Guidelines for facilitating the learning of STEAME
Reference Number: 101102619

Module and Workshop Learning Plan

Module Number and Area/Topic: AREA 1 ENVIRONMENT, Topic 3. STEAME TECH RESOURCES AND METHODS
Module leaders: P8. UNIVERSITY OF PLOVDIV PAISII HILENDARSKI

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

This module, situated in Area 1 of the STEAME Teachers Competence Framework, places a distinct emphasis on integrating Project-based learning (PBL) into STEAME education. The competences within this domain focus on enhancing educators' proficiency in employing PBL as a primary pedagogical tool. This includes the collaborative design, planning, and management of STEAME projects with fellow teachers, school administration, and representatives from other institutions. Additionally, teachers are expected to possess knowledge of regional or national educational standards related to STEM/STEAME/STEAME education, showcasing competence in monitoring and reporting on STEAME projects to ensure their accuracy development and sustainability.

Recognizing the transformative impact of current and emerging technologies on our world and daily lives, the integration of advanced technologies in the classroom becomes a pivotal means to enhance the quality of learning experiences for both students and teachers.

The STEAME TECH RESOURCES AND METHODS module stands as a key initiative to enrich the STEAME learning environment. By applying cutting-edge technological resources and methods, this module supports educators at every stage of project development - from the initial phases of designing and planning a project, through implementation and ongoing progress monitoring, up to the evaluation of results and knowledge sharing. Led by the University of Plovdiv Paisii Hilendarski, this module aims to equip educators with essential competencies for implementing Project-based learning in the STEAME education context. Emphasising collaborative practices, incorporating emerging technologies, and providing practical tools for monitoring and reporting, the module empowers teachers to create engaging and impactful STEAME projects. Through a focus on real-world applications and the integration of advanced technologies, educators will gain valuable insights and skills to enhance the learning experiences of both students and themselves.

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

For student teachers (Level 1):
Competence 6. Learning outcomes

1. Define a productive use of up-to-date technologies to facilitate student learning in STEAME PBL learning activities, including artificial intelligence, virtual and hybrid learning environments

2. Select and adapt digital content to support micro-learning, such as instructional videos and infographics

For service teachers (Level 2):
Competence 6. Learning outcomes

1. Demonstrate a productive use of up-to-date technologies to facilitate student learning in STEAME PBL learning activities, including artificial intelligence, virtual and hybrid learning environments

2. Create, modify and/or appropriately share digital content to support micro-learning, such as instructional videos and infographics

3. Developed Competences
This module primarily cultivates the following competences from the STEAME Teachers Competence Framework:
Main competences:
Competence 6: Support STEAME projects with the right learning environment and resources
Secondary competences:
Competence 1: Design and implement context-bound STEAME projects
Competence 3: Monitoring STEAME projects and reporting
Competence 4: Embed learning in truly interdisciplinary STEAME projects
Competence 11: Apply creativity and innovation in STEAME projects
Competence 12: Keep learning about STEAME projects and share knowledge

Key Skills and Competences Developed:

The primary aim of this module is to foster the development of the following key skills and competences in both student teachers and service teachers:

- Knowledge Acquisition: Possess and acquire knowledge of modern technology tools and software relevant to STEAME fields, emphasizing online safety and ensuring responsible use of technology resources.
- Technology Integration: Incorporate current and emerging technologies seamlessly into PBL and STEAME education and research.
- Engagement and Enhancement: Use modern technologies to actively engage students in the educational process, enhancing their creativity, critical thinking, problem-solving skills, and motivation while facilitating effective learning.
- Resource Creation: Develop the ability to create educational resources using up-to-date technologies specifically designed for PBL and STEAME education.
- Virtual and Hybrid Learning: Proficiently use virtual and hybrid learning environments to enhance the STEAME education experience.
- Collaboration and Inclusion: Promote teacher and student collaboration, active participation, and the inclusion of all students in the learning process through the strategic utilisation of modern technologies.

4. Content and Resources (Including Presenter's Notes)

The workshop for this module delves into an array of themes aimed at equipping educators with practical insights and skills for integrating technology into their teaching practices. The constituents of this workshop encompass:

- Applying Technologies to Modelling and Problem Solving:
  - Exploration of technologies such as programming, AI, computer algebraic systems, dynamic geometric software, CAD/CAM software, and more.
  - Emphasis on applying these technologies to model and solve problems across diverse disciplines, including mathematics, sciences, economics, arts, and entrepreneurship.
- Implementing Technologies in PBL STEAME Teaching:
  - Strategies for incorporating technologies in the classroom to enhance learning activities.
  - Creating an appealing and engaging learning environment by leveraging current and emerging technologies.
- Creating Digital Educational Resources and Quizzes:
  - Guidance on utilising technologies to develop digital educational resources.
  - Techniques for creating interactive quizzes that assess students' knowledge and skills effectively.
- Using Technologies for Project Development, Planning, and Management:
  - Practical insights into leveraging technologies throughout the project development lifecycle.
  - Strategies for efficient planning and management of STEAME projects through the integration of relevant technologies.
- Sharing STEAME Projects and Resources:
  - Exploring methods and tools for effectively sharing STEAME projects and resources.
  - Emphasis on fostering collaboration and knowledge-sharing within the educational community.

Presenter's Notes for Workshop Organization:
Guidelines for organising the workshop include:

- Clearly defining the objectives of each thematic session.
- Providing hands-on demonstrations of technologies discussed.
- Encouraging interactive discussions and collaborative problem-solving.
- Allocating time for participants to explore and experiment with the technologies introduced.
- Offering supplementary resources and reference materials for further exploration.
- Incorporating group activities that promote networking and knowledge exchange.

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

The module adopts a comprehensive methodology designed to guide teachers through a progressive learning journey. The step-by-step approach includes:

Assessment of Current Knowledge and Skills:
- Identifying what teachers already know about the technologies under consideration.
- Recognizing their existing skills, competencies, and limitations.

Introduction to Additional Technologies:

- Presenting knowledge about additional technologies relevant to STEAME education.
- Encouraging teachers to connect this new information with their existing knowledge and competencies.

Independent and Collaborative Work:
- Facilitating independent and team-based activities to allow teachers to apply their knowledge practically.
- Encouraging collaboration and collective problem-solving.

Application in Project Development:
- Encouraging teachers to apply the acquired knowledge and skills in the development of their own STEAME projects.
- Providing support and guidance as educators navigate the practical implementation of technologies in their projects.

Methodology Support Strategies:
- Moderator-led presentations to convey foundational knowledge.
- Group activities focused on discussion and synthesis to promote interactive learning.
- Continuous encouragement for participants to share experiences and insights.
- Opportunities for hands-on exploration of technologies to reinforce learning.
- Dedicated time for reflection and discussion on the application of knowledge in real-world educational settings.

6. Instruments/Tools/Supporting Materials/Resources

This module harnesses a diverse array of instruments, tools, and supporting materials to provide a rich and immersive learning experience. Educators engaging with this workshop will have access to:

- Text Processors, Spreadsheets, Presentations, and Database Software:
  - Utilised for documentation, data analysis, and presentation of ideas within the workshop context.
- Dynamic Geometrical Software (e.g., GeoGebra, Desmos):
  - Facilitates hands-on exploration and visualisation of geometric concepts, enhancing the understanding of mathematical principles.
- Computer Algebraic Systems (CAS) (e.g., Wolfram Mathematica, Symbolab):
  - Empowers educators with computational tools for symbolic mathematics, aiding in problem-solving and equation manipulation.
- CAD/CAM Systems:
  - Introduces participants to Computer-Aided Design and Manufacturing systems, fostering a deeper understanding of applications in diverse disciplines.
- Programming Languages and Environments:
  - Enables educators to delve into the world of coding, fostering a foundation for computational thinking and problem-solving.
- Website Development Software:
  - Provides tools for creating and managing educational websites, enhancing the dissemination of information and resources.
- Online and Virtual Learning Environments:

- o Platforms that facilitate remote and virtual learning experiences, ensuring accessibility and flexibility in educational delivery.
- Platforms for Online Quiz Preparation:
  - o Supports the creation of interactive assessments to gauge student understanding and knowledge retention.
- Platforms for Image and Video Creation and Sharing:
  - o Equips educators with tools for creating engaging multimedia content, enhancing instructional materials and communication.
- Social Networks:
  - o Encourages collaboration and networking among educators, fostering a community of practice for ongoing support and resource sharing.
- YouTube Videos as Free Educational Resources:
  - o Leverages the vast repository of educational content on YouTube as a valuable resource for supplementary learning materials.
- Other Free Digital Educational Resources:
  - o Explores a myriad of freely available digital resources, ranging from e-books and interactive simulations to open educational resources (OER), providing a wealth of content for diverse educational needs.

This diverse toolkit ensures that educators are well-equipped with the necessary resources to engage with modern technologies effectively, fostering a dynamic and enriched learning experience for both teachers and students alike.

PART 1	Introductory Activities (Creating Interest, Connecting to Real-world Issues, and Leveraging Background and Experiences)
Learning Objectives	- Establish the primary tasks for participants to collaboratively utilise modern technologies in designing and implementing Project-Based Learning (PBL) within the STEAME fields. - Explore and identify the general knowledge, skills, and interests of participants related to the use of modern technologies in education.
Learning Outcomes	Upon completion of Part 1, participants will: - Demonstrate a clear understanding of the learning objectives and their relevance to PBL in STEAME education. - Articulate their individual knowledge, skills, and interests related to modern technologies in education. - Establish connections with peers, recognizing potential synergies and collaborative opportunities.
Competences	This part of the module contributes to the development of the following competences: - Competence 2: Consider formal education standards in STEAME projects. - Competence 5: Guide student learning in STEAME projects.

	- Competence 8: Promote student self-regulation and metacognition in STEAME projects.
	- Competence 11: Apply creativity and innovation in STEAME projects.
	- Competence 12: Keep learning about STEAME projects and share knowledge.
Content, Resources and Tools	- Flip chart, white sheets or a whiteboard / virtual whiteboard
	- Markers, colored pens, sticky notes
	- Timer
Activities	A. Introduction and Learning Objectives Setting (10 min):
	- Provide an overview of the session objectives and the importance of collaborative technology use in PBL.
	- Clarify the main tasks participants will engage in during the module.
	B. Presentation of Participants' Skills (10 minutes):
	- Each participant shares their experiences with various modern technologies in education.
	- Participants visually represent these aspects on provided sheets, a flip chart, or a whiteboard.
	- Participants take turns presenting their experiences to the group.
	C. Links (10 minutes):
	- After each presentation, participants post their visual representations on a shared wall or board.
	- The moderator encourages participants to identify connections or overlaps between their knowledge, skills, and interests.
	- Facilitate a brief discussion on potential collaborative opportunities based on shared experiences.
Estimated Time	30 min
Additional Information	- Encourage participants to highlight any challenges or successes they faced while using modern technologies in their teaching practices.
	- Emphasise the importance of building a collaborative learning community and fostering connections among participants.
	- Consider introducing a digital collaboration platform where participants can continue sharing resources and ideas beyond the workshop sessions.

(add more Activity sections as needed)

PART 2	Development Activities
Learning Objectives	- Explore the practical application of modern technologies in STEM education. - Analyse the advantages and challenges associated with the integration of these technologies.
Learning Outcomes	By the end of this session, participants will: - Demonstrate an understanding of how modern technologies can be effectively applied in organising and conducting STEAME learning processes. - Evaluate and articulate the advantages and potential problems related to the use of modern technologies in Project-Based Learning (PBL) within the STEAME context.
Competences	- Competence 6: Support STEAME projects with the right learning climate. - Competence 7: Involve students in STEAME projects.
Content, Resources and Tools	- Presentation materials - Whiteboard or flipchart - Markers - Sticky notes
Activities	A. Presentation and Discussion (15 min): - Provide a comprehensive presentation on the diverse applications of modern technologies in organising and conducting STEAME learning processes. - Facilitate a discussion highlighting practical examples and case studies. B. Discussion of Advantages and Disadvantages (15 min): - Participants divide into small groups. - Groups discuss and comment on the advantages and disadvantages of using modern technologies in PBL STEAME learning. - Each group records their findings by writing them down or placing sticky notes on the board under two categories - "Advantages" and "Problems." C. Group Reflection (5 min): - Each group shares a key advantage and a potential problem identified during their discussion.

	- Facilitate a brief reflection on common themes and differences emerging from the group discussions. D. Synthesis and Q&A (5 min): - Summarise key insights from the group discussions. - Open the floor for questions and answers, encouraging participants to seek clarification and share additional perspectives.
Estimated Time	40 min
Additional Information	- Encourage participants to draw connections between the advantages and potential problems identified and their own teaching contexts. - Discuss strategies for mitigating challenges and maximising the benefits of integrating modern technologies in PBL STEAME learning. - Consider incorporating real-world examples and success stories to illustrate the transformative impact of technology in STEAME education.

(add more Activity sections as needed)

PART 3	Practical Activities (Hands-on Activity) for Workshop Mode
Learning Objectives	- Develop competences for the effective application of modern technologies in organising Project-Based Learning (PBL). - Plan a STEAME project, demonstrating collaboration among teachers from different disciplines and outlining the technologies they would use. - Engage in finding and considering additional information to enhance the application of learned concepts.
Learning Outcomes	By the end of this session, participants will: - Exhibit enhanced competences in applying modern technologies for effective PBL organisation. - Demonstrate the ability to plan a collaborative STEAME project, incorporating various technologies at different stages. - Utilise additional information to enrich their understanding of the learned concepts.
Competences	- Competence 8: Promote student self-regulation and metacognition in STEAME projects. - Competence 9: Engage and coach to support learning.
Content, Resources and Tools	- Sample case studies - Experiential knowledge - Paper, whiteboard, large white sheets, markers - Internet and digital devices
Activities	A. Consideration of Case Studies (10 min):

	- Present and discuss selected case studies highlighting successful applications of modern technologies in STEAME projects.
	- Encourage participants to draw insights from these examples.
	B. Organizing Group Work (30 min):
	- Divide teachers into small groups, ensuring representation from various STEAME disciplines.
	- With moderator assistance, groups choose a joint project topic and select appropriate technologies for each stage of the project.
	- Preliminary preparation (e.g., AI Chatbot)
	- Experimental work (e.g., sensors, dynamic graphics software, navigation systems)
	- Presentation of results and project evaluation.
	C. Graphic Presentation and Justification (15 min):
	- Each group visually presents their project idea.
	- Groups justify the selection of technologies, emphasising their relevance and contribution to the project.
	- Encourage creative and collaborative discussions within each group.
	D. General Discussion of Group Work (5 min):
	- Open the floor for a brief general discussion.
	- Invite reflections on common themes, challenges, and innovative ideas emerging from the group presentations.
	E. Group Reflection and Additional Information Search (10 min):
	- Facilitate group reflection on the learning process and outcomes.
	- Encourage participants to search for additional information related to their project topics, leveraging the internet and digital devices.
Estimated Time	60 min
Additional Information	- Emphasise the importance of effective collaboration across disciplines for a holistic STEAME project.
	- Encourage participants to explore real-world applications and case studies relevant to their chosen technologies.
	- Foster an environment that promotes creativity, adaptability, and critical thinking during the planning and justification phases.

(add more Activity sections as needed)

PART 4	Evaluation of Learning Outcomes
Learning Objectives	Assess and self-assess the application of technology in STEAME Project-Based Learning (PBL).
Learning Outcomes	By the end of this session, participants will:

	- Effectively evaluate the advantages and disadvantages of technologies used in STEAME PBL. - Reflectively assess their understanding of technology integration in the development of STEAME projects.
Competences	- Competence 10: Reflection on performance as a STEAME project facilitator.
Content, Resources and Tools	- Whiteboard and markers - Internet-based evaluation tool
Activities	A. Discussion and Matrix Completion (15 min): - Facilitate a discussion on the advantages and disadvantages of technologies used in the presented STEAME projects. - Participants collaborate to complete a matrix on the whiteboard, categorising and discussing the identified advantages and disadvantages. B. Reflective Assessment (10-15 min): - Provide participants with an internet-based evaluation tool or a paper-based template. - Participants individually write a reflective assessment of their understanding of technology use in the development of STEAME projects. - Reflect on personal growth, challenges faced, and insights gained during the workshop. - Evaluate the effectiveness of technology integration in their proposed STEAME project. C. Group Sharing and Discussion (5 min): - Invite participants to share key reflections from their assessments within small groups. - Facilitate brief group discussions to encourage knowledge exchange and mutual learning. D. General Discussion and Conclusion (5 min): - Open the floor for a general discussion. - Summarise key takeaways and insights from the reflective assessments. - Conclude the session by emphasizing the importance of continuous self-assessment for professional development.

Estimated Time	25-30 min
Additional Information	- Encourage participants to be honest and specific in their reflections, focusing on both successes and areas for improvement. - Highlight the value of ongoing self-assessment as a tool for continuous improvement in the integration of technology in STEAME education. - Consider incorporating peer feedback or group discussions for additional perspectives and insights.

(add more Activity sections as needed)

7. Reflection and Closure activity

Reflection and Closure activity	
Learning Objectives	- Summarise key insights from the workshop. - Reflect briefly on personal growth and application of learned concepts.
Learning Outcomes	By the end of this reflection and closure activity, participants will: - Articulate the significance of modern technologies in STEAME education. - Identify one key takeaway and a strategy for integrating technology into their teaching practices. - Recognize the value of collaborative project planning in Project-Based Learning (PBL).
Competences	- Competence 11: Apply creativity and innovation in STEAME projects. - Competence 12: Keep learning about STEAME projects and share knowledge.
Content, Resources and Tools	- Flip chart or whiteboard - Markers - Reflection template or brief worksheet
Activities	A. Quick Group Reflection (10 min): - Participants quickly discuss key takeaways in small groups. - Share one main insight related to technology integration in STEAME education. B. Personal Reflection (5 min): - Individually reflect on personal growth during the workshop. - Write down one strategy for applying technology in teaching practices.

	C. Sharing Insights (10 min):
	- Each participant briefly shares their key insight with the larger group.
	- Facilitate a concise discussion on shared reflections.
	- D. Express Commitments (5 min):
	- Participants briefly express one commitment to applying workshop learnings.
	- Emphasise the significance of each commitment.
	E. Closing Remarks and Resources (5 min):
	- Provide brief closing remarks expressing appreciation for active participation.
	- Share post-workshop resources for ongoing support.
Estimated Time	30 min
Additional Information	- Encourage participants to focus on one impactful takeaway and its application.
	- Acknowledge potential fatigue and aim for a concise, positive conclusion.
	- Reiterate the value of participants' insights and commitments for continuous improvement.