Learn STEM
Innovative Model of learning STEM
in secondary schools

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ERASMUS+ KA220-SCH
Cooperation Partnerships in School Education

National Evaluation Report

PADERBORN
UNIVERSITY

University of Paderborn, Germany

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1. Introduction

This report aims to evaluate the outputs produced in the project, which include the LearnSTEM Pedagogical Model, the Teacher Training Programme, and the Online Learning Environment. This report offers a partner-centered perspective, showcasing the successes, challenges, and lessons learned during the project's implementation. The evaluation will help assess the effectiveness of the outputs and provide recommendations for improvements.

1.1 Project Overview

The LearnSTEM "Innovative Model of learning STEM in secondary schools "aims at enhancing the capacity of secondary schools to foster skills in subjects like science, technology, engineering, and mathematics using innovative and interactive teaching methods and approaches, improving students' attitudes and performance in the STEM areas of interest, exploring effective strategies for captivating students' attention and cultivating their interest in essential subjects like science, technology, engineering, and mathematics, which play crucial roles in both the present and the future, permeating all aspects of our lives motivating students to invest more time and effort into these subjects, recognizing the potential they hold in shaping their future endeavors. The following outputs were addressed when implementing the project.

1.1 In Work Package 2, the LearnSTEM Pedagogical Model has been developed,
1.2 In Work Package 3, the LearnSTEM Teacher Training Programme has been developed, and
1.3 In Work Package 4, the LearnSTEM Online Learning Environment has been developed.

1.2 Evaluation of LearnSTEM Pedagogical Model

This section summarises the evaluation of the LearnSTEM Pedagogical Model based on surveys from UPB, Germany.

Respondents

The survey was answered by 20 people out of the following professional areas: STEM (1), EKT (1), Craft (1), Educational Counselling (1), Smirking Dragon (1), School (6), Church (2), Student (2), Role play (1), Higher Education (1), Curriculum Development (1), Teacher Education (1), Extracurricular Education (1).

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In welchem Arbeitsbereich / Fachbereich sind Sie tätig? ⌄
MINT
EKT
Handwerk
Bildungsberatung
Smirking Dragon
Schule
Kirche
Kirche
Schüler
Rollenspiel
Grundschule, Naturwissenschaften
Sekundarschule Mathematik
MINT-Fach Hochschule
Schulleitung
Curriculum-Entwicklung
Lehrerfortbildung
Außerschulische Bildung
Lehrerin
Gymnasiallehrerin
Lehramtsstudent

Figure 1: Survey1-LearnSTEM Pedagogical Model-Question 2

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Fostering STEM skills in the classroom

Overall, the LearnSTEM Pedagogical Model was rated by the majority as very effective (8) and effective (6). Five people found it rather effective and only one person found it not effective at all. It can therefore be concluded that the model worked well in fostering STEM skills in the classroom.

Wie gut konnte das LearnSTEM Pedagogical Model die Entwicklung der MINT-Fähigkeiten Ihrer Schüler*nnen / Student*innen fördern?
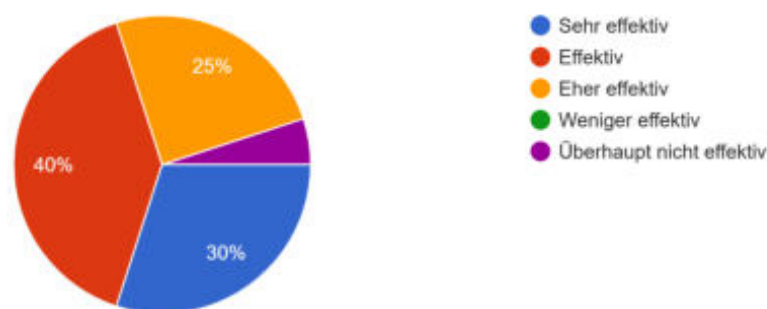20 Antworten

- Sehr effektiv
- Effektiv
- Eher effektiv
- Weniger effektiv
- Überhaupt nicht effektiv

Figure 2: Survey1-LearnSTEM Pedagogical Model-Question 3

Quality of the teaching content

The quality of the LearnSTEM Pedagogical Model was rated as excellent and good by 7 people each. 4 people rated the quality as average, while one person each rated the quality as poor and very poor. This results in a majority positive rating (70 %).

Wie bewerten Sie die Qualität des LearnSTEM Pedagogical Model insgesamt?
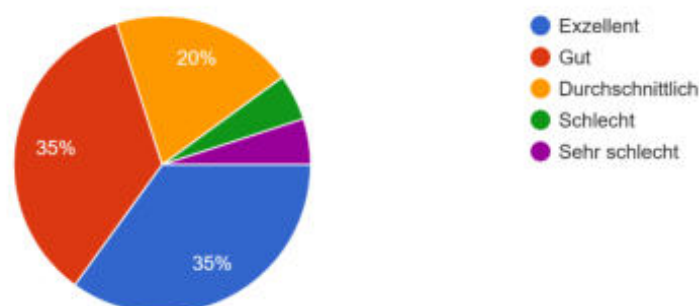20 Antworten

- Exzellent
- Gut
- Durchschnittlich
- Schlecht
- Sehr schlecht

Figure 3: Survey1-LearnSTEM Pedagogical Model-Question 4

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Relevance of the LearnSTEM Pedagogical Model

The relevance of the LearnSTEM Pedagogical Model was rated as very relevant by 75% of respondents (15). Only 4 people rated it as somewhat relevant and only one person rated it as less relevant. This leads to the conclusion that the teaching content is very relevant.

Wie relevant war der im Rahmen des Pedagogical Model vermittelte Lehrinhalt für die Bedürfnisse Ihrer Schüler*innen / Student*innen?
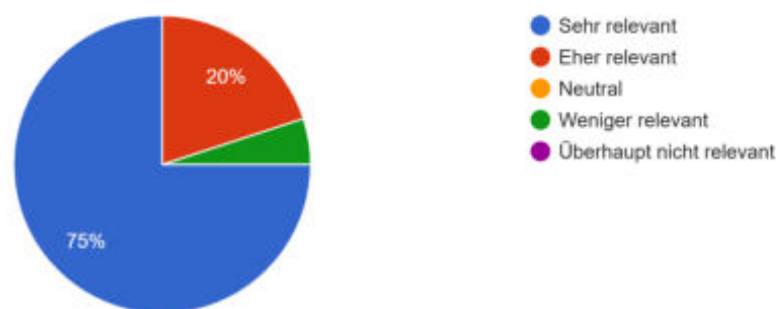
20 Antworten

Figure 4: Survey1-LearnSTEM Pedagogical Model-Question 5

Match of teaching content and learning objectives

Half of the respondents (10) are of the opinion that the teaching content fully matches the learning objectives of their learning group. 8 people think that the teaching content fits the learning objectives rather well. And one person each assumes that the content is partially and not at all well suited to the learning objectives of their learning groups. Overall, it can be assumed that the content is suitable for a majority of learning groups.

Wie gut passte der Lehrinhalt zu den Lernzielen Ihrer Schüler*innen / Student*innen zusammen?
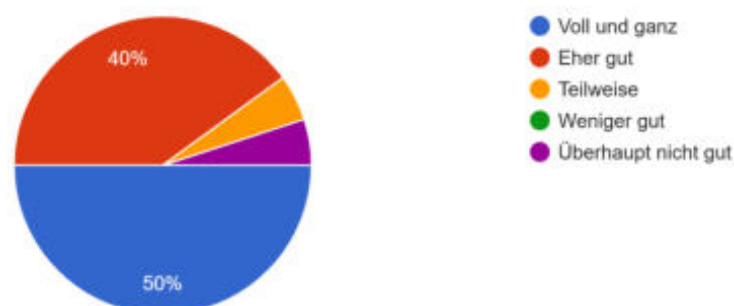
20 Antworten

Figure 5: Survey1-LearnSTEM Pedagogical Model-Question 6

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Level of difficulty

When it comes to the level of difficulty, the majority of respondents, i.e. 70% or 14 people, consider the content to be appropriate for their learning group. 3 people find the content rather difficult, 2 people find it too easy and one person finds it too difficult. Therefore, it can be assumed that the content has an overall appropriate level of difficulty for the majority of the learning groups in which the LearnSTEM Pedagogical Model was tested.

Wie angemessen war der Schwierigkeitsgrad des Lehrinhalts für Ihre Lerngruppe?
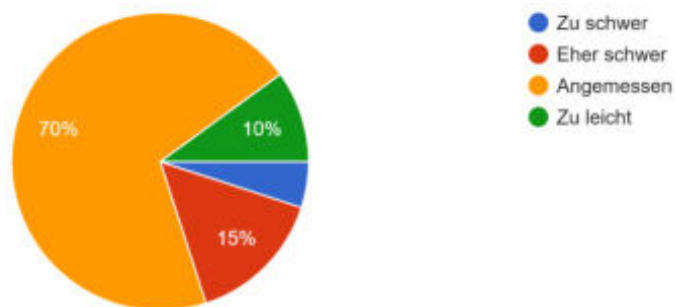20 Antworten

● Zu schwer
● Eher schwer
● Angemessen
● Zu leicht

Figure 6: Survey1-LearnSTEM Pedagogical Model-Question 7

Recommendations for improving the pedagogical model

15 people described recommendations for improving the pedagogical model:

- Outcomes sometimes difficult to achieve
- Is not explicitly for the craftsmanship
- STEM could be integrated into role-plays
- Better integration into the curriculum
- Fit for young people
- More application examples
- More age-appropriate materials
- Integrate peer feedback/opportunity for exchange
- Adaptation to national standards
- Check content! Shameful that this is funded by the EU. Uniformity in writing? Question whether the authors have understood the content! Far too superficial.
- More in-depth technical content
- More practical workshops
- More flexible application options
- The ethical focus can be strengthened
- Carry out longitudinal studies on effectiveness

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Figure 7: Survey1-LearnSTEM Pedagogical Model-Question 8

Suggestions for improvement of the teaching materials or methodology

8 people described suggestions for improvement of the teaching materials or methodology:

- Offer additional material for parents
- Focus more on the German perspective than on the EU
- Content quality of the teaching material
- More courses if necessary
- More interactive elements
- What is a method for the authors? METHOD is not a term that should be used inflationary, especially not in the STEM field
- Accessibility via website
- Presentation could be more modern

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Wie könnte das Lehrmaterial oder die Methode des Models verbessert werden?	⌄
Was ist für die Autoren eine Methode? METHODE ist kein Begriff, der inflationär verwendet werden darf, insbesondere nicht im MINT-Bereich	
Zugänglichkeit über Website	
keine Ahnung	
??	
ggf auch mehr Kurse	
mehr auf deutschen Blickwinkel als auf EU ausrichten	
-	
bin unsicher	
Inhaltliche Qualität des Lehrmaterials	
Darstellungsart könnte moderner sein	
Zusätzliches Material für Eltern anbieten	
Mehr interaktive Elemente	

Figure 8: Survey1-LearnSTEM Pedagogical Model-Question 9

Overall, the LearnSTEM Pedagogical Model was rated positively by various people from the education sector in Germany. The relevance of the teaching content to the needs of the learners and the appropriateness of the level of difficulty of the teaching content should be emphasised in particular.

1.3 Evaluation of LearnSTEM Teacher Training Programme

This section summarises the evaluation of the LearnSTEM Teacher Training Program based on surveys from UPB, Germany.

Respondents

The survey was answered by 29 people from Germany.

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Usefulness of the LearnSTEM Teacher Training Program

The majority of respondents rated the LearnSTEM Teacher Training Program as very helpful (13) and helpful (15). Only one person did not find the content helpful at all for planning their STEM lessons.

Inwieweit helfen Ihnen die beispielhaften Lehrpläne für die Planung Ihrer MINT-Unterrichtsstunden?
29 Antworten
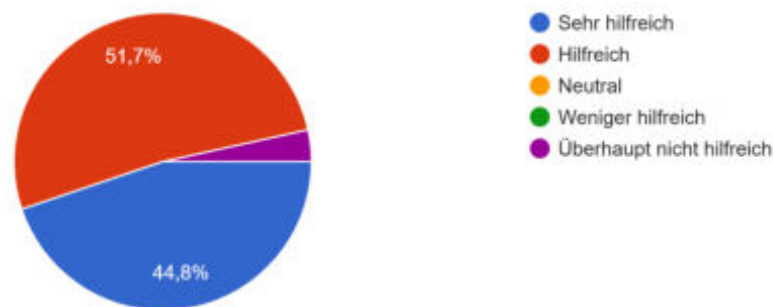
Figure 9: Survey2-LearnSTEM Teacher Training Program-Question 2

14 people explained their responses additionally:

- Inappropriate for the grammar school curriculum
- Suitable for teachers
- Cooperation in MINT is being expanded
- Can be well combined with IT lessons
- An interdisciplinary approach is encouraged
- Biology is one of the STEM subjects and fits in well here
- These are good examples that serve well as a basis for implementation.
- I plan my lessons according to a clear didactic approach. The things from LearnSTEM fit in well.
- Lesson planning is well supported.
- Planning always takes place in lesson series and the project documents help here.
- I hadn't given it much thought at first and orientated myself more towards subject-specific content.
- We didn't do much about it at university and not even during my traineeship. It's good that something is coming.
- That's the feeling.
- I only ever adapt my planning to a limited extent anyway.

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Begründen Sie Ihre Antwort zur vorherigen Frage hier:

Unpassend hinsichtlich Lehrplan am Gymnasium

Passend für Lehrkräfte

Kooperation in MINT wird ausgebaut

Kann gut mit dem IT Unterricht verbunden werden

Ein fächerübergreifernder Ansatz wird gefördert

Die Biologie ist eines der MINT Fächer uns passt hier gut ins Bild

Das sind gute Beispiele, die als Basis der Umsetzung gut dienlich sind.

Die Planung meines Unterrichts mache ich nach einem klaren didaktischen Vorgehen. Da passen sich die Sachen von LearnSTEM gut ein.

Die Stundenplanung wird gut unterstützt.

Planung erfolgt immer in Unterrichtsreihen und hier helfen die Dokumente des Projekts.

Ich hatte da erst wenig drüber nachgedacht und mich eher an fachlichen Inhalten orientiert.

In der Uni haben wir da wenig zu gemacht und auch im Referendariat nicht. Gut dass da mal was kommt.

ist so ein Gefühl.

Meine Planung passe ich eh immer nur begrenzt an.

Figure 10: Survey2-LearnSTEM Teacher Training Program-Question 3

Improvement of STEM skills

The majority of respondents have improved their understanding of teaching in STEM subjects as a result of the exemplary curricula (51.7% or 15 people), and even greatly improved (37.9% or 11 people). The understanding of two people improved only slightly and only one person stated that their understanding had not improved. Therefore, it can be assumed that the LearnSTEM teaching materials have improved understanding of STEM subjects.

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Inwieweit haben die beispielhaften Lehrpläne Ihr Verständnis für den Unterricht in MINT-Fächern verbessert?

29 Antworten

- Sehr verbessert
- Verbessert
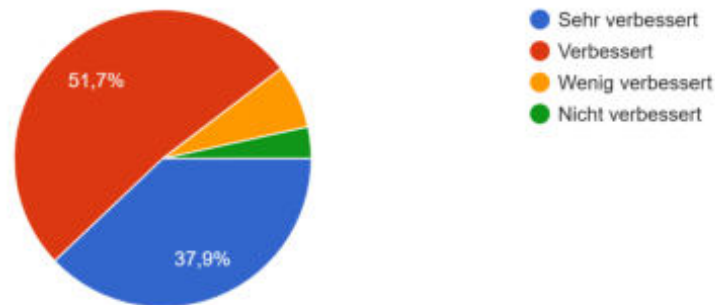- Wenig verbessert
- Nicht verbessert

51,7%

37,9%

Figure 11: Survey2-LearnSTEM Teacher Training Program-Question 4

21 people explained their responses additionally:

- I now understand the pedagogical context a little more clearly.
- The curricula take into account the work in the project. You have to consider the interfaces to the national curriculum yourself.
- This could even be taught in a foreign language.
- Maths and IT are more in focus
- I'm a subject teacher and know the content anyway. But there are new insights into the links to other subjects.
- had already worked in STEM
- The materials have given me new ideas
- Have only now realised the importance
- I always saw the subjects in isolation. However, the connections are very important and always come to light in practical cases.
- I already had my first co-operative approaches in my lessons
- I can use the videos and presentations directly in my classroom and only have to adapt a few things to my school.
- A curriculum should improve the understanding of teaching in STEM subjects? Very presumptuous question
- I feel more confident about the direction of the lessons.
- I had few points of reference so far
- I now better understand the link between physics and biology in terms of climate.
- Fit to MINT has been increased
- The materials fit in well
- The interaction of so many subjects is more difficult than I thought.
- I feel a bit more confident.

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- An interdisciplinary approach in STEM is probably very important and has not yet been implemented enough.
- I now have the option of accessing an eLearning setting and integrating it into my programme.

Figure 12: Survey2-LearnSTEM Teacher Training Program-Question 5

Preparation for STEM lessons

The majority of respondents feel better prepared for the design and implementation of STEM lessons thanks to the exemplary curricula. Here, 48.3% or 14 people stated that they felt better prepared, 24.1 % or 7 people even felt much better prepared. 24.1 % or 7 people also feel somewhat better prepared. Only one person stated that they did not feel better prepared as a result.

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Inwieweit fühlen Sie sich nach diesen beispielhaften Lehrplänen besser auf die Gestaltung und Durchführung von MINT-Unterricht vorbereitet?

29 Antworten
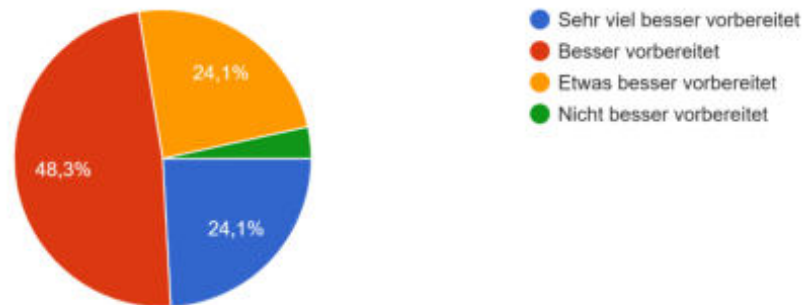
Figure 13: Survey2-LearnSTEM Teacher Training Program-Question 6

22 people explained their responses additionally:

- By coordinating with colleagues, STEM lessons can be taken into account much better.
- Design is linked to planning and there is now a lot of support for this.
- The videos are universally applicable
- The structure of the curricula suits my approach and the content complements each other very well.
- I can now see this in a more interdisciplinary way
- I can compare my material with that of the PRoject.
- The fit with my own teaching materials is clearer
- The tool complements my lessons
- I now have a didactic basis for implementation
- The material from LearnSTEM is available in different languages, which also helps learners with a migration background.
- Nice teaching material that is made available
- I now have a wider range of material.
- Matches my own documents.
- I feel better informed
- I didn't have anything yet and now I have the material
- You get good new insights into STEM issues and also into the relationship to chemistry / biochemistry.
- I have more material
- That's not the focus at the moment
- The structure of the LEarnSTEM approach is very easy to combine with lessons.
- As I have been doing this for a long time, I already have suitable lessons.

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- I got a lot of good ideas and inspiration for my lessons.
- I already knew the basics anyway. But it's good to refresh my knowledge and recognise current issues.

Begründen Sie Ihre Antwort zur vorherigen Frage hier:

Ich habe mehr Material

Ich hatte noch nichts und jetzt habe ich das Material

Ich kann das nun fächerübergreifender sehen

Das ist im Moment nicht so im Fokus

fühle mich besser informiert

Habe nun didaktische Grundlagen zur Umsetzung

Passung mit eigenen Unterrichtsmaterialien ist klarer

Das Tool ergänzt meinen Unterricht

Schönes Unterrichtsmaterial, das zur Verfügung gestellt wird

Ich kann mein Material mit denen des PRojekts abgleichen.

Die Videos sind universell einsetzbar

Durch Abstimmung mit Kolleg*innen ist dem MINT-Unterricht viel besser Rechnung zu tragen.

Die Struktur der LEhrpläne passt zu meinem Ansatz und die Inhalte ergänzen sich sehr gut.

Passt zu meinen eigenen Unterlagen.

Ich habe jetzt einen breiteren Fundus an Material.

Dei Grundlagen wusste ich ja eh schon. Aber es ist gut aufzufrischen und aktuelle Fragen zu erkennen.

Ich habe eine Reihe von guten Ideen und Inspirationen für meinen Unterricht bekommen.

Die Struktur des LEarnSTEM Ansatzes ist sehr gut mit dem Unterricht verbindbar.

Das Material aus LearnSTEM ist ja in verschiedenen Sprachen vorhanden und das hilft auch bei Lernenden mit Migrationshintergrund.

Da ich das ja schon länger mache habe ich eigenlich schon passenden Unterricht.

Da bekommt man schon gute neue Einblicke in Fragen von MINT und auch in den Bezug zur Chemie / Biochemie.

Gestaltung häng tja mit Planung zusammen und da wird man jetzt ganz gut unterstützt.

Figure 14: Survey2-LearnSTEM Teacher Training Program-Question 7

Improvement of the LearnSTEM Teacher Training Program

27 people described possible improvements of the LearnSTEM Teacher Training Program:

- The objectives are written in a more results-orientated way. Is that what you want?

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- These are not national curricula. They don't apply and are more ideas on how things could be done better.
- Curricula are often very long and are only adopted to a limited extent.
- I'm not sure about that.
- I haven't looked closely at the curricula
- Curricula are only useful to a limited extent. It's the preparation of the lesson that counts.
- Own adaptations are necessary
- I have to adapt the curriculum to the subject even more precisely
- Findability
- More attention could be paid to language skills in connection with STEM.
- Fit with the various curricula of the subjects in the different federal states
- They are orientated towards outcomes, which has only been implemented to a limited extent in the subject curricula to date
- The teachers at our school usually don't read them at all, but work on the basis of experience and textbooks.
- Are made to fit
- Fit between what is aimed for in terms of objectives and what the school authorities require.
- I'm very unsure what is meant by that.
- I can read and understand the curricula well. They can stay that way.
- They are just examples. They have to be adapted to the framework conditions in the schools and countries.
- They are less in focus than the material
- I don't know
- The subjects are structured differently than a cross-curricular approach would require.
- The relationship between the curriculum and the curricular lesson structure could be clearer, but it is the same everywhere.
- are OK
- They are just curricula and not concrete individual lesson plans.
- You could put the subject curricula next to each other and look for overlaps.
- These must be taken into account in the revision of the state curricula.
- This must be anchored in the annual didactic planning of the school.

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Figure 15: Survey2-LearnSTEM Teacher Training Program-Question 8

Suggestions for an effective STEM Teacher Training Program

28 people described possible suggestions for an effective STEM Teacher Training Program:

- Study of a STEM subject including compulsory didactic modules
- Integration into SCHILF
- STEM could be more closely linked to the other subjects
- Strengthen co-operation between teachers
- Adapt material to own lessons
- Training from the state
- Regular STEM workshops would be good
- An exchange with IT colleagues would be good

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- Cooperation with the university would be desirable and free training would be good. The state can certainly make a contribution here.
- An educational day on STEM could be organised at school.
- Coordination within the educational programme is important.
- An NRW working group on STEM would certainly be beneficial here, in which the materials could be discussed in detail.
- I am active in a digital exchange group on STEM and would like to see something like this offered more often.
- I would like to receive an eLearning course on STEM from the teacher training programme in Soost.
- Combination of online and face-to-face programmes
- Workshops, online webinars, discussion forums on STEM
- An online page with further materials would be nice.
- An exchange of materials on the subject would be useful in physics.
- I imagine a co-operation at school and a mentoring and coaching offer would be great.
- More interdisciplinary offers for networking.
- This should already be taken into account in the first phase and the second phase of teacher training.
- It's up to the school management to decide.
- On-site training and online discussions in webinars would be desirable.
- STEM is a good topic on the pedagogical day, but not all teachers are STEM teachers.
- A one-year training programme on one day a week would be good.
- A free training programme for a week, for example, would certainly be appealing.
- An exchange with teachers and trainee teachers from other schools and universities is a good start.
- More co-operation and advice from STEM experts

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Bitte machen Sie Vorschläge für ein effektives MINT-Lehrerausbildungsprogramm.

Studium eines MINT-Faches inklusive didaktischer Pflichtmodule

Einbindung in SCHILF

MINT könnte stärker mit den anderen Fächern verbunden werden

Kooperation zwischen den Leherer/innen stärken

gestalte ich nicht

Material an eigenen Unterricht anpassen

Schulungen des Landes

Gut wären regelmäßige MINT Workshops

Ein Austausch mit IT Kolleginnen wäre gut

Ein Kooperation mit der Uni wäre wünschenswert und kostenlose Schulungen wären gut. Da kann das Land sicher seinen Beitrag leisten.

In der Schule könnte ein pädagogischer Tag zu MINT umgesetzt werden.

Eine Abstimmung im Bildungsgang ist wichtig.

Eine NRW-Arbeitsgruppe zum MINT wäre hier sicher vorteilhaft in der die Materialen einmal ausführlich diskutiert werden könnten.

Ich bin in einer digitalen Austauschgruppezu MINT aktiv und würde mir wünschen, dass so etwas öfters angeboten würde.

Ich würde gern einen eLearning Kurs zu MINT von Seiten des Lehrerfortbildung in Soost erhalten.

Kombination aus online und Face-to-face Angeboten

Workshops, Online Webinare, Diskussionsforen zu MINT

Eine Online-Seite mit weiteren Materialien wäre schön.

Ein Materialaustausch zum Thema wäre im Fach Physik sinnvoll.

Ich stelle ir eine Kooperation in der Schule vor und da wäre ein Mentoring und Coaching-Angebot super.

Mehr fächerübergreifende Angebote zur Vernetzung.

Eine Berücksichtigung sollte schon ind er ersten Pahse und der zweiten Phase der Lehrerbildung erfolgen.

Das muss doch die Schulleitung entscheiden.

Schulungen vor Ort und Online Diskussionen in Webinaren wären wünschenswert.

Am pädagogischen Tag ist MINT ein gutes Thema, aber es sind ja nicht alle Lehrkräfte MINT-Lehrer.

Ein einjährige Fortbildung an einem Tag der Woche wäre gut.

Eine kostenlose Fortbildung z.B. eine Woche lang wäre sicher mal ansprechend.

Ein Austaquch mit Lehrkräften und Referendaren anderer Schulen und mit Hochschulen ist ein guter Beginn.

Mehr Kooperation und Beratung durch MINT-Experten

Figure 16: Survey2-LearnSTEM Teacher Training Program-Question 9

Overall, respondents in Germany rated the LearnSTEM Teacher Training Programme as (very) helpful in terms of planning, understanding, designing and implementing their STEM lessons.

1.4 Evaluation of LearnSTEM Online Learning Environment

This section summarises the evaluation of the LearnSTEM Online Learning Environment based on surveys from UPB, Germany.

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Respondents

The survey was answered by 20 people from Germany. 14 of them are students and 6 of them are teachers.

Interface of the learning platform

The interface of the learning platform is intuitive to use for the majority of respondents and they know how to navigate through the learning units and the website. Here, 55% or 11 people fully agreed and 35% or 7 people agreed. One person each voted for neutral and disagreed.

Die Oberfläche der Lernplattform ist für mich intuitiv zu bedienen. Ich weiß, wie ich durch die Lerneinheiten und die Webseite navigieren kann.
20 Antworten

- Stimme voll und ganz zu
- Stimme zu
- Neutral
- Stimme nicht zu
- Stimme überhaupt nicht zu
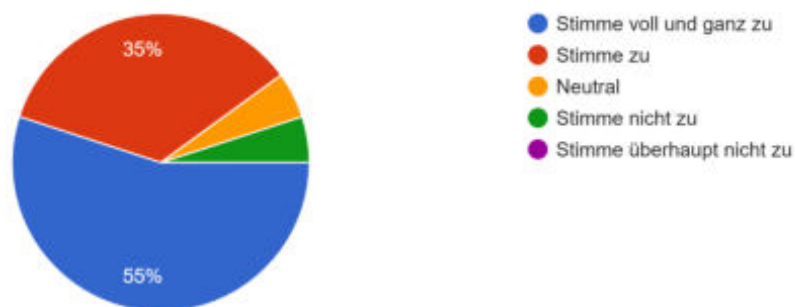
Figure 17: Survey3-LearnSTEM Online Learning Environment-Question 3

Understanding

Half of the respondents (10) fully agree that the materials are easy to understand and that they were able to complete a learning unit without any problems. In addition, 40 % or 8 people agreed and 10 % or 2 people remained neutral.

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Die Materialien sind leicht zu verstehen. Ich konnte eine Lerneinheit ohne Probleme abschließen.
20 Antworten
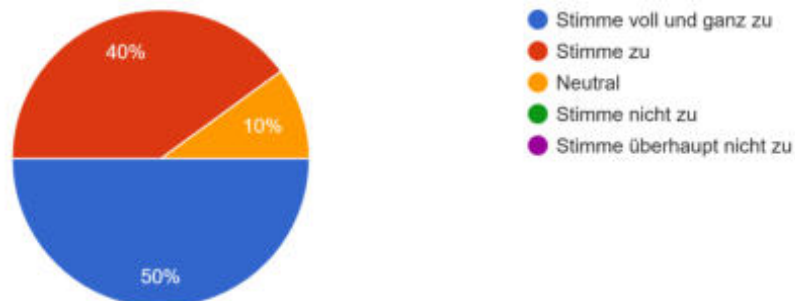
Figure 18: Survey3-LearnSTEM Online Learning Environment-Question 4

Design of the website

Half of the respondents (10) fully agree that the general design of the website is good and intuitive. In addition, 40 % or 8 people agreed and 10 % or one person disagreed.

Das generelle Design der Webseite ist gut und intuitiv.
20 Antworten
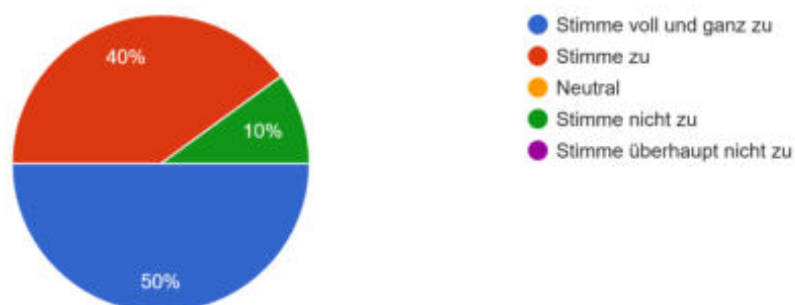
Figure 19: Survey3-LearnSTEM Online Learning Environment-Question 5

Practical use

The statement that the respondents would use the learning platform themselves or for the learning processes of their learning groups was fully agreed by 40% or 8 people, 35% or 7 people agreed, 5% or one person disagreed and 20% or 4 people remained neutral.

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Ich würde die Lernplattform selbst oder für die Lernprozesse meiner Schüler*innen / Student*innen nutzen.

20 Antworten
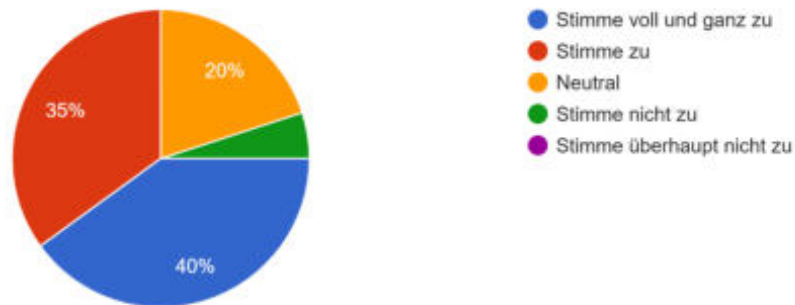
Figure 20: Survey3-LearnSTEM Online Learning Environment-Question 6

Misfunction of the website

20 people provided additional information on the misfunctions of the website and/or stated the browser they have used when testing:

- Navigation - Edge from Microsoft
- Videos - Microsoft Edge
- I find the orientation difficult
- The presentations were well structured, which we worked on in Edge in the group
- I am a student and have no other students. I need them for this. I did not recognise
- Firefox
- Material research - Edge
- Enlarge images to decipher legends
- I got on well with it. I use Edge
- Vote in my group on the videos - We used Edge
- Good as it is
- Mircosoft Edge
- Explorer
- Better docking to learning processes
- Microsoft Edge
- everything works - Mozilla
- Use in the media didactics module - Explorer
- Opera
- Edge
- Still unsure when this will be used

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Hat etwas nicht funktioniert? Lassen Sie es uns wissen und erwähnen Sie dabei, welchen Browser Sie genutzt haben. ⌄
Zoom bei Abbildungen, um Legenden zu entziffern
in Ordnung so wie es ist
alles klappt - Mozilla
Besser an Lernprozesse andocken
explorer
Edge
Mircosoft Edge
Firefox
Ich finde die Orientierung schwer
Microsoft Edge
Ich bin Studentin und habe keine anderen Studenten. Braucht an die dazu. Habe ich nicht erkannt
Bin noch unsicher, wann das eingesetzt wird
Opera
Materialabruf - Edge
Videos - Microsoft Edge
Nutzung im Modul Mediendidaktik - Explorer
Ich konnte gut damit klar kommen. Ich nutze Edge
Navigation - Edge von Microsoft
Abstimmung in meiner Gruppe über die Videos - Wir haben Edge genutzt
Die Präsentationen waren gut strukturiert, die wir in Edge in der Gruppe bearbeitet haben

Figure 21: Survey3-LearnSTEM Online Learning Environment-Question 7

Particularly good about the learning platform

19 people gave additional information about what they find particularly good about the learning platform:

- That you can find everything at a glance
- Presentations and videos
- Content
- Free access to the content
- Is well organised
- Is quite normal
- Accessibility for all
- Is OER and I can use it myself later
- That you are flexible in terms of time
- Clarity
- It is transparent

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- The easy way to navigate
- The materials and the practical benefits
- The good structure
- structure
- Clear arrangement
- Fitting for the teachers
- Everything is very well done and beautiful
- is something new. It's just digital

Was finden Sie an der Lernplattform besonders gut? ∨

Übersichtlichkeit

Struktur

Die Materialien und den praktischen Nutzen

Die leichte Form zu navigieren

Alles sehr gut gemacht und schön

Sie ist transparent

ist ganz normal

Inhalt

die gute Struktur

Ist gut aufgebaut

ist mal was Neues. Ist halt digital

Passung für die Lehrkräfte

Zugänglichkeit für alle

Präsentationen und Videos

Übersichtliche Anordnung

Ist OER und ich kann sie später selbst nutzen

Das man alles auf einen Blick findet

Das man zeitlich flexibel ist

Den freien Zugang zu den Inhalten

Figure 22: Survey3-LearnSTEM Online Learning Environment-Question 8

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Less good about the learning platform

15 people gave additional information about what they find less good about the learning platform:

- sometimes I had to reload
- That you should relate this to events yourself
- Graphical appearance
- layout
- Non-scrollable presentation
- There is so much information
- That you are obliged to use it
- Very many sections
- That you have to familiarise yourself
- Is just a separate platform again
- More contact options would be helpful
- That you should coordinate in groups
- I'm not sure if the students can implement this
- that you sometimes have to click several times
- I'm not sure where this is used. That is unclear to me

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Was finden Sie an der Lernplattform weniger gut?	˅
Nicht blätterbare Präsentation	
alles prima	
weiß ich jetzt nicht	
Ist halt wieder eine separate Plattform	
Das man sich einarbeiten muss	
das man manchmal mehrfach klicken muss	
Sehr vele Bereiche	
Layout	
Graphisches Aussehen	
mehr Kontaktmöglichkeiten wären hilfreich	
Kann ich so gar nicht sagen	
Bin nicht sicher wo die eingestetzt wird. Das ist mitunklar	
Ich bin nicht sicher, ob die Studierenden das umsetzen können	
?	
Das man das selsbt auf Veranstaltungen beziehen soll	
Das man sich in Gruppen abstimmen soll	
Es sind sehr viele Informationen	
manchmal musst ich neu laden	
das man vrepflichtet ist sie zu nutzen	
weiß ich nicht	

Figure 23: Survey3-LearnSTEM Online Learning Environment-Question 9

General feedback

18 people gave general feedback:

- STEM is increasingly important for learning education
- Please integrate into more modules
- Could be more intuitive
- Thank you for letting us try this out
- Thank you is ok as it is
- Fits well for teacher training students
- Navigation bar as wide as presentation window
- Good MINT approach. I like it
- Is quite well done

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- This is a helpful project
- Is helpful for me as a student
- The materials could be expanded further
- Everything is well designed
- Fits well for learners
- Nice platform
- I don't really like group work
- Good way in the right direction
- If this is fitted in well, it is certainly helpful

Allgemeine Rückmeldung

Navigationsleiste so breit wie Präsentationsfenster

Das ist ein hilfreiches Projekt

Schöne Plattform

Alles sinnvoll gestaltet

Die Materialien können gern weiter ausgebaut werden

Ist hilfreich für mich als Student

Könnte inuitiver sein

Passt gut für Lernende

Danke ist Ok so wie sie ist

Wenn das gut eingepasst wird, ist das sicher hilfreich

Guter Weg in die richtige Richtung

Passt gut für Studierende im Lehramt

Bitte in mehr Module einbinden

Ich mag eigentlich keine Gruppenarbeiten

Guter MINT Ansatz. Gefällt mir

MINT ist für die Lerherbildung immer wichtiger

Ist ganz gut gemacht

Danke, dass wir das mal ausprobieren konnten

Figure 24: Survey3-LearnSTEM Online Learning Environment-Question 10

Overall, respondents are satisfied with the LearnSTEM Online Learning Environment. Nevertheless, there are some suggestions for improvement that the project partners should take a closer look at and discuss.

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1.5 Exploitation

For future educational practices to integrate and sustain the outcomes of the LearnSTEM project, it is crucial to follow up on the feedback that has been reported.

A suggestion was to embed the LearnSTEM Pedagogical Model and Teacher Training Program into curricula. Therefore, the project and it's outcomes should be shared with educational bodies to work on aligning the model with national standards.

Further, the LearnSTEM Pedagogical Model and Teacher Training Program should continue to be developed and shared within the professional training of educators and students. There could be workshops at universities, schools and other educational institutions.

To make the content more adaptable and flexible, it could be opened and shared explicitly to change the content to different educational settings and age levels. As the content is openly and freely accessible, this shouldn't be a huge challenge.

The content could also be added with additional interactive tasks, also in terms of different educational settings and age levels.

Moreover, the content can be added with different cultural aspects. As the content was made within a consortium of different countries all over Europe, it could add to different cultural aspects within the learning and teaching materials.

The dissemination of the project's results should not come to a stop, they should continue. The social media channels of the project could be used for that. Also, educational networks and conferences of the schools and universities could be a place to share the LearnSTEM outcomes.

A future goal could also be to keep evaluating the LearnSTEM Pedagogical Model, Teacher Training Program and Online Learning Environment, to make sure that the materials are up to date and meet the needs of the current demands. At some point, there could be an evaluation of the long-term effects of the learning platform.

2. Conclusion

In conclusion of the LearnSTEM project with a look at the national evaluation, the LearnSTEM project received high satisfaction ratings from people from the educational sector in Germany. Especially the relevance, effectiveness and skill development of STEM subjects were positively evaluated.

The combination of an interdisciplinary pedagogical model and teacher training program design was appreciated as it allowed for flexibility in different educational settings. However, there is a need to enhance the degree of alignment between curriculum, content depth, interactivity, and practical skills.

The LearnSTEM Online Learning Environment was considered user-friendly, but navigation, usability, and overall user engagement improvements are recommended.

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Based on the national results, the final recommendations are:

- Work with local educational institutions to align standards and curricula to national requirements.
- Introduce new elements such as deeper technical content, suitable for different age groups, more interactivity, and real-world relevance.
- Create multiple new formats for training such as online webinars, and workshops with mentoring to increase preparedness among teachers.
- Long-term impact and effectiveness evaluations should be conducted.
- Continuous development through regular feedback and long-term analysis of the learning and teaching materials as well as the platform.
- Foster greater adoption through education networks and repositories, and increase application in other subject areas and levels.
- Networking with teachers of different educational levels to foster long-term partnerships and professional learning communities. Within these communities and networks, educators can share their experiences and adapt the content.
- The network can also be expanded through partnerships with policymakers and other extracurricular stakeholders.

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ERASMUS+ KA220-SCH
Cooperation Partnerships in School Education

National Evaluation Report

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Date:
31.01.2025

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1. Introduction

This report aims to evaluate the outputs produced in the project, which include the LearnSTEM Pedagogical Model, the Teacher Training Programme, and the Online Learning Environment. This report offers a partner-centered perspective, showcasing the successes, challenges, and lessons learned during the project's implementation. The evaluation will help assess the effectiveness of the outputs and provide recommendations for improvements.

1.1 Project Overview

The LearnSTEM "Innovative Model of learning STEM in secondary schools "aims at enhancing the capacity of secondary schools to foster skills in subjects like science, technology, engineering, and mathematics using innovative and interactive teaching methods and approaches, improving students' attitudes and performance in the STEM areas of interest, exploring effective strategies for captivating students' attention and cultivating their interest in essential subjects like science, technology, engineering, and mathematics, which play crucial roles in both the present and the future, permeating all aspects of our lives motivating students to invest more time and effort into these subjects, recognizing the potential they hold in shaping their future endeavors. The following outputs were addressed when implementing the project.

1.1 In Work Package 2, the LearnSTEM Pedagogical Model has been developed,
1.2 In Work Package 3, the LearnSTEM Teacher Training Programme has been developed, and
1.3 In Work Package 4, the LearnSTEM Online Learning Environment has been developed.

1.2 Evaluation of LearnSTEM Pedagogical Model
Please write a text here to answer questions below:

-Describe how well the LearnSTEM Pedagogical Model worked in fostering STEM skills in your classrooms. Did it help engage students in STEM subjects?

The LearnSTEM Pedagogical Model has proven to be highly effective in supporting the development of STEM skills in classrooms. According to the responses received to the evaluation questionnaires, when asked *"How well did the LearnSTEM Pedagogical Model support the development of STEM skills in your classroom"*, over 92.5% of respondents selected the option *"Very effectively"* and *"Effectively"*

The feedback also indicates that LearnSTEM has made a significant contribution to increasing student engagement in STEM subjects. This is due both to its real-world problem-centered approach, which helps students to see the concrete applicability of theoretical concepts, and to the interactive and innovative pedagogical methods used.

LearnSTEM, the pedagogical model for innovative learning and teaching in STEM, addresses the current demand for new pedagogical models as a result of global change. This pedagogical model provides a didactic framework that can and should be adapted to the specific situation and context of different schools, regions, education systems and cultures in Europe and worldwide. STEM focuses on the interrelation and integration between these four domains: science, technology, engineering and mathematics.

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Therefore, LearnSTEM not only enhances students' understanding of STEM subjects, but also stimulates their creativity and interest in these fields, having a positive impact on their education and career guidance.

-Evaluate the relevance and quality of the teaching content. Was it engaging, appropriate, and aligned with the learning goals?

According to the answers received to the evaluation questionnaires, when *asked "How would you rate the overall quality of the LearnSTEM Pedagogic Model?"*, the majority of respondents selected the option *"Excellent"*, which shows that the model is appreciated for its well-designed structure, innovative methods and positive impact on the educational process.

Also, to the question *"How well did the teaching content align with your learning goals for students?"*, more than 97.5% of the respondents answered *"Fully aligned"* and *"Mostly aligned"*. This result confirms that the teaching materials are relevant, well structured and adapted to the specific needs of the students, facilitating the achievement of the learning objectives in a clear and effective way.

By combining these two aspects, it can be concluded that LearnSTEM not only provides high quality educational content, but also ensures a perfect alignment with the learning objectives set. This contributes to increased student engagement, a better understanding of STEM concepts and the development of skills needed for real societal challenges.

-Were there any difficulties with the model? If yes, describe them.

For the question *"Do you think the level of difficulty of the teaching content was appropriate for your students?"*, the majority of respondents chose the option *"Appropriate"*, indicating that the teaching materials in the LearnSTEM model are well calibrated to the needs of the students. Of course, the difficulty of the exercises can vary depending on the level of each class and each student, but the flexibility of the model allows the content to be adjusted to be both accessible and challenging.

If there were any difficulties, they were more likely to be related to adapting the content to the level of each class, which is a normal part of any educational process. However, thanks to the flexibility of LearnSTEM, teachers were able to adjust materials and activities to better suit the specific needs of their students. This helped to increase student understanding and engagement in STEM activities.

-Provide any recommendations for improving the pedagogical model.

Although the majority of respondents rated the content difficulty level as *"Appropriate"*, adjusting the activities to allow more customization to the level of each class could further enhance the learning process.

Overall, the pedagogical model is well structured and effective, providing a solid foundation for learning. Providing more flexibility in adapting the model to different learning styles could also improve its effectiveness. In addition, the inclusion of projects with real-world

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applicability and links to industry could provide students with a clearer perspective on how the concepts learned apply to everyday life.

-Provide suggestions on how the teaching materials or methodology could be improved.

One of the strengths of the LearnSTEM model is the integration of relevant and current themes - Nature, Pollution, Recycling and Climate. These manage to smoothly blend the challenging issues of global change with STEM concepts in a harmonious way, providing students with real-world contexts to put their knowledge into practice. Through this approach, students not only better understand the impact of science, technology, engineering and mathematics on the world in which they live, but also become more engaged in finding solutions to society's current problems.

Another aspect that they really enjoyed about this project is the series of mobile games, which they understand that the project coordinators have carefully selected. These games are a great way to engage students in STEM learning by giving them an interactive and engaging way to understand important concepts. In addition, through these games, students are brought closer to other two topics that are particularly relevant today: renewable energy and artificial intelligence. Approaching the topics through interactive games not only helps students gain valuable knowledge, but also stimulates their curiosity and interest in these innovative and essential fields for their future.

1.3 Evaluation of LearnSTEM Teacher Training Programme
-How useful were the lesson plans created for LearnSTEM Teacher Training Programme ?

When asked in the questionnaire *"How useful were the example lesson plans in helping you develop your own STEM lessons?"*, the majority of respondents rated the lesson plans as *"Very useful"* and *"Useful"*. The lesson plans contribute to more organized learning and save time, allowing teachers to apply appropriate teaching strategies. They also help them to be better prepared and more confident when teaching.

Effective lesson planning plays a key role in achieving successful learning outcomes for students. Well-designed lesson plans not only provide clarity on the objectives of an instructional module, but also facilitate the implementation of the curriculum into practical educational activities. In addition, their interactive structure helps to maintain students' interest throughout the lesson.

Another aspect appreciated by teachers was that these lesson plans provide clear objectives, step-by-step instructions and practical activities that are easily adaptable to different educational contexts. They demonstrate effective teaching strategies, such as inquiry-based learning and hands-on activities, which help to increase student engagement and develop critical thinking. The lesson plans also highlight the ways in which different STEM subjects can be integrated, thus facilitating relevant interdisciplinary connections.

Although these lesson plans do not exactly follow the standard format used in Romanian schools, they are easy to follow and understand. Their clarity and flexibility make them a

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valuable tool for teachers, giving them real support in the teaching process and in adapting the content to the needs of the students. More attention to differentiated teaching strategies could help to respond better to the needs of students with different abilities and learning rhythms.

In conclusion, the lesson plans from the LearnSTEM Teacher Training Program are a valuable tool for teachers, offering a clear and structured approach to STEM teaching.

-Provide suggestions on how the teacher training programme could be improved to better support teachers.

A successful teacher training program should provide teachers with both relevant theoretical knowledge and practical opportunities to apply teaching strategies. It is important for the training to be clearly structured, include interactive methods and encourage the exchange of good practice between teachers. Also, diversifying the mode of course delivery - through face-to-face sessions, practical workshops and online resources - can increase the accessibility and impact of the program. Last but not least, continuous support after completion of training, through mentoring and additional resources, can ensure more effective implementation of what has been learned in the classroom.

In this regard, the LearnSTEM project succeeds in integrating a variety of course delivery methods, combining theory with practice and providing teachers with the tools needed to successfully implement STEM approaches in their teaching process.

1.4 Evaluation of LearnSTEM Online Learning Environment
-Evaluate the usability of the tools and materials used in the project. Were they user-friendly for teachers and students?

The materials and tools used in the project were found to be very easy to use by both teachers and students. To the question *"The materials are easy to understand. I was able to complete a learning unit without any problem"*, 100% of the respondents chose *"Strongly Agree"* and *"Agree"*, indicating a high level of accessibility and clarity of the content. The platform was also considered to be extremely useful, with many teachers and students stating that they would continue to use it for learning activities.

A particularly appreciated aspect was the possibility to access all content in Romanian, which facilitates the learning process and eliminates possible language barriers. The platform was described as intuitive, well-organized and easy to access, and the fact that all resources are open, without the need to create an account, was seen as a great advantage. In addition, the option to download the materials gives users the flexibility to work offline or customize them according to specific needs.

In addition to these aspects, an effective platform should not only be accessible, but also visually pleasing, with a modern and well-structured interface so that users can quickly find what they are looking for. In this regard, LearnSTEM has succeeded in creating a user-friendly and efficient experience that supports both teachers and students in their learning process.

-Summarize feedback on ease of use, navigation, and accessibility.

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The overall feedback on the usability, navigability and accessibility of the platform is very positive, with the majority of respondents choosing "Strongly Agree" to questions related to the intuitive interface, the overall look and layout of the site and its usefulness for learning.

One of the most appreciated aspects was the fact that the platform offers unlimited access to content without restrictions imposed by complicated policies or the need to create an account. This allowed users to access materials quickly, without unnecessary obstacles.

Also, a significant number of users initially accessed the platform on mobile phones and were satisfied with its mobile optimization. The website automatically adapts to the screen size, adjusting its resolution and changing its format to provide a smooth and pleasant browsing experience. This means that menus, text and buttons are resized appropriately so that users can explore content without having to zoom or scroll excessively sideways. This optimization significantly improves accessibility and makes the platform easy to use regardless of device.

-Suggest improvements for the usability of the resources and tools used in the project.

An important improvement could be to add a dedicated section for feedback and discussion, where teachers and students can share their impressions of the resources, offer suggestions for improvement and collaborate to find the most effective ways to implement the materials in the learning process. This interactive space would encourage the exchange of good practice and facilitate better adaptation of content to different educational contexts.

Also, although the platform is available in several languages, there are still some texts that have not been fully translated from English. This does not affect the functionality of the site and access to essential materials for teachers and students, but a full translation would contribute to a more fluent and accessible user experience for all users.

A problem was also noticed on the site: when clicking on the "Send message" button in the contact form, nothing happens. The issue was found when using Google Chrome (version 112.0) on Windows 10. Fixing this would improve the experience for users who want to send questions or suggestions.

In addition, certain aspects of the platform could be improved, such as adding more advanced customization options for lesson plans so that teachers can more easily customize them to the specific needs of their students.

It would also be useful to offer more detailed support for troubleshooting technical problems, so that users can quickly resolve any difficulties they encounter in using the resources and tools in the project.

1.5 Exploitation
Discuss how the project outcomes can be sustained and integrated into future educational practices.

In order for the project results to be sustainable and effectively integrated into future educational practices, it is essential to invest in continuous teacher training and in maintaining the accessibility of digital resources.

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An important first step is to organize workshops, webinars and courses to help teachers understand and effectively use STEM resources. As today's young people are deeply connected with technology, teachers must be prepared to adapt their teaching methods to make learning more engaging and interactive. In addition, creating a community where teachers can share their experiences and learn from each other will help to reinforce the impact of the project.

At the same time, maintaining free access and constant updating of the platform will ensure the relevance of the resources over time. Young people are used to searching for information quickly, learning independently and using digital tools in every aspect of their lives. The fact that LearnSTEM resources are available online, intuitive and easy to access gives students the opportunity to learn in a flexible way that suits their modern learning style.

By combining these measures - supporting teachers and providing an accessible and up-to-date digital platform - the LearnSTEM project can become a sustainable model for integrating new technologies in education, helping to shape a generation of learners ready for the challenges of the future.

Evaluate the potential for the tools, methodologies, and resources to be used outside of the project's initial scope (e.g., for other subjects, by other educational institutions).

The tools, methodologies and resources developed within the LearnSTEM project have great potential to be used beyond their original purpose, extending to other disciplines and educational institutions. The platform is based on educational principles inspired by social constructivism, and is complex, process-oriented, holistic, practical and social. It promotes the idea that students must become responsible for their own learning, while teachers act as facilitators, mentors and guides, supporting their development through guidance and supervision.

Although LearnSTEM focuses on STEM subjects, its methodology can be combined and adapted for use in teaching other subjects, such as social sciences, the arts or even foreign languages. The digital resources and interactive approach stimulate critical thinking and active engagement of students, contributing to applied and effective learning. Moreover, LearnSTEM does not impose a single rigid methodology, but offers flexible tools that can be integrated with other educational approaches to respond to different learning styles.

Another major advantage of the platform is its wide accessibility. The fact that it can be used free of charge, without an account and without restrictions makes it extremely attractive not only for schools and universities, but also for NGOs organizing educational and recreational activities or parents who want to have interactive activities at home with their children. In addition, the platform is optimized for mobile devices, allowing it to be used both in the classroom and outside the traditional school environment, facilitating flexible and autonomous learning.

In addition to transmitting knowledge, LearnSTEM emphasizes the development of STEM skills and competencies, providing a learning environment based on reflection and repeated practice. Its resources are not just general guides, but tools directly applicable in school activities, helping teachers to create more structured and effective lessons.

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In conclusion, LearnSTEM is a valuable educational resource that can be successfully integrated not only in the formal education system but also in multiple other learning contexts. The platform's flexibility, constructivist approach and customizability make it an essential tool for teachers, students and parents who want to combine technology with education to create a dynamic and engaging learning process.

Suggest opportunities for further dissemination and use of the project's results.

To extend the impact of LearnSTEM and ensure effective dissemination of the results, it is essential to adopt strategies that exploit both the potential of the platform and the growing need for innovative Science, Technology, Engineering and Mathematics (STEM) education. LearnSTEM has been designed as a complex educational tool to improve the quality and effectiveness of STEM learning in secondary schools through an interdisciplinary, reflective and real-life problem-solving-oriented approach. Several measures can be implemented to facilitate its widespread integration and use.

An important first step is to organize teacher workshops and trainings where teachers can learn how to use the LearnSTEM platform and resources effectively. These training sessions, held both physically and online, would provide teachers with the necessary support to adopt modern teaching methods based on experimentation and critical thinking.

Another key direction is to collaborate with NGOs, after-school centres and educational organizations so that LearnSTEM can be used not only in schools, but also in extra-curricular activities, science clubs or educational camps. This would help to increase students' interest in STEM and develop practical skills to prepare them for the future.

For better visibility, there needs to be a stronger digital presence, through the creation of educational videos and interactive tutorials explaining the use of LearnSTEM resources in different educational contexts, as well as webinars with STEM experts where teachers and students can receive practical advice. Also, publishing case studies and examples of good practice on educational blogs and in specialized publications can demonstrate the effectiveness and applicability of LearnSTEM methodologies.

Another important aspect is the development of an active user community where teachers and students can share ideas, resources and experiences of using the platform. The creation of a discussion forum or a section for feedback and recommendations could help to continuously adapt the materials to the real needs of the users, thus ensuring a constant improvement of the platform.

Through these measures, LearnSTEM can become a reference educational tool, used not only within the initial project, but also by other educational institutions, NGOs and even parents who want to become actively involved in their children's education. Thus, the project not only improves STEM learning in schools, but also contributes to a generation better prepared for the challenges of the future.

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2. Conclusion:

Summarize your overall evaluation of the LearnSTEM project and its outputs.

Offer any final recommendations for the European Evaluation Report based on your national results.

The LearnSTEM project is a valuable initiative in modernizing STEM education, providing innovative resources and methodologies designed to improve the quality and effectiveness of the learning process. By integrating an interdisciplinary, reflective and real-world problem-solving-oriented approach, the project succeeds in supporting both teachers and students in developing the knowledge, skills and competences needed for the future.

One of the most appreciated aspects of the platform is its accessibility and user-friendliness, as confirmed by the positive feedback received from users. Educational materials are intuitively structured, available in Romanian and can be used without the need to create an account. In addition, the fact that the resources are open, free and downloadable is a significant advantage, facilitating their integration in both formal and non-formal environments.

The teachers particularly appreciated the well-structured lesson plans, which provide them with a clear framework for organizing their lessons and applying effective teaching strategies. The LearnSTEM methodology also emphasizes the role of the teacher as a facilitator of learning, encouraging critical thinking and student empowerment.

Regarding the educational content available on the platform, LearnSTEM offers materials structured around four major current topics: recycling, nature, climate and pollution. Each of these themes is developed through four learning units, resulting in a total of 16 interactive lessons. These lessons include videos, PowerPoint presentations, exercises and lesson projects ready to be used directly in the classroom or in individual activities. This way of organization not only makes the educational process more engaging, but also allows students to understand real environmental issues through a practical and interdisciplinary approach.

From the sustainability perspective, the project offers a flexible platform that can be used and adapted for other subjects, educational institutions and even extracurricular activities organized by NGOs or parents. However, an expansion of the user community, together with improvements such as a discussion forum and a full translation of all materials into all available languages, could strengthen the project's long-term impact.

In conclusion, LearnSTEM is a well-designed project with a positive impact on STEM education, providing accessible, modern and relevant resources. Thanks to its well-organized structure and interactive content, the platform not only supports teachers in the teaching process, but also motivates students to explore STEM in an engaging way. With wider promotion and dissemination, this initiative has the potential to become an important reference for the development of STEM competences at European level.

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ERASMUS+ KA220-SCH
Cooperation Partnerships in School Education

National Evaluation Report

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IEK Kavalas, Kavala, Greece

Date:
31.01.2025

Reference Number:
2022-1-TR01-KA220-SCH-000087583

Learn STEM
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in secondary schools

Introduction

This report aims to evaluate the outputs produced in the project, which include the LearnSTEM Pedagogical Model, the Teacher Training Programme, and the Online Learning Environment. This report offers a partner-centered perspective, showcasing the successes, challenges, and lessons learned during the project's implementation. The evaluation will help assess the effectiveness of the outputs and provide recommendations for improvements.

1.1 Project Overview

The LearnSTEM "Innovative Model of learning STEM in secondary schools "aims at enhancing the capacity of secondary schools to foster skills in subjects like science, technology, engineering, and mathematics using innovative and interactive teaching methods and approaches, improving students' attitudes and performance in the STEM areas of interest, exploring effective strategies for captivating students' attention and cultivating their interest in essential subjects like science, technology, engineering, and mathematics, which play crucial roles in both the present and the future, permeating all aspects of our lives motivating students to invest more time and effort into these subjects, recognizing the potential they hold in shaping their future endeavors. The following outputs were addressed when implementing the project.

1.1 In Work Package 2, the LearnSTEM Pedagogical Model has been developed,
1.2 In Work Package 3, the LearnSTEM Teacher Training Programme has been developed, and
1.3 In Work Package 4, the LearnSTEM Online Learning Environment has been developed.

1.2 Evaluation of LearnSTEM Pedagogical Model
Please write a text here to answer questions below:
-Describe how well the LearnSTEM Pedagogical Model worked in fostering STEM skills in your classrooms. Did it help engage students in STEM subjects?

LearnSTEM, the Pedagogical Model for Innovative STEM Learning and Teaching, addresses the current demand for new models due to global changes. This Pedagogical Model provides a didactical framework which can and needs to be adjusted to the specific situation and context regarding the different schools, regions, educational systems and cultures in Europe and worldwide. STEM focuses on the interrelation and integration between these four topics: Science, Technology, Engineering and Mathematics (STEM).
LearnSTEM provides pedagogical methods and learning tools for secondary schools to improve STEM education. This is based on real-world problems and shall stimulate professional carriers in this direction which can eventually assist in solving real-world challenges of society.
LearnSTEM is designed to help learners to better understand the impact of the rather 'abstract' STEM subjects on the real life of individuals and communities, stimulating their sense of creativity.

-Evaluate the relevance and quality of the teaching content. Was it engaging, appropriate, and aligned with the learning goals?

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LearnSTEM is intended to stimulate interest, ability and motivation in dealing with different aspects of STEM and thus, encourage more young people to seek a professional STEM career.

The Vision of LearnSTEM is to innovate and improve school education in STEM as key subjects for our future life, work and society. This is been achieved by focusing on the interrelation of STEM topics, reflective STEM education and pedagogical methodologies.

The Mission of LearnSTEM is to increase the learners' interest in STEM and their STEM competences (in order to promote a professional career in STEM).

The main goal of LearnSTEM is to improve learning and teaching STEM and in particular the quality and efficiency of STEM education in secondary schools.

-Were there any difficulties with the model? If yes, describe them.

Using specific tools for creating videos and assessment was a kind of difficulty as not all partners were familiar with these tools.

-Provide any recommendations for improving the pedagogical model.

LearnSTEM is the Pedagogical Model for Innovative STEM Learning and Teaching. It is a general and holistic framework for improving learning and teaching of Science, Technology, Engineering and Mathematics (STEM) in secondary schools. Learn STEM combines innovative key learning skills and competences:
1. Empathy and motivation
2. Self-regulated learning and learning how to learn
3. Critical thinking and media literacy
4. System thinking and problem solving
5. Exploration and experiments
6. Learning cycles and repeated training of basic knowledge and skills
7. Creativity
These principles should be applied and implemented for all LearnSTEM activities, however with different relative contributions.

Pedagogical Model should support the development of teachers in the way of establishing a positive classroom atmosphere and having lessons are well-structured.

-Provide suggestions on how the teaching materials or methodology could be improved.

It could be suggested for improving the teaching-learning process regarding strategies that address both teaching methods and student engagement to introduce a more Collaborative Learning, by the way of working in Group Projects as it fosters teamwork through collaborative assignments that require students to work together.

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1.3 Evaluation of LearnSTEM Teacher Training Programme
-How useful were the lesson plans created for LearnSTEM Teacher Training Programme ?

They were very useful as it is essential to include key topics and activities in lesson plans in order to ensure that the students gain a comprehensive understanding of the subjects. Additionally, it is important that lesson plans were structured in an engaging manner that keep the learners interested.

These lesson plans are a teacher's daily guide for what students need to learn, how it will be taught, and how learning will be measured. Lesson plans help teachers be more effective in the classroom by providing a detailed outline to follow each class period.

It is clear that lesson planning is an essential contributor to effective teaching and learning and is therefore a key element of professional practice.

They help in organized teaching and save time. They allow teacher to apply appropriate strategy. Teacher is more prepared and confident while teaching the lesson.

Effective lesson planning contributes to successful learning outcomes for students in several ways. These well-designed lesson plans help students and teachers understand the goals of an instructional module and also allow the teacher to translate the curriculum into learning activities.

-Provide suggestions on how the teacher training programme could be improved to better support teachers.

Teaching teachers is paramount to the great performance of an educational institution. While designing successful teacher training programs for teachers means something different to everyone, establishing the basics from the very beginning, providing relevant courses, diversifying delivery, promoting collaboration and offering continuous support, are among the things every teacher training program organizer must consider if they want to ensure the program will have positive results.

1.4 Evaluation of LearnSTEM Online Learning Environment

-Evaluate the usability of the tools and materials used in the project. Were they user-friendly for teachers and students?

The tools and materials were positive to use, as they were:
- well-designed, easy to learn, easy to use
- simple to navigate and have a well-designed layout
- easily accessible from all places and open to everybody
- transparent (tool does not hinder, frustrate the user)
- used as up to date support for the course, not as a replacement of lessons and
- relevant to the lesson and tied into the specific course structure and content.

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-Summarize feedback on ease of use, navigation, and accessibility.

An analysis of all student and teachers comments suggested that they favoured using tools and materials primarily because they were:
- convenient
- accessible 24 hours a day, 7 days a week
- flexible in terms of accessing information in different languages and from all locations and
- supportive of their learning

-Suggest improvements for the usability of the resources and tools used in the project.

It is important to ensure and provide training and support of instructors and students in tool application, implementation and use. Students should have the opportunity to choose which assessment tool to use among a wider variety.

Developments in STEM are deeply rooted in today's challenges and at the same time focus on the future. Young people are born researchers: they are specialized in constantly exploring the world they live in. LearnSTEM acknowledges this natural urge and directs them towards deepening insights and finally a potential STEM specialization through a better learning process and a customized career choice. A main subject of interest these days is robotics. Robotics education provides learners with practical experiences for understanding mechanical and technological systems and languages. It helps to adapt to constant changes driven by the complex environment and to utilize knowledge in real-world situations across time, space and contexts. In addition, along with the growing attention to STEM education, robotics has been suggested as an innovative solution. Regardless of the economic and social needs for new types of innovative and knowledgeable citizens, robotics can easily gain the attention of scholars as a means of empowering learners and providing authentic learning. By allowing learners to engage in these process-oriented learning experiences of robotics, learners can take initiative roles as co-constructors of learning, not as passive knowledge receivers or technology consumers.

1.5 Exploitation
Discuss how the project outcomes can be sustained and integrated into future educational practices.

As sustainability is the ability of a project to continue its mission far into the future and all projects have to end eventually, but the project impact should continue and as it is widely accepted that there is no more powerful transformative force in the world today than quality education that empowers people to determine their own destiny, it is crucial to apply LearnSTEM for qualifying future professionals (secondary school students) able to support the digital transformation of European companies exploiting the advantages offered by IoT technology. Here, we can profit from the learners' experiences, knowledge and skills already gained in the past and build more knowledge, skills and competences through experiments

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and learning activities which are present in learners' daily life guaranteeing human interactions and emotional involvement. Investment in quality education is an investment in our future. It has the potential to change the way we learn and improve the quality of life for people across the globe.

Evaluate the potential for the tools, methodologies, and resources to be used outside of the project's initial scope (e.g., for other subjects, by other educational institutions).

LearnSTEM is the Pedagogical Model for Innovative STEM Learning and Teaching that comprises a general and holistic framework for improving learning and teaching of Science, Technology, Engineering and Mathematics (STEM) in secondary schools. Learn STEM can and needs to be adjusted to the specific educational situation and context.
LearnSTEM can be considered a combination and adaptation of the educational theories and positions based on social constructivism focusing on the following characteristics:
• Complex
• Process-oriented
• Holistic
• Practical
• Social
We believe that learners should become the owners of their own learning processes and that the role of teachers needs to change: teachers should facilitate such learning processes and act as coaches. In addition, they also should guide and supervise the learning process. Furthermore, LearnSTEM can be combined with other approaches and methodologies to learn and teach STEM and is not the only suitable approach to be followed.
LearnSTEM provides teachers with not only general guidelines but rather tools for their practical school education in STEM.
LearnSTEM objectives consist of three elements: knowledge, skills and competences. Learners gain STEM knowledge and build STEM skills. Through reflection and repeated training, they build STEM competences based on assimilation and accommodation. Learners can use and demonstrate their knowledge and skills in daily life and successfully apply their assimilated competences in new situations. LearnSTEM incorporates the complexity of STEM learning activities. Besides a variety of competences learners develop a growing mindset.
LearnSTEM connects the world of learners with our society and provides insights into the complex relations between science, technology and society. This includes professional perspectives for scientists and engineers.
Thus, LearnSTEM meets the demands of the society for independent and well-educated citizens as well as for future innovative professionals working in STE

Suggest opportunities for further dissemination and use of the project's results.

We need innovative and better school education in Science, Technology, Engineering and

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Mathematics (STEM) as key sectors for our future life, work and society. Our European Partnership LearnSTEM focuses our interrelation and integration in cross-disciplinary and reflective STEM education and pedagogical methodologies. Main goal of LearnSTEM is to improve the quality and efficiency of STEM learning in secondary schools. Consequently, LearnSTEM is increasing the pupils' interest in STEM and building STEM competences. Therefore, Learn STEM designs and provides pedagogical methods and tools for secondary schools to explore and solve real life questions. Thus, LearnSTEM supports and contributes to the key objective of the European Education and Training 2020 Strategy (ET 2020) that fewer than 15% of 15-year-olds should be under-skilled in reading, mathematics and science. Moreover, the LearnSTEM project also addresses the need to enhance knowledge of and about science as a precondition to prepare Europe's population to be actively engaged, responsible citizens as well as conversant with the complex challenges facing society. In the PISA study 2015, most students expressed a broad interest in science topics and recognised the important role that science plays in their world; but only a minority reported their participation in science activities. In addition, teachers still declare they need more professional development linked to tailoring, diversifying, and innovating teaching practices. Thus, LearnSTEM is strengthening secondary schools' capacity to develop skills in subjects such as science, technology, engineering and mathematics through innovative and interactive pedagogical methods and approaches. Therefore, LearnSTEM designed and provided practical instruments and online tools for secondary schools and their teachers and pupils to explore and solve real life questions.

1. Conclusion:

Summarize your overall evaluation of the LearnSTEM project and its outputs.
Offer any final recommendations for the European Evaluation Report based on your national results.

Learn STEM is based on general theories, models and principles about learning. They have been combined and integrated for an innovative pedagogical model. The Pedagogical Model is based on a general teaching methodology and didactical aspects and supports the guiding principles of STEM, namely the understanding of phenomena as well as exploring possible solutions for a given problem.
LearnSTEM is also built on practical experiences for different types of school education systems which have been reviewed and analyzed. Furthermore, it benefits from experiences of learners, who are interested in STEM and of university students starting study courses in STEM.
LearnSTEM shall not replace valuable and successful educational traditions and methods, but enhance them by adding an innovative methodology which can be used and applied in STEM. As a theoretical concept, it can also be transferred and adjusted to other fields and contexts, such as social sciences etc.

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ERASMUS+ KA220-SCH
Cooperation Partnerships in School Education

National Evaluation Report

Antonino Imbesi
EURO-NET
Italy

Date:
31.01.2025

Reference Number:
2022-1-TR01-KA220-SCH-000087583

Learn STEM
Innovative Model of learning STEM
in secondary schools

1. Introduction

This report aims to evaluate the outputs produced in the project, which include the LearnSTEM Pedagogical Model, the Teacher Training Programme, and the Online Learning Environment. This report offers a partner-centered perspective, showcasing the successes, challenges, and lessons learned during the project's implementation. The evaluation will help assess the effectiveness of the outputs and provide recommendations for improvements.

1.1 Project Overview

The LearnSTEM "Innovative Model of learning STEM in secondary schools "aims at enhancing the capacity of secondary schools to foster skills in subjects like science, technology, engineering, and mathematics using innovative and interactive teaching methods and approaches, improving students' attitudes and performance in the STEM areas of interest, exploring effective strategies for captivating students' attention and cultivating their interest in essential subjects like science, technology, engineering, and mathematics, which play crucial roles in both the present and the future, permeating all aspects of our lives motivating students to invest more time and effort into these subjects, recognizing the potential they hold in shaping their future endeavors. The following outputs were addressed when implementing the project.

1.1 In Work Package 2, the LearnSTEM Pedagogical Model has been developed,
1.2 In Work Package 3, the LearnSTEM Teacher Training Programme has been developed, and
1.3 In Work Package 4, the LearnSTEM Online Learning Environment has been developed.

1.2 Evaluation of LearnSTEM Pedagogical Model

Situated in Potenza, EURO-NET is a not for profit organisation that works with young people and students. As association EURO-NET engaged different students in the events, goals and activities of the project Learn STE, giving them the opportunity to learn very important competences in the project sector and raise awareness in STEM education. We did not find any difficulty with the model so we do not have recommendations or suggestions to improve.it

1.3 Evaluation of LearnSTEM Teacher Training Programme

The lessons created for LearnSTEM Teacher Training Programme were condired very interesting and useful.Who had the possibility to follow them appreciated them a lot and suggested to share them as much as possible on educational school systems in the various countries. We received alo the suggestion to develop these activities in all possible schools interested to STEM education.

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1.4 Evaluation of LearnSTEM Online Learning Environment

The usability of the tools and materials used in the project is very good and they appear as user-friendly for teachers and students and also considered as really accessible for the navigation online. No suggestions received.

1.5 Exploitation

The outcomes developed into the project Learn STEM should be integrated into the educational annual plan of all the schools interested to obtain and reach the project goals and objectives. Methodologies and tools developed can be, in fact, an important resource for providing benefits to STEM educational system and especially for the students/beneficiaries. It is really important to promote all the project results and tools at regional and national level and also at internal level to permit other schools or oranisations to have the opportunity to use them. So it is important to promote them using articles on media, newsppares, social media, ePale, etc.

2. Conclusion:

We can say that the project tools and the structure of the methlogies used were really appreciated and the evaluation from the interested stakeholders and teachers was very good. They suggested to promote the project and its tool as much as possible.

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Cooperation Partnerships in School Education

National Evaluation Report

ALİ ERDEM

KIRSEHIR AHI EVRAN ANADOLU LISESI

KIRSEHIR, TURKIYE

Date:
05.03..2025

Reference Number:
2022-1-TR01-KA220-SCH-000087583

Learn STEM
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1. Introduction

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1.2 Evaluation of LearnSTEM Pedagogical Model

Situated at the Cappadocia region, Ahi Evran Anadolu High School is in the heart of Turkey, Kırşehir. We are a state secondary school in Kırsehir, which is a city with the population of 250 thousand citizens. There are 28 class units and a total of 585 students between 14 and 18 years old. Our students are very fluent in English and German.

With this project, first of all, the partner institutions were introduced to Erasmus opportunities, interacted with different cultures, gained a European dimension institutionally, and developed by enriching themselves with the experiences of different countries in applications related to the project subject. Each partner has a plan to equip its students with Sustainable Living skills and has unique STEM activities and event plans designed as a solution to Sustainable Development Goals.

We wanted to raise awareness through STEM education on this path we set out to improve the competencies of our students at partner institutions and to ensure that our students have high digital skills, are environmentally sensitive, and are academically and culturally successful. We believed that thanks to our project, we reached the educational capacity to meet the needs of the digital age and strengthen our education and training activities on a European scale.

We implemented the project as a transnational project in order to share our successful work and experiences, observe and compare trainings and transfer the best practices to our own schools. As project partner KIRSEHIR AHI EVRAN , we met our most important need, which is to increase the success rate in Mathematics and Science courses, with this project.

1.We collected some learning resources and materials which already exist in partner country concerning the Climate topic.

Topic 4 Climate by Ahi Evran Anadolu Lisesi

2.We as a school found the Good Practice Examples of Innovative STEM Learning in Turkey

3. We had written the report 'Existing learning resources and materials for the learning units (Climate' for TÜRKİYE' We collected some learning resources and materials which already exist in our country concerning the topic we are responsible for. Also we translated into our national language as well as in English language.

4.We prepared our topic related materials and learning units below:

* Video about the experiment real part and video scribe part,

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* Presentation with the subject-related backgrounds

* Interactive H5P- tasks

* Additional Learning Materials and youtube videos

5. Learn STEM wants to define the needs of STEM teachers and to design a Teachers' Training Programme that will help to meet those needs.Therefore, Learn STEM conducts the surveys for teachers based on the scientific research.Learn STEM Surveys had already been done by Our schooll with 12 teachers.We collected data carrying out these forms and   reported the results to NEU.

6.We participated to the teacher training programme

In addition, our project contributed to the adoption of Digital Transformations and Digital Technologies and Innovative and Open Pedagogies, which are among the Erasmus+ new term priorities.

Additionally, with the activities we carried out in the project, we managed to raise awareness about Climate Change, one of the most important problems of the EU and the world.

Learn STEM PROJECT is based on educational theories and positions and focuses mainly on the following five characteristics of the learning process:

• Complex

• Process-oriented

• Holistic

• Practical

• Social

Results

For students;

*They gained the ability to use technology resources with a focus on self-management and problem solving.

*We increased their success in Science and Mathematics courses.

*We enabled them to produce solutions to environmental and climate problems.

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*We contributed to the development of cultural and foreign language skills.

*With the development of their competencies, they were able to make their own games.

*They have reached a level where they can produce solutions against environmental and climate change problems.

*Their communication skills were enriched and they adapted to technological developments more easily.

For teachers;

1. STEM activities and lesson plans have been prepared for curriculum integration.

2. Professional development of teachers regarding the STEM approach was provided.

3. Sustainable consumption behavior of students has increased by 30%.

1.3 Evaluation of LearnSTEM Teacher Training Programme

-How useful were the lesson plans created for LearnSTEM Teacher Training Programme ?

-Provide suggestions on how the teacher training programme could be improved to better support teachers.

Participating in the project teachers from the school have attended Erasmus+ courses on STEAM teaching and they wanted to apply their knowledge into practice and to share them on an international level. We have used ready-made STEAM kits and by this project initiation we accepted the challenge to design such activities on their own. By doing so, the were were able to match the activities not only to the curriculum, but also to students needs. From our experience in the past, schools and teachers acknowledge there is a real need of changing and adapt teaching methods and curricula, but they are given only theoretical framework and lack the practical know-how on how to implement that in their schools. By applying for this project, participating teachers were given a chance to compare their STEAM teaching activities to the ones of their colleagues from abroad and thus to estimate the real added value and effectiveness of the STEAM lessons. This project was initiated in order to help teachers from participating schools to understand what are the main challenges but especially the advantages of implementing such innovative activities as well as to share the results on an international level.

1.4 Evaluation of LearnSTEM Online Learning Environment

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-Evaluate the usability of the tools and materials used in the project. Were they user-friendly for teachers and students?

-Summarize feedback on ease of use, navigation, and accessibility.

-Suggest improvements for the usability of the resources and tools used in the project.

We prepared our topic related materials and learning units(Climate) below:

* Video about the experiment real part and video scribe part,

* Presentation with the subject-related backgrounds

* Interactive H5P- tasks

* Additional Learning Materials and youtube videos

This MOOC aimed to tackle the need for more complete multidisciplinary learning activities, and for the acquisition of 21st-century skills by introducing the participants to STEAM education.

We learned how to involve students in useful and stimulating learning activities, in which Science, Technology, Engineering, and Mathematics (the basic components of STEM education) connect with the Arts in a broader sense.

Through MOOC, students can explore and experience the relationships between school subjects and real life, and have more chances for cross-disciplinary dialogue, inquiry, and problem-solving.

In this MOOC , participants acquired a practical understanding of what STEAM really is, how it differs from STEM, and how their own learning environments could incorporate STEAM activities effectively.

Participants explored STEAM-style exercises.

Intellectual Output 3 (IO 03) consists of five activities: Design of the Learn STEM learning environment architecture (IO 03-A1), Development of the technical functionalities of the Learn STEM online learning environment (IO 03-A2), Integrate the training contents, delivery and assessment tools, and inquiry learning package in the Learn STEM online learning environment (IO 03-A3), Testing of technical functionalities (IO 03-A4) and Validation of the Learn STEM online learning environment (IO 03-A5).

The output of IO 02 was coordinated by the German team IK and Pwith the support of all partners providing their contributions based on their expertise and based on the agreed methodological approach (design template, design groups, national testing and consultation workshops, live events and final survey). The coordinator Open University of the Netherlands was realizing the complete development (IO 03-A2) and integration (IO 03-A3) of the Online Course including the creation of all learning materials and the six videos. The other partners contributed to the design of the

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Online Course in shared responsibilities and group work collaboration as presented in the following table:

Topic 1 Recycling

Topic 2 Pollution by IEK Kavalas

Topic 3 Nature Yusuf Demir Bilim ve Sanat Merkezi

Topic 4 Climate by Ahi Evran Anadolu Lisesi

1.5 Exploitation

Discuss how the project outcomes can be sustained and integrated into future educational practices.

Evaluate the potential for the tools, methodologies, and resources to be used outside of the project's initial scope (e.g., for other subjects, by other educational institutions).

Suggest opportunities for further dissemination and use of the project's results.

All the teachers who participated in the study stated that STEM applications have a positive advantage of the education used.Teachers stated that they had difficulty involving STEM training in their lesson plans. Teachers want to integrate STEM training into the course process, but they state that they face time problem due to the intensity of the curriculum. For this reason, it is seen that they do not have theoretical concepts to use the concepts they know theoretically, causing what they cannot adapt to STEM training to the course processes. It was seen that most teachers comprehend the importance of STEM education and have positive opinions on STEM education, but the theoretical and practical knowledge is not sufficient.

It is seen that teachers need a better education and more practices in order to achieve the purpose of STEM education and to provide the benefits of STEM education to their students.

2. Conclusion:

Summarize your overall evaluation of the LearnSTEM project and its outputs.

Offer any final recommendations for the European Evaluation Report based on your national results.

Many of the teachers who participated in the study know the word STEM. Our other teachers state that they are aware of this word during in -service training. Teachers stated that after Stem training, their awareness increased and that they have better comprehend the concept of STEM.

The opinions of the teachers are also expressed by the teachers that it is not easy to prepare and implement the STEM plan and that the number of examples for applications are limited.

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The teachers who participated in the Project stated that engineering skills give life skills (creativity, critical thinking communication) to the educational process.

The teachers who participated in the Project stated that engineering skills give engineering skills (product -formation invention and innovation) to the educational process.

Teachers think that engineering design skills can be integrated into the teaching process of the Science course, and most of them express their time limitation as a disadvantage. In addition to time restriction, lack of materials and crowded classes are the disadvantages expressed by teachers.

The recommendations of teachers:

STEM training should start in preschool period; the necessary arrangements should be made by providing sufficient opportunities and quotas should be reduced. Many of the teachers stated that they could not establish a relationship between the concepts of engineering and teaching before STEM education and defined the concept of engineering as "technical knowledge. However, after STEM training, they stated that they could connect between the concepts of engineering and teaching.

Teacher's views on teaching processes of the development of engineering skills enhances entrepreneurship skills, enables the learning of multi -faceted and critical thinking and enables them to produce creative solutions to the problems encountered. Considering all the findings, it is seen that teachers are willing to open to innovations and will be willing to Stem applications. All teachers think that STEM education is advantageous, necessary, and different from other applications. Teachers stated that STEM education contributes to daily life, develops problem solving skills, provides permanent learning, and develops students' critical thinking and creativity skills. Learn STEM: Innovative STEM learning in schools

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ERASMUS+ KA220-SCH
Cooperation Partnerships in School Education

National Evaluation Report

Yusuf Demir Science and Art Center

Kırşehir, Türkiye

Date:
04.03.2025

Reference Number:
2022-1-TR01-KA220-SCH-000087583

Learn STEM
Innovative Model of learning STEM
in secondary schools

1. Introduction

This report aims to evaluate the outputs produced in the project, which include the LearnSTEM Pedagogical Model, the Teacher Training Programme, and the Online Learning Environment. This report offers a partner-centered perspective, showcasing the successes, challenges, and lessons learned during the project's implementation. The evaluation will help assess the effectiveness of the outputs and provide recommendations for improvements.

1.1 Project Overview

The LearnSTEM "Innovative Model of learning STEM in secondary schools "aims at enhancing the capacity of secondary schools to foster skills in subjects like science, technology, engineering, and mathematics using innovative and interactive teaching methods and approaches, improving students' attitudes and performance in the STEM areas of interest, exploring effective strategies for captivating students' attention and cultivating their interest in essential subjects like science, technology, engineering, and mathematics, which play crucial roles in both the present and the future, permeating all aspects of our lives motivating students to invest more time and effort into these subjects, recognizing the potential they hold in shaping their future endeavors. The following outputs were addressed when implementing the project.

1.1 In Work Package 2, the LearnSTEM Pedagogical Model has been developed,
1.2 In Work Package 3, the LearnSTEM Teacher Training Programme has been developed, and
1.3 In Work Package 4, the LearnSTEM Online Learning Environment has been developed.

1.2 Evaluation of LearnSTEM Pedagogical Model

LearnSTEM Pedagogical Model has been highly effective in developing STEM skills in classrooms. This model has provided students with various opportunities to enhance their thinking skills in science, technology, engineering, and mathematics (STEM). Particularly for gifted individuals, who have high potential in multiple areas, the model has been beneficial in supporting problem-solving, creative thinking, critical thinking, and overall higher-order thinking skills. Additionally, students have started to show increased interest in STEM subjects. The model has played a supportive role in enhancing students' engagement in learning processes by connecting them with real-world problems. Teachers have benefited from the model by offering more interactive and hands-on lessons, which have encouraged students' interest in STEM subjects. Another significant advantage of the model is that it provides students with opportunities to understand the relationships between STEM disciplines. Knowledge and skills in STEM subjects offer students substantial advantages for their future careers. Especially those aiming for technical fields have shown strong interest and commitment. However, some students still face challenges in STEM subjects, but the model helps them overcome these difficulties. LearnSTEM Pedagogical Model has contributed to fostering a deeper understanding of STEM and encouraging students in these fields.

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-Evaluate the relevance and quality of the teaching content. Was it engaging, appropriate, and aligned with the learning goals?

The teaching content has been designed in a highly appropriate and high-quality manner to help students achieve their learning goals. By presenting fundamental STEM concepts in a clear and comprehensible way, the content has captured students' interest. Since it was developed considering age and developmental characteristics, it has been beneficial. Fully aligned with learning objectives, the content balances both theoretical and practical knowledge effectively. Interactive elements that encourage students' active participation have enabled deeper learning. The integration of audiovisual elements has made the content more engaging, increasing students' motivation and strengthening their commitment to learning. Additionally, the content has been diversified to cater to different learning styles, incorporating videos and various resources. Each STEM subject has been presented in a way that maintains students' interest, supported by real-world examples and activities such as experiments that can be easily conducted at home. The learning materials have been designed to enhance students' critical thinking and problem-solving skills. The quality of the content has been reinforced through strong visuals and applications that solidify students' conceptual understanding. Overall, the program's content has enriched both the teaching process and students' learning experiences, successfully helping them achieve their goals.

-Were there any difficulties with the model? If yes, describe them.
Naturally, any newly introduced educational program may have some shortcomings. It is expected that teachers, students, and other stakeholders may face challenges during the implementation process. One of the primary difficulties is that implementing teachers may not initially have sufficient experience in utilizing all aspects of the model effectively. Additionally, classroom challenges such as a lack of technology, internet access, and materials have been other obstacles. Students' interest in STEM subjects has varied over time, with some disciplines attracting more attention than others. Another factor influencing the process has been students' motivation levels toward learning new concepts.

-Provide any recommendations for improving the pedagogical model.

Providing more training and guidance for implementers is one of the most critical aspects of improvement. To help teachers use the model more effectively, comprehensive and efficient initial training, as well as continuous support, should be provided. A rapid and effective support mechanism should be established to address encountered difficulties. Furthermore, creating a platform where teachers can share their experiences and learn from each other would be beneficial. Classroom technology and material deficiencies should be addressed to enable more effective STEM lessons, and digital tools and multilingual resources should be expanded. To help students adapt more easily to the active learning processes required by the model, they could initially be supported with simpler and more effective methods. A gradual approach, moving from simple to complex, could be beneficial. More interactive and visual materials could be incorporated to increase student

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engagement. Real-world examples related to STEM subjects could be expanded to enhance students' interest. To promote a sense of ownership, students could be encouraged to create and share their content. Additionally, offering more personalized learning opportunities would allow students to progress at their own pace. By increasing the model's flexibility, solutions tailored to different classroom dynamics could be developed. Finally, regularly collecting feedback from students and teachers would ensure the continuous improvement of the model.

-Provide suggestions on how the teaching materials or methodology could be improved.

Teaching materials should be further diversified to align with students' interests and needs. Adding more visual and interactive content could increase student engagement. By utilizing digital tools, simulations, and artificial intelligence applications, abstract STEM concepts could be made more concrete, allowing students to gain practical experience. To enhance accessibility, a variety of resources catering to different learning styles should be provided. Incorporating game-based learning strategies and competitions could encourage active student participation. For example, digital content that involves games or challenges could be integrated. Additionally, teaching materials should include more project-based, hands-on activities that promote problem-solving and research skills. The teaching methodology should adopt a student-centered approach, enabling students to learn at their own pace and explore subjects in depth. This way, both fast and slow learners can progress at their own speed without feeling overwhelmed or disengaged. Including up-to-date STEM developments in the curriculum could further enhance students' interest. Support should be provided for free access to global STEM resources. Digital assessment tools and surveys could be used to monitor student progress and provide feedback. Personalized student dashboards and tracking mechanisms could be developed. Moreover, a feedback system for teachers should be established to ensure continuous evaluation and updates to teaching materials and methodologies.

1.3 Evaluation of LearnSTEM Teacher Training Programme
-How useful were the lesson plans created for LearnSTEM Teacher Training Programme ?

The teacher training program conducted within the scope of the LearnSTEM project has been designed to enhance the effectiveness of STEM education. This evaluation examines the benefits of the developed lesson plans and identifies areas for improvement to better support teachers. The lesson plans developed as part of the LearnSTEM teacher training program have been designed to help teachers implement the STEM approach in their classrooms. The benefits of these lesson plans can be summarized as follows:

- Student-Centered Learning Environments Were Provided: The lesson plans have made STEM learning more effective by offering students opportunities for problem-solving, creative thinking, and collaboration.

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- Interdisciplinary Approach Was Strengthened: Connections between science, technology, engineering, and mathematics subjects were made more explicit, enabling a more meaningful and integrated learning experience.
- Applicability Increased: Based on feedback from teachers in different countries, the lesson plans have been designed to be adaptable to various educational systems.
- Technology Use Was Encouraged: The integration of digital simulations, coding applications, and virtual laboratories has been supported in the lesson plans.
- Student Engagement Increased: The implementation of STEM-focused lesson plans has resulted in increased student interest and motivation in the classroom.

-Provide suggestions on how the teacher training programme could be improved to better support teachers.

To enhance the support provided to teachers within the LearnSTEM training program, the following improvements are recommended:

- Flexible and Modular Lesson Plans Should Be Provided: Lesson plans should be made modular to facilitate easier adaptation to different curriculum structures. This would allow teachers to select and implement sections that best fit their lesson schedules.
- More Hands-On Training Should Be Provided: To enable teachers to effectively apply the lesson plans in their classrooms, more workshops and hands-on training opportunities should be offered.
- Guidance and Mentorship Support Should Be Increased: A mentorship network should be established to assist teachers in overcoming challenges they face when implementing STEM applications, even after completing the training program.
- Access to Resources and Equipment Support Should Be Provided: Schools facing material and equipment shortages for STEM activities should be offered low-cost alternative materials, and teachers' access to resources should be expanded.
- Continuous Support Should Be Offered via Digital Platforms: Online training modules, Q&A panels, and platforms where teachers can share their experiences should be developed.
- Greater Focus on Real-World Problems Should Be Encouraged: Lesson plans should include more projects that encourage students to use STEM skills to solve environmental and social issues.

1.4 Evaluation of LearnSTEM Online Learning Environment

-Evaluate the usability of the tools and materials used in the project. Were they user-friendly for teachers and students?

The ability to use the online learning environment in the languages of the countries participating in the project is a significant advantage. However, the lack of videos in

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every language can be considered a drawback. The online learning environment does not provide separate access for teachers and students; both have access to the same content. The learning materials primarily serve as supplementary resources for teachers. The online learning environment consists of two main sections: learning units and games**.** The learning units section includes four different topics, with a total of 16 different subject contents. Each topic contains a video and a presentation file**,** which provide material support for teachers.

-Summarize feedback on ease of use, navigation, and accessibility.

The games section includes various games. It would be more beneficial to evaluate each game individually. These games can be assessed based on feedback collected from students and teachers after they have been used.

-Suggest improvements for the usability of the resources and tools used in the project.

While the presence of supplementary materials in the online learning environment provides advantages for teachers, obtaining feedback from them regarding usability would be more beneficial. Based on the feedback received, new adjustments and improvements can be made to the online learning environment.

1.5 Exploitation
Discuss how the project outcomes can be sustained and integrated into future educational practices.

‾ The materials developed within the project (lesson plans, digital tools, website, STEM activities, etc.) can be integrated into teacher training programs, allowing more educators to benefit from these resources. This ensures that project outcomes are not limited to a specific group of teachers but become sustainable within a broad educational network.

‾ Establishing STEM clubs in schools can support the continuity of activities developed during the project. This way, the implementation of STEM-based activities will not be confined to the project duration but will become long-term and sustainable.

‾ Continuous professional development workshops can be established for teachers to regularly introduce project tools. This will enable educators to implement STEM-based educational strategies in their classrooms, making project outputs a permanent part of education.

‾ To assess applicability in different educational settings and identify best practices for wider dissemination, small-scale pilot implementations of STEM models developed within the project can be tested in collaboration with various schools. Data and feedback gathered from these trials can be analyzed to determine effective measures. Subsequently, guideline documents can be prepared to serve as reference materials for other schools and teachers.

‾ The STEM activities, digital tools, and instructional activities developed within the project can be utilized in different subject areas. This will enhance both the project's lifespan and sustainability. Interdisciplinary applications can include:

- Science: Experiments and observations
- Mathematics: Data analysis

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- Coding & Robotics: Programming and engineering applications
- Geography & Biology: Simulations
- Technology: Development of engineering skills

Evaluate the potential for the tools, methodologies, and resources to be used outside of the project's initial scope (e.g., for other subjects, by other educational institutions).

¯ Digital sharing platforms for teachers can be established.
¯ Inter-school collaborations on STEM education can be fostered.
¯ Partnerships with universities, Science and Art Centers, and lifelong learning institutions can be developed.
¯ The project can be disseminated through platforms such as eTwinning, Google Classroom, and Moodle.
¯ Free STEM courses can be published on YouTube, Udemy, and other online education platforms.
¯ STEM guides can be created and distributed to teachers and students.
¯ STEM-based workshops and summer camps can be organized in collaboration with local municipalities, science centers, and non-governmental organizations.
¯ Student projects can be encouraged to participate in competitions and science fairs to promote and expand STEM skills.

Suggest opportunities for further dissemination and use of the project's results.

¯ Workshops can be organized at local and national levels (Teacher Education Conferences, symposiums, etc.).
¯ Project presentations can be showcased at STEM fairs.
¯ The project can be widely disseminated through social media, blogs, and open education platforms (such as eTwinning, YouTube, and Udemy).
¯ Collaboration with students and educational institutions can be encouraged to contribute to STEM policies.

2. Conclusion:
Summarize your overall evaluation of the LearnSTEM project and its outputs.

The LearnSTEM project has yielded significant outcomes in enhancing STEM education and supporting teachers in integrating this approach into their classrooms. One of the key achievements is the development of a comprehensive teacher training program, which has provided educators with the necessary skills and resources to implement STEM-based teaching strategies. The lesson plans and educational materials designed within the project have contributed to creating student-centered learning environments, encouraging problem-solving, creativity, and interdisciplinary thinking. Additionally, the integration of digital tools, such as simulations, coding applications, and virtual labs, has made STEM learning more engaging and accessible.

The online learning platform developed within the project serves as a valuable resource, primarily supporting teachers with structured learning content. However, the lack of video materials in multiple languages has been identified as a limitation, suggesting the need for further improvements to enhance accessibility and usability.

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Moreover, the project has emphasized the importance of sustainability by proposing the establishment of STEM clubs in schools, which would ensure the continuity of STEM-related activities beyond the project's duration. Expanding STEM applications across different subjects has also been encouraged to promote interdisciplinary learning and maximize the impact of the project.

For long-term sustainability and widespread adoption, integrating project materials into teacher education programs and implementing pilot studies in various schools have been recommended. Strengthening collaboration between schools and creating digital platforms for teacher support and resource sharing would further facilitate the dissemination of STEM education. Additionally, preparing STEM education guidebooks and offering free online courses on platforms such as eTwinning, Udemy, and YouTube would help reach a broader audience. Overall, the LearnSTEM project has made a substantial contribution to STEM education by equipping teachers with effective teaching strategies, fostering student engagement, and promoting interdisciplinary learning. Ensuring the continued development and accessibility of its resources will be key to sustaining its long-term impact.

Offer any final recommendations for the European Evaluation Report based on your national results.

Based on the national results, several key recommendations can be made for the European Evaluation Report to enhance the overall impact and sustainability of the LearnSTEM project. Firstly, ensuring the accessibility of project materials in multiple languages would improve inclusivity and allow a broader range of educators and students to benefit from the resources. This includes translating videos, lesson plans, and digital content to align with the linguistic needs of different partner countries.

Secondly, expanding teacher training programs with more hands-on workshops and mentoring opportunities would enhance the practical implementation of STEM methodologies in classrooms. Offering ongoing professional development beyond the initial training phase, including online support networks and peer collaboration platforms, would provide teachers with continuous guidance and reinforcement.

Another crucial aspect is strengthening interdisciplinary connections by integrating STEM concepts across various subjects. Encouraging teachers to incorporate STEM principles into science, mathematics, technology, and even social sciences or humanities can foster a more holistic learning experience for students. Pilot studies in diverse educational settings would further refine best practices and identify the most effective teaching strategies for different classroom contexts.

Furthermore, promoting collaboration between schools, universities, and local education centers would create a stronger support network for STEM education. Establishing partnerships with science and technology institutions, industry professionals, and policymakers can contribute to the long-term sustainability of the project and ensure that STEM education aligns with real-world challenges and career opportunities.

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Finally, the digital learning environment should be continuously evaluated and improved based on user feedback. Enhancing its interactivity, incorporating gamified learning experiences, and ensuring distinct access points for students and teachers would make the platform more effective and engaging.