t43b)

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

In folder "Week 1 – Materials":

Our slides with the content of the week 1 for your download

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

And some recommendations for further reading:

European Commission (2007): Science Education NOW. A Renewed Pedagogy for the Future of Europe [Rocard-Report]. Retrieved from: [https://ec.europa.eu/research/science-society/document\\_library/pdf\\_06/report-rocard-on-science-education\\_en.pdf](https://ec.europa.eu/research/science-society/document_library/pdf_06/report-rocard-on-science-education_en.pdf)

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](http://www.ase.org.uk/bigideas)

Weinert, F. E. (2001). Concept of competence: A conceptual clarification. In D. S. Rychen (Ed.), Defining and selecting key competences (pp. 45-66). Seattle: Hogrefe & Huber.

Westera, W. (2001). Competences in education: A confusion of tongues. Journal of Curriculum Studies, 33(1), 75-88. doi:10.1080/00220270120625

And finally, enjoy the following quiz at the end of week 1!

## Subsection 9:

### Your quiz in week 1

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 1, we are using the built-in quiz from the open edX platform, enjoy!

1. What does STEM stand for?
  - A. Science, Technology, Engineering and Mathematics**
  - B. Science, Teaching, Engaging and Mathematics
  - C. Science, Technology, Engineering and Marketing
2. Innovative STEM education is:
  - A. teacher-centred
  - B. parents-centred
  - C. learner-centred**
3. The Pedagogical Model Learn STEM ...
  - A. highlights the importance of STEM subjects as separate disciplines
  - B. recognises that the STEM subjects require an interdisciplinary view**
  - C. explains how meaningful the focus on single STEM subjects is
4. Learn STEM focuses on these five characteristics of the learning process:
  - A. Complex, process-oriented, holistic, practical, social**
  - B. Simple, teacher-centred, practical, social, goal-oriented
  - C. Complex, process-oriented, simple, practical, social
5. Learn STEM suggests that the learning process is:
  - A. goal centred and linear
  - B. going through iterative improvement cycles**
  - C. not clearly defined yet
6. The statement that Learn STEM is Complex means:
  - A. it is interdisciplinary and connects numerous subjects**
  - B. it emphasizes the ethical component of STEM
  - C. it supports learners in building knowledge, skills and competences
7. The statement that Learn STEM is Practical means:
  - A. it is learner-centred
  - B. it emphasizes the ethical component of STEM
  - C. it supports learners in acquiring knowledge, skills and competences**
8. The statement that Learn STEM is Holistic means:
  - A. it explains and explores the environment of different levels using different models and even languages**
  - B. it supports a complex growth of the learner
  - C. it is inclusive, gender balanced and values diversity
9. The statement that Learn STEM is Complex means:
  - A. it supports a complex growth of the learner**

B. practical experiments are essential for the learning process and for the development of practical skills

C. it creates a trusted environment for the learning process

10. The statement that Learn STEM is Social means:

A. it supports learners in acquiring knowledge, skills and competences

B. learning happens just inside school

**C. it is learner-centred aiming to impact individuals and society**

11. The Pedagogical Model Learn STEM incorporates the complexity of STEM learning activities. This means:

A. it is related to the various STEM disciplines

**B. it connects the world of learners with our society**

**C. it is interrelated with other areas**

12. The statement that Learn STEM is Process-oriented means:

**A. STEM learning is feasible in a self-regulated and creative way**

B. STEM learning needs no visible feedback and reflection

C. the learning process has to fulfil teacher's expectations

13. Learners who build STEM competences in one or more fields:

**A. should be given a new task to use these competences in the following cycle**

B. should be assessed to give them a certain evaluation

C. should be given a new task beyond the new STEM competences

## 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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