

STEM  
School  
Label



*STEM School Label Project Output 1*

**European STEM Schools Report**

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# **KEY ELEMENTS AND CRITERIA**

**EXECUTIVE REPORT**

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## RATIONALE

**This publication presents the results of an analysis developed to establish and validate the definition of a STEM (Science, Technology, Engineering and Mathematics) school. It describes (1) which are the key elements and criteria that should be taken into account when defining a STEM strategy at school level, which would ultimately characterise a STEM School, and (2) how the different phases in the information-gathering process to select these key elements and criteria were developed.**

It responds to the fact that STEM education has become a priority in European countries and strategies are being developed to improve teaching and learning and the uptake of studies and careers in STEM. The information provided in this report is based on a literature review and on consultations with four groups of key stakeholders in STEM education: schools, STEM teachers, Ministries of Education and STEM industries.

The report is written within the framework of the STEM School Label project, co-funded by the Erasmus+ Programme of the European Union (Grant Agreement N. 2017-1-BE02-KA201-034748). The STEM School Label project will develop a framework where school representatives will be able to evaluate their school's performance in STEM via an online self-assessment tool, according to the set of criteria defining a STEM School from this report. This self-assessment tool will help schools identify required areas of development and will provide suggestions of resources for applicant schools to improve their STEM activities at school level.

## **DEVELOPMENT OF KEY ELEMENTS AND CRITERIA TO DEFINE A STEM SCHOOL**

**The first step, in order to identify an initial set of key elements and criteria that describe a STEM School, consisted of a literature review, analysing the existing definitions, frameworks and classifications of the concept of a STEM School.** Creating a common or even clear definition of a school of this kind is still a complicated task, as the existing research efforts on the issue often appear isolated. Furthermore, STEM-focused schools are normally established in East-Asian countries or in the United States and do not appear to be common in European countries. However, some American frameworks were considered, including the Wisconsin STEM Education Program Self-Evaluation Rubric, the University of Chicago STEM School Study: The Eight Essential Elements of Inclusive STEM Schools, the Carnegie STEM Excellence Pathway, the Arizona STEM immersion Guide, and the Indiana STEM Strategy, from the Indiana Department of Education. Only one European framework was found, in the Flemish Community of Belgium, entitled STEM Framework for Flemish Schools: Principles and Objectives.

**The second step was the development of consultations addressed to four groups of stakeholders (schools, STEM teachers, Ministries of Education and STEM industries) identified as key actors in STEM education and in possession of relevant understandings to challenge, confirm and expand the initial set of key elements and criteria.** An initial survey was developed targeting a number of European schools (see Section 1. Survey of schools). Further consultations were addressed to STEM teachers, Ministries of Education and STEM industries (see: 2. Survey of STEM teachers, 3. Consultation of Ministries of Education, and 4. Consultation of STEM industries).

### **1. Survey of schools**

The respondents to the survey of schools included the organisations of the four STEM School Label project partner countries (Serbia, Portugal, Lithuania and France), as well as schools from five additional countries (Romania, Iceland, Finland, Norway and Belgium (Flanders)). At the end of the survey process, 31 responses were collected from nine different countries, which helped clarify the different elements and criteria.

## **2. Survey of STEM teachers**

195 STEM teachers from 31 different countries completed an online survey (192 respondents from 29 European countries and three from three non-European countries, namely Zambia, the United States and India). Of the European teachers, 185 concurred with the STEM School Label criteria, representing 96% of the total and leaving only seven of them (4%) in disagreement.

Out of the 185 affirmative answers, 151 agreed that the list of key elements and criteria was exhaustive enough and that no additional criteria should be added. Nevertheless, 30 teachers mentioned that extra criteria could be integrated and 21 of them made specific comments about this.

## **3. Consultation of Ministries of Education**

19 Ministries of Education, belonging to European Schoolnet's Ministry of Education STEM representatives Working Group (MoE STEM WG), were contacted to provide feedback on the key elements and criteria defining a STEM-oriented school. The responses ranged from appreciation of the development of this STEM School criteria, to specific comments clarifying the key elements, adding missing stakeholders to some criteria, or expanding some criteria.

## **4. Consultation of STEM industries**

A number of companies were also approached, taking into consideration their interest and involvement in STEM education and in projects promoting its improvement. For this reason, the companies contacted were selected among active members of two European Schoolnet-led projects: the privately funded STEM Alliance initiative and the Erasmus KA2 project SYSTEMIC. While the exhaustiveness of the key elements defining the strategy of a STEM School was confirmed, the need to include more detailed information within the definition of some criteria was highlighted.

## **Advisory Board**

Finally, the members of the STEM School Label Pedagogical Advisory Board (PAB) were consulted, to ensure the validity of the results.

## IMPROVEMENT OF THE KEY ELEMENTS AND CRITERIA TO DEFINE A STEM SCHOOL

**Overall, these various consultations revealed extensive satisfaction with and approval of the initial set of key elements and criteria defining a STEM School. These results are highly relevant, given that these impressions were collected from key stakeholders in the provision and development of STEM education. Nevertheless, the consultations also revealed that a number of key elements and/or criteria could be refined.**

The remarks from schools and teacher respondents and the consultations with Ministry of Education and industry representatives led to some adjustments of the initial key elements and criteria that should be included in the definition of a STEM School. Examples of elements and criteria that had to be refined included:

- It was made especially clear that teachers interpreted differently what each of the criteria within *Assessment* (that is, continuous and personalised) meant and that this needed to be clarified.
- Concerning *School infrastructure*, the boundaries between *Access to technology and equipment* and *High-quality instruction materials* were not clear enough and/or the criteria were too general.
- The industry representatives approached also noted the need for a better definition of some of these criteria. This was especially relevant regarding *Assessment*, *Connections* (specifically, connections with other schools and/or educational platforms) and *School infrastructure* (particularly regarding High-quality classroom instruction materials).
- The term “interdisciplinary” was repeated throughout the consultation results, stressing the importance of criteria not operating alone but being connected to one another.
- Ministry of Education representatives suggested some additional criteria to better define STEM Schools, which confirmed the results from the previous consultations with STEM teachers and industry representatives. The key elements *School infrastructure*, *Professionalisation of staff*, *School leadership and culture*, and *Assessment* were deemed to need a more in-depth and clarifying

definition; and in regard to the criterion *Connections*, linkages with universities were once more mentioned as relevant.

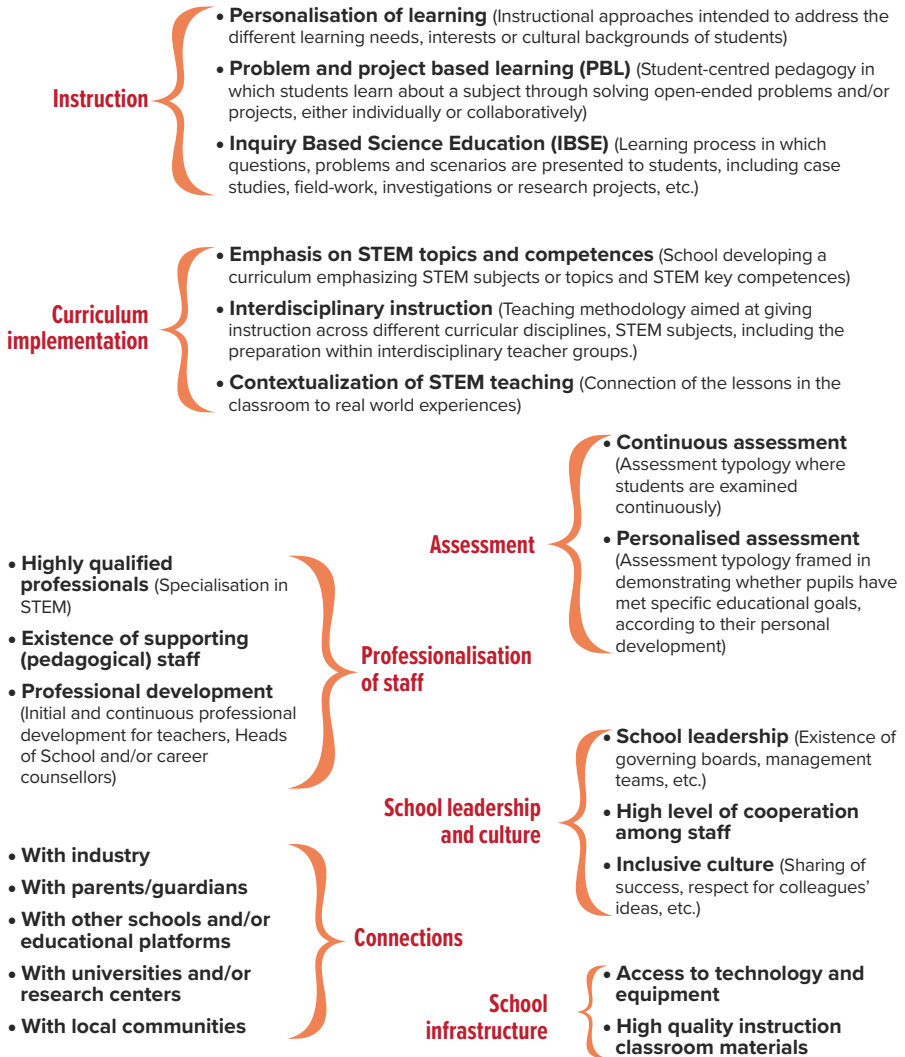
- In addition, the key element *Instruction* was repeated a number of times as being of great importance but in need of further clarifications (it should be noted that this was also acknowledged in the survey of teachers, in relation to the importance of better characterising the pedagogical approaches stated and better contextualising the STEM disciplines). Lastly, Ministries of Education also stressed the relevance of stating the interdisciplinary character of STEM education in all the criteria that were set out.
- *Project-Based Learning* was included under *Instruction*, alongside *Problem-Based Learning*.
- *Connections with universities and research centres* and *Connections with local communities* were both criteria added under the key element *Connections*.
- The wording of the *School infrastructure* key element was improved. Particularly, it was specified how *Equipment* was inherent to the criterion *Access to technology*;
- Contextualisation of STEM teaching, referred to as *Connection of the lessons in the classroom to real-world experiences*, was added under the key element *Curricula*.
- The key element *Curricula* was changed to *Curriculum implementation*.
- The criterion Specialised STEM curriculum was changed to Emphasis on STEM topics and competences (school developing a curriculum emphasising STEM subjects or topics and STEM key competences).

## FINAL KEY ELEMENTS AND CRITERIA TO DEFINE A STEM SCHOOL

**Following the different interventions, discussions and amendments, the final elements and criteria that a school's STEM strategy needs to fulfil in order to be considered a STEM school are displayed in Figure 1: Final set of key elements and criteria.**

## STEM School = School with a clear STEM strategy

# STEM School Key Elements And Criteria\*



*"It must be noted that all criteria mentioned do not operate alone but are connected to each other. When referring to a "STEM School", these criteria should always be considered in regards to STEM education. When the criteria are fulfilled for all subjects and at whole school level, we would be referring to a "Leading School".*

Figure 1: Final set of key elements and criteria



Finally, and according to the comments received from the consultations, it should be noted that all the criteria mentioned do not operate alone but are connected to one another and STEM Schools should have it in their plan to re-evaluate their STEM strategy on a regular basis. When referring to a “STEM School”, these criteria should always be considered in regard to STEM education. When the criteria are fulfilled for all subjects and at whole-school level, it was decided that we would be referring to a “Leading School”.

## **LOOKING AT THE FUTURE OF THE STEM SCHOOL LABEL PROJECT AND THE NEXT STEPS OF DEVELOPMENT**

Overall, the STEM School Label's mission for its next stage of evolution should be to develop the reference framework for schools to complete in order to be labelled a STEM School. This will be done using the aforementioned key elements and criteria and expanding the definition of them according to the comments received from the survey and the consultations carried out in this report. These key elements should be integrated in the management strategy of STEM-oriented schools in Europe and evaluated via the online self-assessment tool to be developed with this project.

It should also be noted that, following the consultations, the responses on most criteria mentioned in the survey outlined the great heterogeneity of situations among respondents and, in particular, among the schools and teachers assessed. Therefore, it seems important to consider the STEM School Label as an open tool, used to provide schools with ideas and guidelines, but which also allows flexibility in the criteria that will be assessed.

Last, it should be taken into account that these key elements and criteria could also be used to encourage other schools in developing a change management strategy regarding STEM in their own specific context. The STEM School Label should also have different effects on schools, including:

- 1.** The promotion of partnerships between schools and educational centres;
- 2.** The development and sharing of resources among educational stakeholders;
- 3.** The engagement of schools in a European STEM network, with the possibility of evolving through a mentoring process.

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- Yves Beernaert, Educonsult

### Ministries of Education

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## **Industry**

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- Axalta
- Obidos
- ICE Cubes

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- Athina Samara, Scientix Ambassador in Norway
- Guðmundur Karlsson, Scientix Ambassador in Iceland
- Irina Vasilescu, Scientix Ambassador in Romania
- Seppe Hermans, Scientix Ambassador in Belgium (Flanders)

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## ABOUT THE STEM SCHOOL LABEL PROJECT

Having recognised the importance of promoting STEM studies in schools, a number of organisations specialised in STEM education have joined forces to address the current lack of pupils embarking on STEM studies and STEM careers in a true multi-stakeholder approach. This joint commitment gave birth to the STEM School Label project.

Within this project, supported by the Erasmus+ programme, school representatives will be able to evaluate their school's performance in STEM via an online self-assessment tool according to a set of criteria defining a STEM School.

This self-assessment tool will identify required areas of development and provide suggestions of resources for applicant schools to improve their STEM activities at school level. The purpose of this strategic partnership project is to enable as many schools as possible to benefit from the STEM School Label, by also engaging the support of Ministries of Education.



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