WP3 Professional Development of STEAM Special Need educators

D3.3 Digital Learning Material for STEAM in Special Education

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Abstract

This report presents Deliverable 3.3, "Digital Learning Material for STEAM in Special Education," offering a comprehensive overview of the methodology used in developing, designing, and reviewing the materials. It also outlines the structure of the digital learning resources, which are now accessible on the SpicE project's Virtual Learning Environment (VLE) platform at: https://vle.spiceacademy.eu/

1. Digital course development methodology

This methodology provides a structured approach to digital course design, seamlessly integrating each phase with clearly defined learning outcomes and educational objectives. It emphasizes active stakeholder engagement, fostering effective communication, resource sharing, and continuous feedback throughout the development process. By leveraging the strengths of the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) alongside Agile methodologies, this approach ensures a dynamic yet organized process for creating digital course content. It highlights specific steps and tools that provide both flexibility and efficiency (Spyropoulou et al., 2014, 2019).

The process began in Work Package 2 (WP2) with a comprehensive needs analysis and competence development. It continued in Work Package 3 (WP3) with the design and development of the course content and will further advance in WP4 with the implementation and evaluation phases.

Step 1: Needs Analysis

The first step in our methodology was conducting a Needs Analysis. In the SpicE project, the outcomes from WP2 and the deliverables (Deliverables 2.1, 2.2 and 2.3), which included literature and surveys with teachers to understand the specific challenges they face when integrating STEAM activities and special education into their classrooms in the participating countries, were conducted.

Step 2: Selection of Competences

Building on the Needs Analysis (Deliverable 2.1), the next step involves selecting appropriate competences from the competence framework during the WP2. This framework (Deliverable 2.2) is designed to cover various aspects of STEAM education, specifically tailored for special education contexts. During this step (that were implemented during the first two steps in the WP3, Deliverables 3.1 and 3.2), the consortium carefully reviews and analyzes the educational needs identified in the previous step to select competences from the competence framework that are not only relevant but also directly applicable to the learners' contexts based on the need analysis results. The result of this step is a set of chosen competences that serve as the foundation for developing the curriculum, ensuring the learning experiences are both practical and impactful.

Step 3: Design and development of the digital content: Integration of ADDIE and Agile Methodologies

In the third step, for our methodology, we integrated the ADDIE (Analysis, Design, Development, Implementation, Evaluation) (Muruganantham, 2015) model with Agile methodologies, specifically using the LLAMA (Looks a Lot Like Agile Methods Approach)(Arimoto et al., 2015; Rapini, 2018). This hybrid approach allows for a structured yet flexible development process, enabling the team to respond quickly to feedback and make necessary adjustments throughout the project.

The modular structure of the course was designed to enhance flexibility and personalization, offering distinct, self-contained modules and units. Each module is composed of several units, which include detailed learning activities such as learning objects and descriptions, providing clear, focused content. Additionally, each unit is paired with evaluation assessments (closed ended questions), ensuring that learners can measure their progress and understanding as they advance. To further support learner engagement and motivation, online badges are provided upon the completion of each module's quiz assessment, recognizing and validating the learner's achievements. This structure allows learners to engage with the material at their own pace, selecting modules that align with their specific interests or requirements. This modular approach not only supports diverse learning pathways but also makes it easier to update and adapt the course content, ensuring its relevance and effectiveness over time.

Examples and Templates

To ensure a systematic and consistent approach to course development, several detailed guides were created, including the "Guide for Development of Material," the "Guide for Learning Outcomes," and the "Guide for Digital Material Development." These guides were accompanied by templates specifically designed to standardize course information and detail the necessary steps for each phase of the design process. We also developed additional guidelines tailored for creating interactive activities, such as engaging presentations and discussion forums. To track progress and ensure these guidelines were followed, we implemented a comprehensive tracking system, which played a critical role in maintaining the quality and consistency of the educational content.

Educational content templates were carefully designed to facilitate the creation of various learning materials, such as study documents, PowerPoint presentations, and transcripts. These templates ensured that all materials were consistently aligned with the course objectives and that each phase of the development process was clear, organized, and well-structured.

As part of the ADDIE model's Implementation phase, the developed materials underwent both technical and scientific reviews. The Hellenic Open University (HOU) conducted the technical review, while academic partners carried out the scientific review using a predefined evaluation form. Feedback was provided in the form of comments on the content or directly within the evaluation form until the materials reached their final version. Once finalized, the authors or the technical partner completed the digital implementation of these materials to ensure they were properly uploaded to the Virtual Learning Environment (VLE) platform.

Step 4: Implementation and Evaluation

In alignment with the ADDIE model, the developed materials will be implemented in real-world educational settings as part of Work Package 4 (WP4). During this phase, the consortium will closely monitor the effectiveness of the materials, collecting feedback from both educators and learners. This feedback will be crucial for assessing the success of the learning materials and identifying areas for improvement.

To evaluate the materials, we will employ a combination of post-implementation surveys and focus groups, as outlined in the training implementation work plan. This evaluation process will ensure that the materials meet the intended educational goals and are effectively supporting the learners' needs, allowing for necessary adjustments to be made to enhance their impact.

The developed digital content overview

The digital content features original videos, study documents, interactive learning activities, self-assessment quizzes, forum discussions, and external resources with embedded hyperlinks. The videos are equipped with subtitles in all partner languages, ensuring accessibility for all learners. Additionally, the study documents have been made available in the languages of all participating countries, providing inclusive and comprehensive support across the project's diverse linguistic landscape.

The content has been uploaded to the VLE of the project and are accessible at the subdomain: https://vle.spiceacademy.eu/

2. Table of the digital content for the MOOC

Table 1: Table with the developed digital content

Week	Module	Unit	Content
0	Information about the course	-	- 3 videos directly related to partner languages (one in Greek, one in Spanish, and one in Bulgarian), providing an introduction to the SpicE project, the training program, the structure, and the evaluation methods of the courses.
1	Module 1.1: Structure of the MOOC and the training program	- Introduction to MOOC and meet the tutors - Unit 1.1.2 Engaging with the E-learning Community	- 1.1.1.a Who we are and what is this training program! (video) - 1.1.1.b Meet our tutors! (Hypertext) - 1.1.2.a The MOOC and its tools (video)
	Module 1.2: The SpicE project	- 1.2.1 Introduction to the Spice Project - 1.2.2 The significance of inclusive STEAM education - 1.2.3 Motivation and Change in Inclusive STEAM Education	- 1.2.1.a The SpicE project (video) - 1.2.2.a Why Inclusive STEAM Education? (video) - 1.2.3.a Motivation and Change in Inclusive STEAM Education (podcast) - 1.2.3.b What are the difficulties of inclusive Education according to you? (forum activity)
	Module 1.3: Building a community of Inclusive STEAM educators	- 1.3.1 Introduction and Community building - 1.3.2 Networking and Collaboration in Inclusive STEAM Education	- 1.3.1.a SpicE Forum and How to (video) - 1.3.1.b Let's get to know each other! (forum discussion) - 1.3.2.a What do we want from our own Inclusive STEAM Collaborative Community? (forum discussion)
2	Module 2.1: The STE(A)M educational approach	- 2.1.1 From STEM to STEAM: An overview of the development of the STEAM education - 2.1.2 Why STEAM education? The value for teaching and learning - 2.1.3 Working together: The collaborative nature of STEAM - 2.1 Assessment	- 2.1.1.a The theoretical background of STEM and STEAM education (study document) - 2.1.1.b STEAM education (video) - 2.1.1.c The distinct principles of the subject disciplines encompassed in STEAM education and their commonalities (interactive activity) - 2.1.2.a The objectives of STEAM education (2 videos_PartA and PartB) - 2.1.3.a Collaboration between teachers for developing and/or implementing STEAM activities and projects (video)

		- 2.1.3.b Self-reflection on current practices in terms of collaboration among teachers of the school (study document) - 2.1.3.c Sharing of practices and experiences regarding STEAM education (forum discussion) - 2.1 Assessment quiz (close ended questions)
Module 2.2: Developing students' STEAM competences	- 2.2.1 Educational strategies in STEAM education - 2.2.2 Developing students' 21st century skills through STEAM education - 2.2.3 STEAM learning activities - 2.2.4 STEAM competences assessment - 2.2.5 Apps and tools for STEAM learning and teaching - 2.2 Assessment	- 2.2.1.a Educational strategies in STEAM education (study document) - 2.2.2.a Developing students' 21st century skills through STEAM education (video) - 2.2.3.a STEAM learning activities (study document) - 2.2.4.a STEAM competences assessment (video) - 2.2.5.a Apps and tools for STEAM learning and teaching (study document) - 2.2.5.b Apps and tools for STEAM learning and teaching – Your answers (forum discussion activity) - 2.2 Assessment quiz (close-ended questions)
Module 2.3: Assessment in STEAM activities/projects	- 2.3.1 Evaluation of STEAM assignments - 2.3.2 Methods and tools for evaluating STEAM assignments - 2.3 Assessment Quiz	- 2.3.1.a Theoretical principles of evaluation (study document) - 2.3.1.b Criteria for evaluating STEAM activity (video) - 2.3.1.c Elements of STEAM activity evaluation (video) - 2.3.2.a Methods and tools for evaluating STEAM assignments (video) - 2.3 Assessment quiz (close-ended questions)
Module 2.4: Participate and collaborate in STEAM Education Communities	- 2.4.1 Introduction to Communities of Practices (CoPs) - 2.4.2 STEAM Communities of Practice - 2.4.3 Can we build a national CoP of STEAM resources all together? - 2.4 Assessment Quiz	- 2.4.1.a Communities of Practice (video) - 2.4.1.b What can we remember about CoPs? (interactive activity) - 2.4.2.a Is there any common ground in our own needs and challenges in STEAM Education? (forum discussion) - 2.4.3.a Can we build a CoP of STEAM resources all together? (interactive activity)

			- 2.4 Assessment quiz (close-ended questions)
3	Module 3.1: Inclusive and Special Education Approaches	- 3.1.1 Relationships, similarities and differences between Special and Inclusive Education - 3.1.2 Important principles and applications of Universal Design for Learning - 3.1.3 Important principles and applications of Differentiated Instruction - 3.1.4 Practical applications of Differentiated Instruction - 3.1 Assessment Quiz	- 3.1.1.a Important parameters of successful special and inclusive education and the significance of Individualized Education Plan (study document) - 3.1.1.a Self-Assessment Activity - 3.1.2.a Theory and practice of Universal Design for Learning (study document) - 3.1.2.a Self-Assessment Activity - 3.1.3.a Theory and practice of Differentiated Instruction (study document) - 3.1.3.a Self-Assessment Activity - 3.1.4.a Applying Instructional Differentiation for Educational Inclusion (video) - 3.1.4.b Instructional Differentiation for Educational Inclusion of students with Mild Disabilities in STEAM lessons (forum discussion) - 3.1 Assessment quiz (close-ended questions)
	Module 3.2: Practical solutions and strategies for Inclusive and Special Education	- 3.2.1 Exploring Assistive Technology tools for students with mild disabilities - 3.2.2 Utilization of Assistive Technology tools to enhance the accessibility of STEAM education for Inclusive and Special Education - 3.2 Assessment Quiz	- 3.2.1.a Developing knowledge on Assistive Technology tools for students with mild disabilities (study document) - 3.2.1.b Matching needs with tools (video) - 3.2.1.b Self-Assessment Activity - 3.2.2.a UDL strategies and Assistive Technology tools for Inclusive STEAM Education (study document) - 3.2.2.a Self-Assessment Activity - 3.2 Assessment quiz (close-ended questions)
	Module 3.3: Facilitate inclusive competences	- 3.3.1 The importance of student diversity on selection of instructional methods and on initial assessment of educational needs according to teacher professional identity	- 3.3.1.a Consideration of student diversity in specifying assessment tools and instructional methods (study document) - 3.3.1.a Self-assessment Activity

		- 3.3.2 Instructional activities serving the goals of Equity, Differentiation, and Inclusion for students with Mild Disabilities attending STEAM lessons according to teacher professional identity - 3.3 Assessment Quiz	- 3.3.1.b Consideration of student diversity in specifying assessment tools and instructional methods (video) - 3.3.1.b Self-Assessment Activity - 3.3.2.a Instruction for the promotion of Equity, Differentiation, and Inclusion for students with Mild Disabilities attending STEAM lessons (study document) - 3.3.2.a Self-Assessment Activity - 3.3.2.b Instruction for the promotion of Equity, Differentiation, and Inclusion for students with Mild Disabilities attending STEAM lessons (video) - 3.3.2.b Self-Assessment Activity - 3.3 Assessment quiz (close-ended questions)
	Module 3.4: Assessment for Inclusive Education	- 3.4.1 Formative and summative assessment of learners' progress - 3.4.2 Formative and summative assessment methods for an inclusive classroom - 3.4 Assessment Quiz	- 3.4.1.a The concept of assessment in education: formative and summative assessment (study document) - 3.4.1.b Methods of formative and summative assessment (interactive activity) - 3.4.2.a Formative and summative assessment activities (video) - 3.4 Assessment quiz (close-ended questions)
	Module 3.5: Participate and collaborate in Communities related to Inclusive and Special Education	- 3.5.1 Exploring different communities related to Inclusive and Special Education - 3.5.2 What initiatives does your local community undertake to encourage inclusive and Special Education practices? - 3.5 Assessment Quiz	- 3.5.1.a Local community practices for promotion of Inclusive Education (video) - 3.5.1.b Engaging in local community practices for promotion of Inclusive Education (study document) - 3.5.2.a Local community initiatives to encourage inclusive and Special Education practices (study document) - 3.5 Assessment quiz (close-ended questions)
4	Module 4.1: Introducing Inclusive and Special	- 4.1.1 Future-Ready Learning: Unveiling the Necessity of STEAM Education	- 4.1.1.a WebQuest: STEAM in our society (interactive activity – webquest) - 4.1.1.b STEAM projects in schools (2 videos)

education strategies in STEAM activities/projects	- 4.1.2 Inclusive Horizons: Understanding the Reciprocal Impact of STEAM Education - 4.1 Assessment Quiz	- 4.1.1.b Self-Assessment Activity - 4.1.2.a Inclusion and STEAM education at The Smithsonian Institution (video) - 4.1.2.b Tandem Inclusion and STEAM education (forum discussion) - 4.1 Assessment quiz (close-ended questions)
Module 4.2: The influence of STEAM education in Inclusive and Special Education	- 4.2.1 Introduction to inclusive STEAM teaching and learning techniques - 4.2.2 Practical examples of inclusive STEAM teaching and learning techniques - 4.2.3 Best Practices of inclusive STEAM teaching and learning techniques in everyday classrooms - 4.2 Assessment Quiz	- 4.2.1.a Fundamental teaching and learning techniques for inclusive and special education (study document) - 4.2.1.b Inclusive and special education teaching techniques for STEAM education (video) - 4.2.2.a Instructional and educational methods to promote inclusive and special education (study document) - 4.2.2.b Inclusive STEAM teaching and learning techniques (video) - 4.2.3.a Inclusive techniques in STEAM activities/projects (interactive activity) - 4.2.3.b Inclusive strategies and methodologies in STEAM activities/projects (forum discussion) - 4.2 Assessment quiz (close-ended questions)
Module 4.3: Participate and collaborate in Communities related to Inclusive STEAM education	- 4.3.1 Netiquette: What is Netiquette and what do we know about it? - 4.3.2 (N)etiquette in our Inclusive STEAM CoP and Classroom? Let's make it work! - 4.3 Assessment Quiz	- 4.3.1.a What is Netiquette? (video) - 4.3.1.b What can we remember about Netiquette? (interactive activity) - 4.3.2.a What are the most important rules within our Inclusive STEAM CoP and Classroom? (forum discussion activity) - 4.3.2.b Netiquette and learning contract! (video) - 4.3.2.c Can we build a CoP of learning/ behavior contracts resources all together? (interactive activity) - 4.3 Assessment quiz (close-ended questions)

5	Module 5.1(PART A): Educational practices for identifying and monitoring students' needs in STEAM activities/projects	- 5.1(A).1 Assessing students' needs - 5.1(A).2 Analyze and monitor learners' needs in an Inclusive STEAM context	- 5.1(A).1.a Need for evaluation of STEAM activities (study document) - 5.1(A).1.b Methods and tools for evaluating (video) - 5.1(A).2.a Analysis of result (video) - 5.1(A).2.b Possible measures after the analysis (video) - 5.1(A).2.c Self-Assessment Activity
	Module 5.1(Part B): Educational practices for identifying and monitoring students' needs in STEAM activities/projects	- 5.1(B).1: Identification and addressing the needs of STEAM students - 5.1(B).2 Implications of STEAM students' needs - 5.1 Assessment Quiz	- 5.1(B).1.a We know the needs of students in STEAM environments (video) - 5.1(B).1.b Adapting lesson plans for our students (forum discussion activity) - 5.1(B).2.a Strategies and resources for creating learner profiles (study document) - 5.1 Assessment quiz (close-ended questions)
	Module 5.2: EU educational policies	- 5.2.1 EU Policies that promote STEAM Education and Inclusion - 5.2 Assessment Quiz	- 5.2.1.a EU Policies for STEAM Education and Inclusion (study document) - 5.2.1.b European pillar of social rights (video) - 5.2 Assessment quiz (close-ended questions)
	Module 5.3: Participate and collaborate in Communities related to Inclusive STEAM education	- 5.3.1 What are the basics of Psychology of the Digital Age? - 5.3.2 Needs and behavior identification in our Inclusive STEAM CoP and Classroom? Let's make it work! - 5.3 Assessment Quiz	- 5.3.1.a How can we protect our online identity? (video) - 5.3.1.b How the digital era has affected our psychology? (study document) - 5.3.2.a Do our students present challenging behaviors? (forum discussion activity) - 5.3.2.b Can you identify the above challenging behaviors? (interactive activity) - 5.3.2.c Can we build a CoP of students' needs/ behaviors identification resources? (interactive activity) - 5.3 Assessment quiz (close-ended questions)

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