Co-funded by the European Union

STEAME TEACHER ACADEMY

Guidelines for facilitating the learning of STEAME
Reference Number: 101102619

Module and Workshop Learning Plan

Module Number and Area/Topic:

MODULE 11: STEAME EVALUATION AND ASSESSMENT METHODS with emphasis in PBL

Module leaders: EACG (Gregory Makrides and Andreas Skotinos)

1. Introduction and broad description of the context and goal of the area/topic addressed with reference to the STEAME Teacher Facilitators Competence Framework for student and serving teachers

Assessment of school work, including project-based learning (PBL), is crucial as it is actually one of the most important aspects of the learning process. In particular the assessment of PBL is essential as the consideration of identifying pros and cons in the extent of learning a topic is particularly achieved through this approach. It has been justified that Project-based learning is an instructional approach that emphasizes hands-on, real-world experiences to help students develop a deep understanding of content and acquire valuable skills. Consequently, it is obvious that by assessing the outcomes and processes where students are involved we have a useful tool for securing that the goals of the learning process have been achieved. This emphasis is particularly useful in the context of the STEAME approach.

In PBL assessment is not just about grading but about guiding students towards deeper understanding and better skills. Some strategies include conducting individual assessment of team products, as well as "weighted scoring" and "role-based" assessment practices. It's necessary to purposely assess this learning during PBL instead of using traditional testing

Thus the whole consideration of the topic is developed around an effort for answering the following issues:
What are the goals/ objectives of assessment in the case of students, learning through the STEAME approach?
In this context what are the responsibilities/ tasks of the teachers facilitators?
What are some important points that have to be considered in the process of learning a topic using the STEAME approach? What is involved in PBL Assessment?
What are the elements of success of a STEAME programme? How do we identify them?
How do we assess secondary students taught through the STEAME approach?
What aspects do we assess in secondary students, taught through the STEAME approach?
How do we prepare tools and or frameworks for assessing the extent of achievement of outcomes (concepts, processes, skills and competencies) that were developed through the STEAME approach?

2. Learning objectives and learning outcomes with reference to the defined list of learning outcomes in the Competence framework

Goals of STEAME Evaluation and Assessment, with emphasis on PBL:

- Provide Feedback for Improvement: Help students identify strengths and weaknesses for continuous learning.

- Measure Learning Outcomes: Measures the effectiveness of the project in achieving its educational objectives.
- Inform Instruction: Guide teachers to tailor future projects and support based on student needs.

In this context the following table 1 provides a framework for the learning Goals and Objectives that the teachers/ facilitators are to be aiming in the context of the course.

TABLE 1

Content Area	Learning Goal	Learning Objective and expected outcome
Integration of Disciplines:	Assess the ability to integrate knowledge and skills from science, technology, engineering, arts, mathematics, and entrepreneurship.	Evaluate students' proficiency in applying concepts and methods across multiple disciplines to solve real-world problems.
Critical Thinking and Problem Solving:	Develop and assess critical thinking skills and the ability to solve complex problems.	Measure students' capacity to analyze, evaluate, and synthesize information to develop innovative solutions.
Creativity and Innovation:	Cultivate creativity and innovative thinking.	Assess students' ability to generate novel ideas, design creative solutions, and think outside traditional boundaries.
Collaboration and Teamwork:	Foster collaborative skills necessary for interdisciplinary work.	Evaluate how well students can work effectively in teams, communicate ideas, and contribute to a shared goal.
Entrepreneurial Mindset:	Instill an entrepreneurial mindset and skills for future success.	Assess students' ability to identify opportunities, take initiative, and apply entrepreneurial principles in problem-solving and project development
Communication Skills:	Enhance communication skills across various mediums.	Evaluate students' ability to articulate ideas, present findings, and communicate complex concepts to diverse audiences.
Ethical and Social Awareness:	Promote ethical considerations and social responsibility.	Assess students' understanding of the ethical implications of their work, as well as their awareness of social and cultural factors related to STEAME disciplines.
Hands-On and Experiential Learning:	Emphasize practical, hands-on learning experiences.	Evaluate proficiency in applying theoretical knowledge to practical situations, often through project-based assessments and real-world applications.
Continuous Learning and Adaptability:	Cultivate a mindset of continuous learning and adaptability.	Assess students' ability to learn independently, adapt to new challenges, and stay current in rapidly evolving fields.
Assessment of Process and Product:	Evaluate both the process and the final product of students' work.	Provide feedback on the development, iteration, and refinement of projects in addition to the end result.

3. Competences that are developed

For the students

When assessing students in the STEAME approach, it's essential to use a variety of assessment methods, including project presentations, portfolios, collaborative evaluations, and reflections. This multifaceted approach provides a comprehensive understanding of students' competences and their ability to integrate knowledge and skills across multiple disciplines. It is expected that through the

STEAME approach the competences/ skills, identified in the next table (TABLE 2) for the competences that should be the object of the teachers, would be developed.

For the teachers

The teachers are expected to acquire skills and competencies that will enable them to assess the extent that the students have developed essential abilities that will lead to the materialization of the goals and objectives identified in TABLE 1. Thus the teachers/ facilitators should be assessed on the extent they develop skills and competences for the development of appropriate skills and competencies to the school students. More specifically this idea is reflected in the following Table 2.

TABLE 2

Competence/ skill of the student	Competences/ skills expected from the teacher in the process of evaluating the respective on by the students
Critical Thinking:	Identify: Look for evidence of students' ability to analyze information, evaluate alternatives, and make reasoned decisions. Assess their problem-solving strategies and the depth of their critical thinking in addressing challenges within the project.
Creativity and Innovation:	Identify: Assess the originality and creativity of students' solutions, designs, or artistic expressions. Look for evidence of unconventional thinking, unique approaches, and the integration of artistic elements into STEM concepts.
Collaboration and Teamwork	Identify: Evaluate how well students work in teams. Look for effective communication, shared responsibilities, and evidence of collaboration in the project. Assess contributions from each team member and the overall synergy of the group.
Communication Skills:	Identify: Evaluate students' ability to clearly communicate their ideas, both in written and verbal forms. Look for well-organized project presentations, reports, or visual displays. Assess how effectively students convey complex concepts to diverse audiences
Problem-Solving	Identify: Examine how students approach and address challenges within the project. Assess their ability to identify problems, propose solutions, and iteratively refine their strategies. Look for evidence of adaptability and resilience in the face of setbacks
Digital Literacy and Technology Integration	Identify: Evaluate how students use technology tools and platforms within their projects. Assess their proficiency in utilizing digital resources, software, and hardware relevant to the STEAME fields. Look for evidence of technology-driven solutions.
Entrepreneurial Mindset	Identify: Assess students' ability to identify opportunities, take initiative, and demonstrate an entrepreneurial mindset. Look for evidence of creativity in designing solutions, awareness of market needs, and consideration of practical applications
Ethical and Social Awareness:	Identify: Examine whether students consider ethical implications in their projects. Assess their understanding of the social impact of their work, including considerations for inclusivity, diversity, and sustainability.
Mathematical and Scientific Literacy:	Identify: Evaluate the application of mathematical and scientific principles in the project. Look for evidence of data analysis, accurate calculations, and the integration of scientific methodologies in problem-solving.
Artistic Expression and Aesthetic Design:	Identify: Assess the incorporation of artistic elements in the project. Look for creativity in design, visual aesthetics, and the integration of artistic expressions to enhance the overall presentation.
Project Management and Time Management	Identify: Evaluate how well students plan and manage their projects. Assess their ability to set realistic timelines, allocate resources effectively, and meet project deadlines. Look for evidence of project milestones and effective time management.

4. Content and Resources (providing information on the various constituents/ dimensions of the topic under consideration), including presenter's notes for guidelines of the workshop's organisation

Resources:

Quite a lot of material for this workshop is provided in the Erasmus + **STEAME project**
Project title: "STEAME: Guidelines for Developing and Implementing STEAME Schools"**: https://steame.eu/**
STEAME COURSE : https://steame.eu/steame-training-course/
Module 10. Evaluating STEAME project/ activities work of students (Evaluation rubrics etc) providing:
A ppt presentation, 2 videos and material where examples and Learning and Creativity Plans with emphasis on the structure of a rubric for evaluation

Furthermore, the following resources provide useful information and guidance

Books:

Barron, B. J., Schwartz, D. L., Vye, N. J., Moore, A., Petrosino, A., Zech, L., & Bransford, J. D. (1998). Doing with understanding: Lessons from research on problem- and project-based learning. Journal of the Learning Sciences, 7(3-4), 271-311.
Larmer, J., Mergendoller, J. R., & Boss, S. (2015). Setting the standard for project based learning: A proven approach to rigorous classroom instruction. ASCD.

Journal Articles:

Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 83(2), 39-43.
Choi, I., & Lee, S.(2018). The effects of STEAM education on academic achievement and motivation in learning. Journal of Science Education and Technology, 27(6), 547-556.

Reports and Whitepapers:

Honey, M., Pearson, G., & Schweingruber, H. (2014). STEM integration in K-12 education: Status, prospects, and an agenda for research. National Academies Press.
Buck Institute for Education. (2018). Gold standard PBL: Essential project design elements. BIE.

Online Resources:

P21 (Partnership for 21st Century Learning). Framework for 21st Century Learning. Retrieved from http://www.p21.org/storage/documents/docs/P21_Framework_Definitions_New_Logo_2015.pdf
Edutopia. Project-Based Learning. Retrieved from https://www.edutopia.org/project-based-learning

Conference Papers:

Thomas, J. W. (2000). A review of research on project-based learning. Autodesk Foundation.
Kang, N. H., & Kaya, S. (2016). Effects of STEAM practices on developing students' creative thinking, problem solving, entrepreneurship and digital literacy skills. In Proceedings of the 5th World Conference on Learning, Teaching and Educational Leadership (WCLTA 2014).

Case Studies:

Barron, B. J., & Darling-Hammond, L. (2008). Teaching for meaningful learning: A review of research on inquiry-based and cooperative learning. Book Excerpt.
Boss, S., & Krauss, J.(2007). Reinventing project-based learning: Your field guide to real-world projects in the digital age. International Society for Technology in Education (ISTE).

5. Methodology and approaches for the module training presentation and guidelines for workshops organisation

At the starting point the participants are introduced to the consideration of the elements for evaluation of PBL as it was initially developed in the precursor STEAME project.

They are informed about the guiding ideas that set the ground for the workshop, and the goals for assessing PBL in the context of STEAME as well as about the processes for evaluation in the present context. They are called to consider such an evaluation using the Rubric approach.
Then they are grouped in groups of 4-6 persons and they are asked to proceed in the development/ adaptation of a rubric for assessing two students' works
This is followed by consideration of the results, reflection and discussion

6. Instruments/Tools/Supporting Materials/Resources to be used

The participants are provided by the following material:

1. Handout with relevant material and examples in ppt slides
   (These include
   The pptx presentation: 1. Main presentation of WS3
   The pptx extended and detailed presentation, as a handout, of the previous one, under the name: 2. WS3-HANDOUT1- Porto
2. The Rubric for evaluation of a PBL as it was developed in the STEAME project under the name
3. The students works/ presentations to be assessed by each group (2 projects)
4. 2 examples with suggested approaches for evaluation in the form of ppt for study and reflection.

PART 1	**Introductory Activities (creation of interest, reference to real-world issues, relation to background and experiences, etc.)**
Learning Objectives	Define key characteristics of effective PBL in a STEAME context, and thus identify various methods for evaluating student learning in PBL projects. Adapt a rubric for this aligned with learning objectives
Learning Outcomes	Start thinking of a plan to analyze and interpret data for the assessment of student's progress and project success
Competences	Develop skills for adapting and using a rubric for assessing
Content, Resources and Tools	The EU Erasmus+ STEAME project and the Rubric for Evaluation of PBL in STEAME context
Activities	Introduction to the evaluation of a Project Based Learning in the context of STEAME education
Estimated Time	15 minutes

(add more Activity sections as needed)

PART 2	**Development Activities**
Learning Objectives	Use key characteristics of effective PBL in a STEAME context, and thus identify various methods for evaluating student learning in PBL projects. Adapt a rubric for this aligned with learning objectives
Learning Outcomes	Reflect on a plan to analyze and interpret data for the assessment of student's progress and project success
Competences	Develop skills for adapting and using a rubric for assessing
Content, Resources and Tools	The EU Erasmus+ STEAME project and the Rubric for Evaluation of PBL in STEAME context If necessary refer to the notes/slides in Section 6

Activities	Formalisation of groups for collaborative work and Consideration of the rubric provided. Exchange ideas between themselves as to the extent that this rubric reflects the ideas for assessing each of the content areas mentioned in Table 1 giving appropriate reflection in the spirit of the respective comments in Table 2 above
Estimated Time	**10 minutes**

(add more Activity sections as needed)

PART 3	**Practical Activities (hands-on activity) in the case of a workshop mode**
Learning Objectives	To use the adapted Rubric for assessment in order assess the presentations of the students' project work
Learning Outcomes	Development of a rubric with marks for each of the two students' projects
Competences	Analysis of the students' presentations Assessing and marking accordingly
Content, Resources and Tools	As above
Activities	Ask the participants to consider the provided rubric for assessing the two examples/ projects of the students work (Section 6 item 4 The students works/ presentations to be assessed by each group (2 projects))
Estimated Time	**50 minutes**

(add more Activity sections as needed)

PART 4	**Evaluation of Learning Outcomes**
Learning Objectives	Teachers demonstrate understanding and ability to apply PBL evaluation through a rubric
Learning Outcomes	Teachers design an assessment plan, analyze sample data, and reflect on course learnings
Competences	Teachers are able to design thinking ideas for PBL evaluation, for data analysis for assessing PBL success and for reflection on teaching practice and next steps.
Content, Resources and Tools	The outcomes of the markings in the rubric in an excel file and the relevant graphical presentations
Activities	Use an excel file to present the markings of the participants in the rubric for the assessment each of the two projects provided Reflect on each of these and discuss them in order to identify their weaknesses, strengths, opportunities and threats (SWOT analysis)

Estimated Time	**15 minutes**

(add more Activity sections as needed)

7. Reflection and Closure activity

Assess the findings on the evaluation of the PBL projects in the context of the STEAME approach considering effectiveness and usefulness of the approach