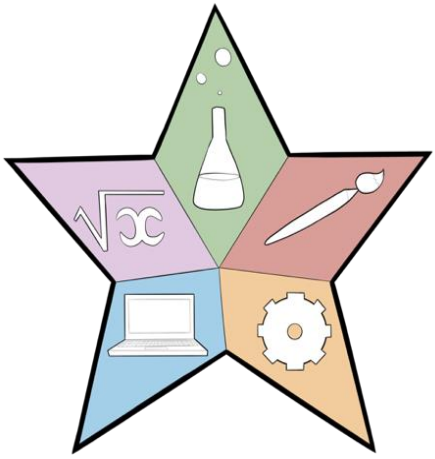


STEAM Stars

2019-1-UK01-KA201-061537

Intellectual Output 4:

Guidelines to promote transparency and recognition of teaching STEAM education for gifted students

This Project has been funded with the support of the European Commission. The information reflects the views of the authors, and Commission cannot be held responsible for any use which may be made of the information contained therein

Contents

Introduction

The aim of the STEAM Stars project (2019-2022) was to design a European Framework of Competences in teaching STEAM education for gifted students, promoting innovative methods and pedagogies and developing Open Educational Resources (OER) and tools in STEAM gifted education. The envisaged long-term impact of the project will be a strengthening of the school education system in Europe.

The STEAM Stars materials have been developed through a multidisciplinary collaboration between seven organisations, including universities, education authorities and experts, and social innovation specialists from five countries. The coordinator, Coventry University, is in the UK, and the partners are: INFODEF and Zabala in Spain, the Rotterdam University of Applied Sciences in The Netherlands, Dokuz Eylul University of Izmir and the Ministry of Education's General Directorate of Special Education and Guidance Services in Turkey, and Innoquality Systems in Ireland.

These guidelines introduce the STEAM Stars outcomes produced during the project and are addressed to policy makers, educational administrations and institutions, schools, educational experts, and non-formal and informal learning providers who want to support teachers to implement the European Framework of Competences in teaching STEAM education for gifted students.

These guidelines consist of the following sections:

- In the first section, the STEAM Stars project background is described.
- The second section introduces the STEAM Stars structure and outputs, and the main units and lessons of the MOOCs are defined.
- The third section describes the conclusions of the STEAM Stars Open Campus and Assessment App pilot testing, in which educators evaluated the learning materials and they ways in which they could use them in their teaching practice.
- Finally, the fourth section provides recommendations for the recognition of prior learning, and the recognition of non-formal and informal learning.

Coventry, United Kingdom, December 31st, 2022
STEAM Stars project partners

1. Background

Evidence suggests that highly gifted learners represent as much as 15% of the EU school-age population (European Economic and Social Committee, 2013, p.3), although at present there is a marked scarcity of targeted teacher training in this area. As a result, most gifted students spend most of their time in mainstream classrooms without access to challenging work or teachers knowledgeable about the special learning needs of high-ability learners. That is the reality in countries like the UK, Ireland, Spain, the Netherlands, and Turkey.

Within this context, recent studies show that STEAM education (Science, Technology, Engineering and Mathematics, interpreted through the Arts) has enormous potential to provide more challenging and motivating exercises to gifted and talented students. However, despite significant interest in STEAM, it can be challenging for teachers to integrate it into their existing teaching practice.

In recognition of this need, and to better support teachers' understanding and use of STEAM education, the STEAM Stars project has produced a European Framework of Competences in teaching STEAM education for gifted children, promoting innovative methods and pedagogies designed to support these students and developing OER digital learning materials and tools.

National and European policies in teaching STEAM education for gifted students

According to the main conclusions extracted from the STEAM Stars report O4/A2: European Policies Analysis Report (see Annex O4/A2), which analyses national and European policies in teaching STEAM education for gifted students, policies and literature on the gifted dimension of STEAM are extremely limited. Regarding gifted education, there is a need to improve educational practices and activities aimed at gifted students, something which is impacted by the scarcity of teachers trained about the special learning needs of these highly able learners.

STEAM education policies and initiatives, however, are receiving continue political and financial support in the face of underachievement, the lack of student interest in STEM/STEAM studies and careers, and the unmet labour-market needs in STEM/STEAM-related sectors, which are likely to expand in the future. Recent research has detected an urgent need to continue improving the quality and relevance of STEAM skills development, to promote STEM/STEAM studies and careers and to support teachers' professional development.

2. Structure and outputs of the STEAM Stars project

The STEAM Stars project has produced a European Framework of Competences in Teaching STEAM Education for Gifted Students, defining for the first time the competences, knowledge and skills required to teach STEAM to high-ability learners. To further support schoolteachers, trainers and non-formal and informal educators in refining these competences, the project has produced the following outputs:

- **Output 1:** European Framework of Competences in teaching STEAM education for gifted students.
- **Output 2:** STEAM Stars Open Campus, a website comprising:
  - an Online Instructional Guide on Digital Competences for Virtual Learning,
  - a set of Training Modules, outlining the content of the open source learning materials and providing suggested classroom exercises, and
  - a suite of learning units structured as a Massive Open Online Course (MOOC).
- **Output 3:** STEAM Stars Assessment App, a practical and innovative web-based tool designed for users to evaluate their own competences against this European Framework of Competences.
- **Output 4:** These accessible guidelines to promote transparency and recognition of teaching STEAM education for gifted students.

OUTPUT 1: European Framework of Competences in teaching STEAM education for gifted students

The European Framework of Competences provides a reference of competences in teaching STEAM education for gifted students, using a common language to describe competences, skills, knowledge and proficiency levels that can be understood across Europe, following European standards and frameworks of reference such as the European Qualifications Framework (EQF).

The Framework consists of seven units designed to train educators in teaching STEAM education for gifted students. These are detailed below, and include the foundations of gifted education, the educational needs of gifted students, and the implementation of STEAM education for gifted students. Each unit provides an overview of the topics which will be covered in the STEAM Stars Open Campus, the competence which will result from studying the unit, and the anticipated learning outcomes which will be gained by completing the unit. These learning outcomes are structured using the EQF categories of knowledge, skills, and responsibility and autonomy.

The Framework will allow school managers, course designers, teachers, trainers, and examining bodies to define and develop new training paths and courses designed for schoolteachers, trainers and non-formal and informal educators. The Framework has been designed at level 6 of the EQF, which reflects the complexity, range, and level of learning expected to be achieved by primary and secondary school teachers, and is compatible with both ECTS and ECVET credit systems.

Unit 1. Foundations of Gifted Education

Understanding of the ways in which some gifted children may present and behave within the classroom, and awareness of some identifying characteristics of gifted students

Unit 2. Educational Needs of Gifted Students

Increased knowledge of the various manifestations of giftedness and how to recognise the educational needs of gifted students in order to meet their need for challenge, coaching and guidance

Unit 3. Curriculum Planning for Gifted Students

Knowledge of how to develop a curriculum that meets the unique needs of gifted students

Unit 4. Learning Environments for Gifted Instruction

Increased awareness of how the learning environment can impact and support gifted students

Unit 5. Teaching Key Competences for Success in STEAM to Gifted Students

The ability to define STEAM and apply complementary soft skills and digital literacy practices to provide enrichment for gifted students

Unit 6. Instructional Design of STEAM for Gifted Students

The ability to define disciplinary, multidisciplinary, interdisciplinary, and transdisciplinary approaches, and apply the basic instructional design features for STEAM with gifted students

Unit 7. Implementation of STEAM Education for Gifted Students

The ability to implement a curriculum which supports gifted students towards successful performance both in and out of the classroom

Summary of competences arising from the STEAM Stars Framework

OUTPUT 2: STEAM Stars Open Campus

@@The STEAM Stars Open Campus addresses the needs of primary and secondary education teachers and defines the competencies that they should develop to teach STEAM education to gifted students. It can be used by various organisations across Europe for the purpose of implementing teacher training programs in the context of school education.

The STEAM Stars Open Campus contains innovative Open Educational Resources (OER), including training contents, practical activities and assessment methods to be used by of school teachers, trainers and non-formal and informal educators working with gifted students.

The Open Campus on teaching STEAM education for gifted students provides online ICT-based educational delivery and management, as well as access to information, tools and innovative resources.

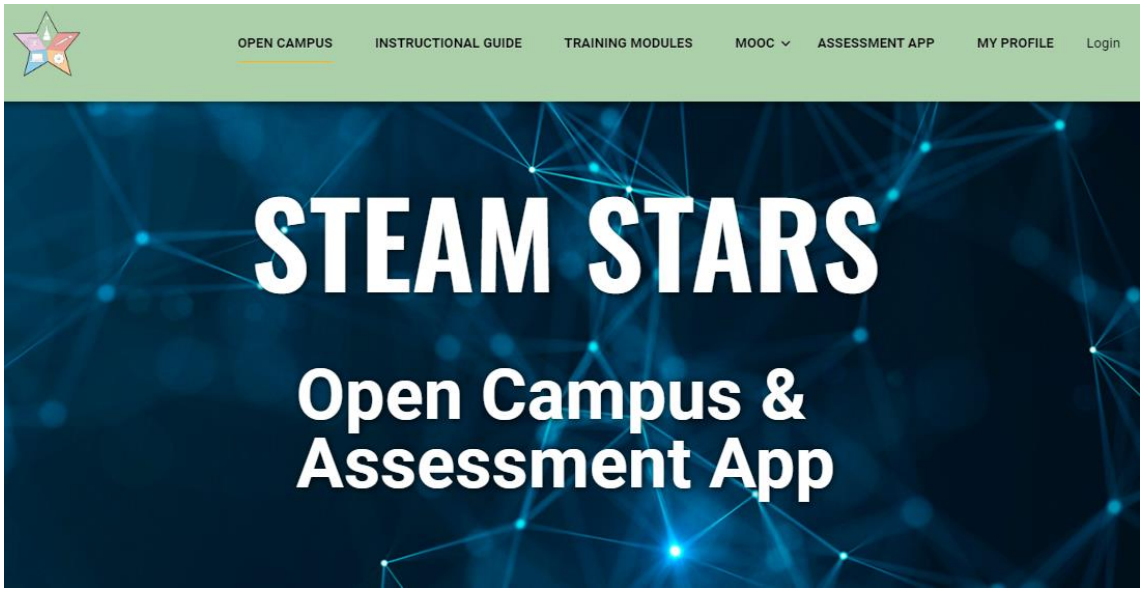
The STEAM Stars Open Campus includes different elements of innovation, such as:

- an **Online Instructional Guide on Digital Competences for Virtual Learning**
- a set of structured **Training Modules**
- and **Massive Open Online Courses (MOOC)**

STEAM Stars Open Campus

This STEAM Stars Open Campus contains training materials and assessment tools for use by teachers, parents, and others who work with gifted children, or who are interested in learning more about identifying and supporting those who are gifted. The Open Campus is available in the four languages of the project (English, Spanish, Dutch, and Turkish).

To explore the STEAM Stars Open Campus: https://en.opencampus.steamstarsproject.com/



The STEAM Stars Open Campus includes the following sections:

Instructional Guide

This Online Instructional Guide on Digital Competences for Virtual Learning aims to improve the digital skills and facilitate the interaction with virtual learning environments of schoolteachers, trainers and non-formal and informal educators, by providing a simple and easy-to-apply guide for anyone who has no prior knowledge on how to create and deliver an eLearning course.

To explore the Online Instructional Guide on Digital Competences for Virtual Learning: https://en.opencampus.steamstarsproject.com/online-instructional-guide/

Training Modules

STEAM STARS Training Modules have been designed as a pedagogical tool providing a set of proposed training contents and practical activities with which schoolteachers, trainers and non-formal and informal educators can work to develop and implement the European Framework of Competences in teaching STEAM education to gifted students.

The Training Modules include:

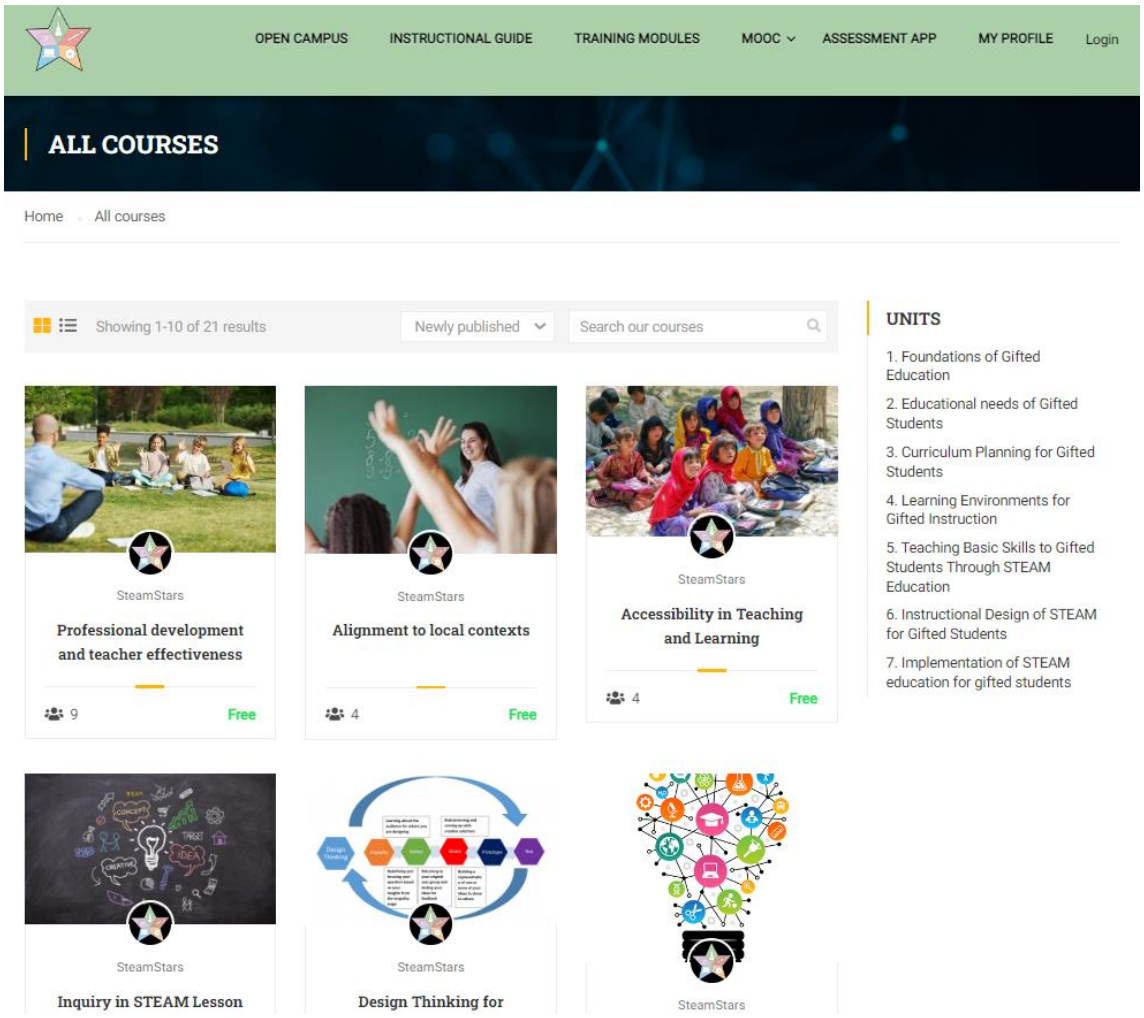
A) Training Contents: A Course Plan proposal including a suggestion of contents, proposed methodology, instructions for the assessment, tips for teachers, trainers and educators as well as references.
B) Practical Activities: A collection of face-to-face practical activities on teaching STEAM education for gifted students.

To explore the Training Modules: https://en.opencampus.steamstarsproject.com/wp-content/uploads/2022/05/STEAM-Stars_Training_Modules_EN.pdf

Massive Open Online Courses (MOOC)

The MOOCs are addressed to School teachers, trainers and non-formal and informal educators, organised in areas, levels and units.

To explore the Massive Open Online Courses (MOOC): https://en.opencampus.steamstarsproject.com/mooc/



In the following section, we provide a summary of each unit and lesson.

UNIT 1. FOUNDATIONS OF GIFTED EDUCATION

Lesson 1.1 Gifted Children in the Classroom

This course will introduce you to some of the skills related to teaching gifted students. It will make use of the content of earlier courses in this Learning Unit, and these topics will be explored in more depth in later Learning Units.

Lesson 1.2 Definitions and Characteristics of Giftedness

This course provides an overview of the definitions and characteristics of giftedness.

Lesson 1.3 Introduction to STEAM and Gifted Education

This lesson focuses on developing an understanding of the concept of STEAM and how it can be applied to gifted education.

UNIT 2. EDUCATIONAL NEEDS OF GIFTED STUDENTS

Lesson 2.1 The Educational Needs of Underachieving and Twice-Exceptional Gifted Students

This lesson focuses on underachieving and twice exceptional gifted students.

Lesson 2.2 Social and Emotional Needs of Gifted Students

This lesson focuses on the social and emotional needs of gifted children.

Lesson 2.3 Common Stereotypes & Common Traits

This course is intended to help educators to understand the common stereotypes and common traits of gifted students, identify gifted students, and adapt and create accessible learning environments for gifted students based on their accessibility needs.

UNIT 3. CURRICULUM PLANNING FOR GIFTED STUDENTS

Lesson 3.1 Curriculum Models for Gifted Students

By examining models of curriculum development, users can analyse the phases essential to the process.

Lesson 3.2 Curriculum Acceleration for Gifted Students

Curriculum acceleration entails working on the programme's contents more rapidly, which enables the teaching of these contents to be tailored to the students' precociousness

Lesson 3.3 Curriculum Enhancement for Gifted Students

Curriculum enhancement entails modifying components of the standard curriculum in order to increase the level of complexity and so adapt it to the development of a student with exceptional intellectual ability.

UNIT 4. LEARNING ENVIRONMENTS FOR GIFTED INSTRUCTION

Lesson 4.1 From Theory to Practical Implementation of Learning Environments in STEAM Education

This course provides an overview from theory to practical implementation of learning environments in STEAM education.

Lesson 4.2 STEAM Learning Environment for Gifted Instruction

This course provides an overview of STEAM learning environments for gifted instruction.

Lesson 4.3 Conceptual and Theoretical Framework of the Learning Environment for Gifted Students

The learning environment is the place where the learning processes related to the knowledge, skills and attitudes of the individual are carried out in order to achieve the desired behaviour.

UNIT 5. TEACHING BASIC SKILLS TO GIFTED STUDENTS THROUGH STEAM EDUCATION

Lesson 5.1 Using Digital Literacy Practices to Enrich STEAM Education for Gifted Students

This online course aims to help learners acquire a basic overview of what Digital Literacy is and why it is essential.

Lesson 5.2 Using STEAM to Work on Soft Skills with Gifted Students

This online course aims to help STEAM educators acquire a basic overview of what Soft Skills are and how to work on them with gifted students through STEAM education.

Lesson 5.3 STEAM, the Arts and Giftedness

This online course for Learning Unit 5 aims to help learners acquire a basic overview of why the Arts were a late addition to STEM, turning STEM into STEAM.

UNIT 6. INSTRUCTIONAL DESIGN OF STEAM FOR GIFTED STUDENTS

Lesson 6.1 Inquiry in STEAM Lesson Design

In this section, we examine inquiry-based teaching/learning, which is thought to have an important role in the education of gifted students.

Lesson 6.2 Design Thinking for Instructional Design

During this course, Design Thinking will be introduced, which will enable both the creation of an instructional design and the examination of the design idea in STEAM.

Lesson 6.3 Integration of Different Disciplines and STEAM Education

Today, it is important to associate disciplines as well as the different teachings of the disciplines. However, linking disciplines includes different approaches. Each discipline has its own concepts, and these concepts can sometimes be linked to concepts or problems in other disciplines.

UNIT 7. IMPLEMENTATION OF STEAM EDUCATION FOR GIFTED STUDENTS

Lesson 7.1 Professional development and teacher effectiveness

This course aims to help teachers to be able to understand the importance of Professional Development, especially in gifted education, and the criteria for assessment and documentary evidence of effective teaching.

Lesson 7.2 Alignment to local contexts

This course is aimed at help teachers to be able to understand the concept of Culturally Responsive Classrooms and to create strategies to adapt and/or Culturally Responsive Classrooms in STEAM and gifted education.

Lesson 7.3 Accessibility in Teaching and Learning

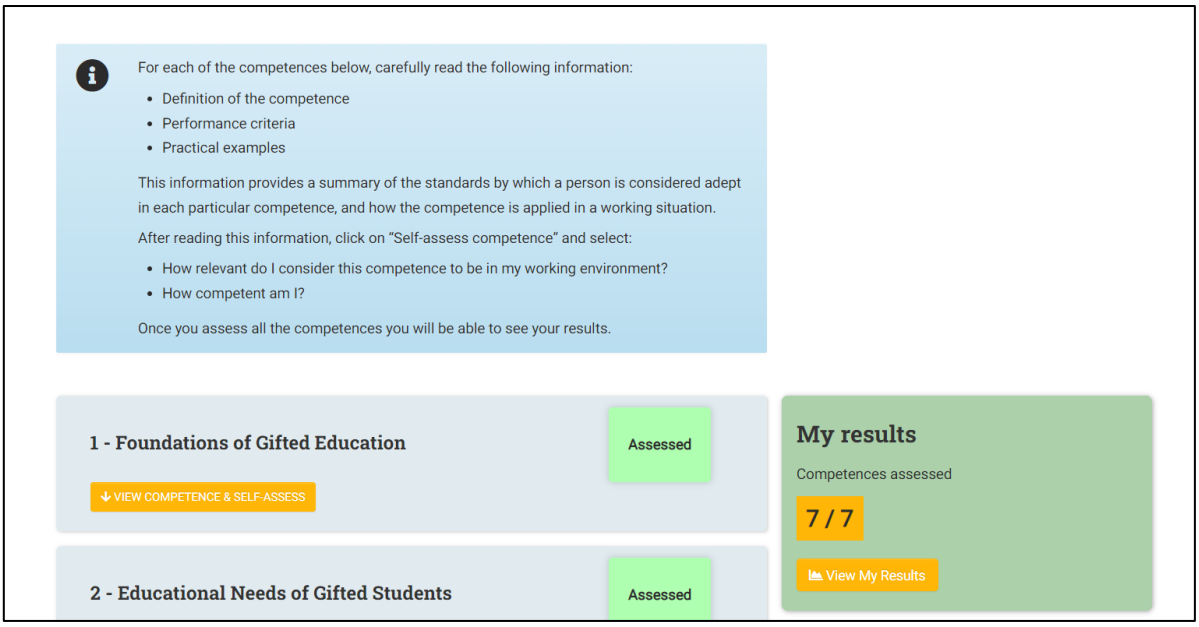
This course is aimed at helping teachers to understand accessibility in teaching and learning, to identify the different accessibility barriers in teaching and learning for gifted students, and to adapt and/or create accessible learning environments for gifted students based on their accessibility needs.

OUTPUT 3: STEAM Stars Mobile Assessment App

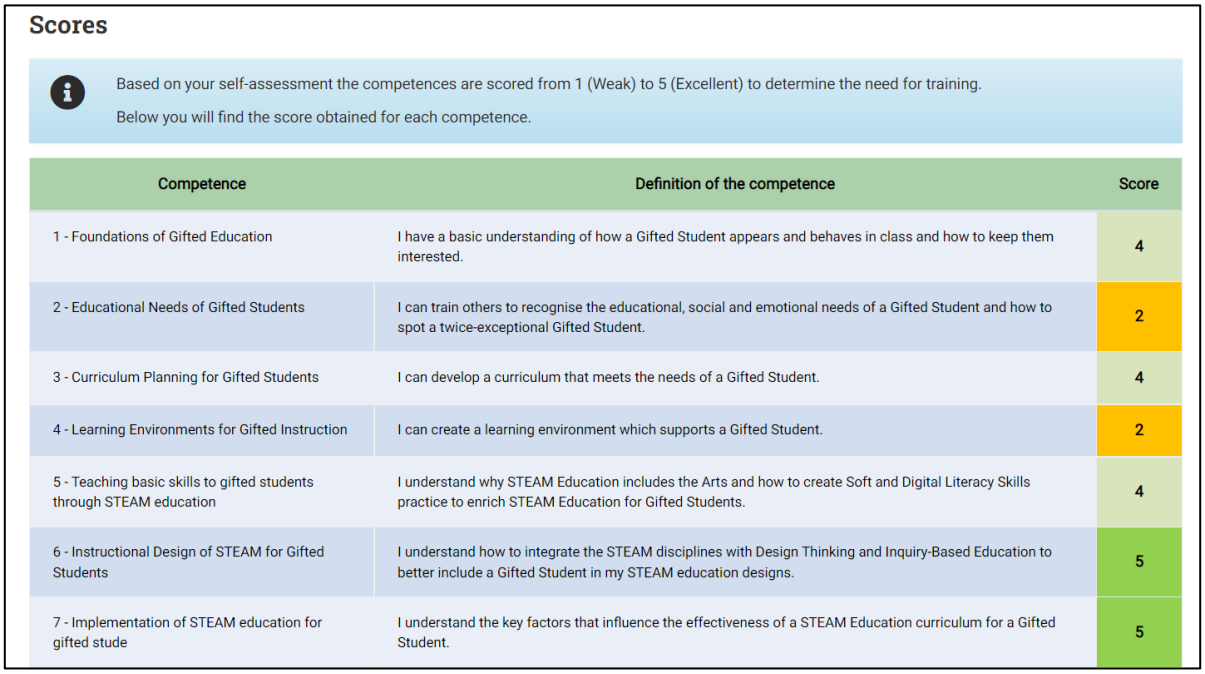
The aim of STEAM Stars Mobile Assessment App is designed for schoolteachers, trainers and non-formal and informal educators to evaluate the competences on teaching STEAM education for gifted students acquired though the European Framework of Competences.

The assessment allows to evaluate the current level of knowledge about teaching STEAM to gifted students and recommends courses within the MOOCs which will help to meet any training needs which are identified. The assessment tool also contains a development plan which provides a pathway to becoming a STEAM Stars ambassador for STEAM and gifted education.

The three screenshots below show the page on which users can review the summary of the competences, the way in which scores are displayed following the self-assessment, and the recommended training based on those scores.



Assessment App: self-assessment page



Competence	Definition of the competence	Score
1 - Foundations of Gifted Education	I have a basic understanding of how a Gifted Student appears and behaves in class and how to keep them interested.	4
2 - Educational Needs of Gifted Students	I can train others to recognise the educational, social and emotional needs of a Gifted Student and how to spot a twice-exceptional Gifted Student.	2
3 - Curriculum Planning for Gifted Students	I can develop a curriculum that meets the needs of a Gifted Student.	4
4 - Learning Environments for Gifted Instruction	I can create a learning environment which supports a Gifted Student.	2
5 - Teaching basic skills to gifted students through STEAM education	I understand why STEAM Education includes the Arts and how to create Soft and Digital Literacy Skills practice to enrich STEAM Education for Gifted Students.	4
6 - Instructional Design of STEAM for Gifted Students	I understand how to integrate the STEAM disciplines with Design Thinking and Inquiry-Based Education to better include a Gifted Student in my STEAM education designs.	5
7 - Implementation of STEAM education for gifted stude	I understand the key factors that influence the effectiveness of a STEAM Education curriculum for a Gifted Student.	5

Assessment App: scores based on self-assessment

Training recommendations

Here you will find some training recommendations to improve your competences.

For those competences with lower score, links to STEAM STARS online training resources are included in the last column.

Score	Training recommendations	Competences with this score	Recommended Training Resources
2		2 - Educational Needs of Gifted Students 4 - Learning Environments for Gifted Instruction	2. Educational needs of Gifted Students Go to training content 4. Learning Environments for Gifted Instruction Go to training content
4		1 - Foundations of Gifted Education 3 - Curriculum Planning for Gifted Students 5 - Teaching basic skills to gifted students through STEAM education	Not applicable
5		6 - Instructional Design of STEAM for Gifted Students	Not applicable

Assessment App: training recommendations based on scores

OUTPUT 4: Guidelines to promote transparency and recognition of teaching STEAM education for gifted students

The aim of this output is to provide a reference document with a coherent set of practical guidelines and recommendations to foster transparency and recognition on teaching STEAM education for gifted students. The Guidelines will support and will be aligned with other European transparency and recognition instruments, such as ECVET, EQAVET, EQF or Europass.

3. Conclusions of the STEAM Stars Open Campus and the Mobile Assessment App pilots

The objective of the pilot phase of the STEAM Stars project is to test and evaluate the project outputs in a real context with the target users. During the piloting phase, school teachers, trainers and non-formal and informal educators from Netherland, Spain, Turkey and United Kingdom have carried out and assessed the STEAM Stars Open Campus and the STEAM Stars Mobile Assessment App.

Feedback from 15 school teachers, trainers and non-formal and informal educators from those four countries has been collected from September to November 2022 through an online questionnaire. The detailed description of the pilot results can be found in *ANNEX O4A6. Evaluation report of the PILOT phase*.

Pilot 1: STEAM Stars Open Campus

From the 15 responses received during the pilot phase, 5 come from Turkey, 4 from UK, 4 from Netherlands, and 2 from Spain. The most common user profile has been school teacher/trainer/non-formal and informal educator working with the student-age group of Secondary level (12/13 – 16 years).

Regarding the usefulness of the STEAM Stars MOOCs, all the lessons have been rated as very useful with scores above 4,1 being the most valued one, Unit 4 Learning Environments for Gifted Instruction with scores among 4,7 – 4,9. Unit 7 Implementation of STEAM education for gifted students and Unit 6 Instructional Design of STEAM for gifted students have also received scores above 4,7. The least valued one has been Unit 3 Curriculum Planning for Gifted Students and Unit 5 Teaching basic skills to gifted students through steam education with scores between 4.1 and 4.3.

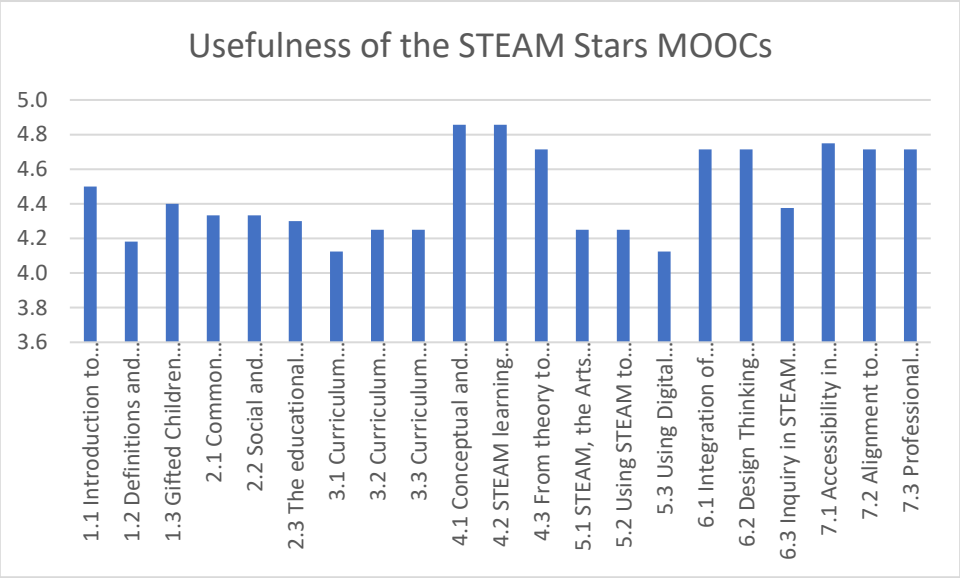


Figure 1 Usefulness of the STEAM Stars MOOCs

The overall rating of the STEAM Stars Open Campus has been very positive. The six questions related to the recommendation of the course to other fellow teachers, the application of the topics learned, the achievement of the outcomes, the usefulness of the course as gifted students' teachers, the educational impact, and the fulfilment of the expectations, have been valued as highly recommendable, applicable, with achievable outcomes, useful for gifted students and teachers, with high educational impact and fulfilling one's expectations with an average rate of 3,9/5.

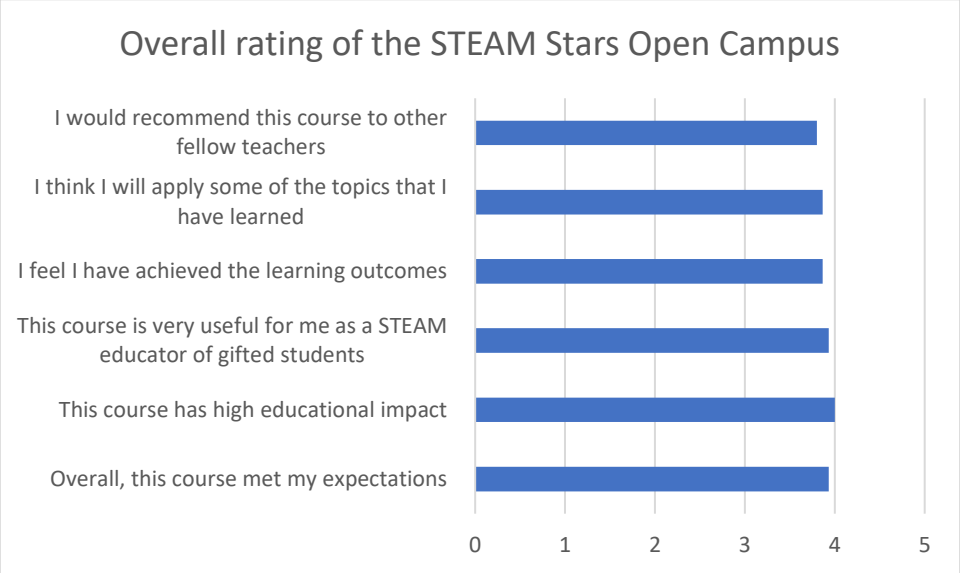


Figure 2 Overall rating of the STEAM Stars Open Campus

Pilot 2: STEAM Mobile Assessment App

Regarding the STEAM Stars Mobile Assessment APP, it has also received very positive feedback with an average rate of 4 out of 5 (average score of objectives, content, usefulness, usability, guidance during the pilot and overall rating).

The overall rating of the STEAM Stars Mobile Assessment App has also received very good feedback. The five questions concerning the overall rating of the Assessment App have been valued very positively (average score of 3,75) in terms of the usefulness of the assessment and the feedback obtained through the app, its educational impact, and the fulfilment of the expectations.

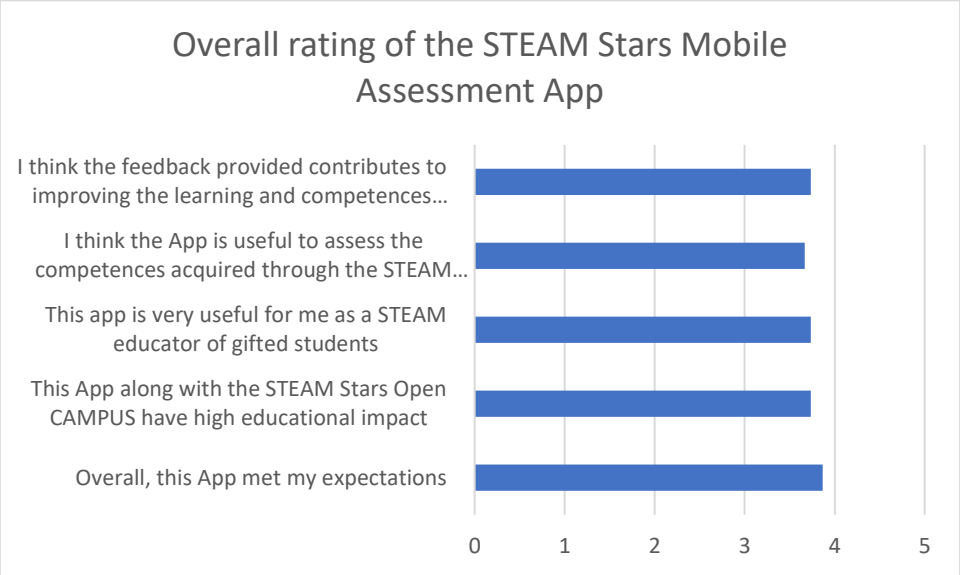


Figure 3 Overall rating of the STEAM Stars Mobile Assessment App

4. Recognition of prior learning and non-formal and informal learning

Based on the major findings gathered in the report O4/A3 (*see ANNEX O4A3. Recognition of prior learning and non-formal and informal learning*) which collects the main European methodologies, tools and frameworks of reference for the recognition of prior learning, and the recognition of non-formal and informal learning within the area of teaching STEAM education, national approaches to setting up these arrangements vary. While some countries take a national approach, others focus on specific sectors. Furthermore, opportunities for validation exist across the different sectors of education and extend into the labour market and third sector to different degrees.

Therefore, school teachers, trainers and non-formal and informal educators offering the STEAM Stars curricula, should establish an internal procedure for the purposes of identification, documentation, assessment, and certification of non-formal and informal learning.

1. **Identification.** The STEAM Stars project has developed training modules based on learning outcomes. The STEAM Stars curricula validation office should invite the candidates into dialogue with counsellors/advisors, possibly using particular tools, so as to identify which STEAM Stars curricula learning outcomes the candidate already achieves.

2. **Documentation.** As a second stage, the STEAM Stars curricula validation office will ask the candidate to provide evidence, so as to synthesise his/her portfolio. Almost every evidence should be taken into account, respecting always the national legislation.

3. **Assessment.** The STEAM Stars curricula validation office will compare the candidate's existing learning outcomes with the ones included in the STEAM Stars curricula using particular assessment methods. In this stage, the candidate becomes eligible to address only the competences that he/she needs so as to reach the range of the learning outcomes of each STEAM Stars curricula. No written or oral tests are foreseen so as to complete the assessment.

4. **Certification.** Learners will attain and complete the course and its partial competences and will take part in the final certification procedures, e.g., assessment tests, projects, etc. After that, the learner who successfully completes the final exams will get recognition of the achievement of particular learning outcomes and will be able to follow the particular STEAM Stars competences and eventually get the same STEAM Stars Certificate with the learners that successfully followed the complete STEAM Stars Curricula training modules. The same Certifications will be awarded to every learner who successfully completes the course, regardless of his/her type of enrolling, e.g., full course learner or partial course learner deriving from prior experience.

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6. ANNEXES

Annex O4/A2: European policies analysis report

Annex O4/A6: Evaluation report of the PILOT phase

Annex O4/A3: Recognition of prior learning and non-formal and informal learning