STEAM Tales

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Final report on the assessment of the impact of STEAM Tales resources on children

U.PORTO

Project Title

STEAM Tales – Enhancing STEAM education through storytelling and hands-on learning (KA220-HE-23 -24-161399)

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Executive summary

This report summarises the results of the project "STEAM Tales: Enhancing STEAM education through storytelling and hands-on learning", organised by the European Union's Erasmus+ Programme and based on a collaboration between CESIE (Italy), GoINNO (Slovenia), LogoPsyCom (Belgium), MIND (Germany), and the University of Porto (Portugal).

"STEAM Tales" aimed to foster interest in the fields of Science, Technology, Engineering, Arts, and Mathematics (STEAM) among primary school children from six to nine years old, especially girls, and potentially promote STEAM professional choices in the future.

For this purpose, an innovative approach of combining storytelling with hands-on activities was conceived: 12 stories were written, inspired on the biographies of real female role models who excelled in STEAM structured using Joseph Campbell's Hero's Journey Model, and 24 lesson plans (2 for each role model) containing hands-on activities related to the work field of the role models.

These materials are to be used by teachers during lessons and, as a way of helping them select the most suitable stories and lesson plans, two additional instruments have been developed: the Instrument to assess children's perceptions, interest and motivation in STEM Fields (a questionnaire to be administered to the children to evaluate children's perceptions through implicit and explicit associations of gender representation in different STEM fields, their associations between gender and different skills, their interest in STEM fields, their professional ambitions and prospects) and the *Selection form of the lesson plan according to the teacher's needs* and curriculum objectives (a table that allow teachers to select the most suitable lesson plan for their class depending on the results of the questionnaire, their personal and curriculum objectives). These documents are contained in the annexes to the Assessment Protocol.

Between April and May 2025, the materials developed in the context of the project were piloted in primary schools in the five partner countries. The procedures consisted in reading one of the 12 stories to a class and carry out related hands-on activities with the children. The questionnaire was applied to the children (either before or after the experimental procedure). Teachers were interviewed as a way of collecting their feedback on the STEM education to them and to children, and they were asked to evaluate the lesson plans' quality.

In this report, we present the teachers' results and an overall analysis of the children's results from all the pilots. We have opted for a synthetic discourse in this report and provided technical appendices for more in-depth reading. The analysis of each partner's pilot results has been carried out and is available in a secondary report.

Chapter 1, the Theoretical context and background, aims to provide a theoretical context for the project's nature and objectives and to explain its pertinence.

Chapter 2, Methods, addresses the method followed in this research, how the pilots were performed, offering information about the sites they took place, the numbers and nature of participants they involved (teachers and children), the instruments used and the procedure.

Chapter 3, Findings, presents the results of the pilots. Results of the interviews with teachers, they generally feel confident in their teaching of STEM-related disciplines such as Mathematics and Environmental Studies (which comprises Science) but find it more difficult to teach Technology. They report that their students are interested in all sorts of disciplines except Mother Language. This is an interesting challenge in the Technology discipline, which is appealing to students but difficult for teachers. None of them consider any of the disciplines to be extremely difficult for their students, but they find Environmental Studies and Technology to be slightly difficult and Mathematics to be moderately difficult. Teachers offered examples of experiences they had with STEM Education, initiatives or programs in their schools that promoted STEM fields, and all revealed positive opinions towards the promotion of STEM fields among children in this age group, considering them to be important and beneficial for students.

In the evaluation of lesson plans' quality, the teachers made quite a very positive evaluation of the lesson plans, in terms of content, objectives, innovation, accessibility, connection with female role models, and the materials' cultural and scientific informativeness, as well as their ability to promote creativity, curiosity, and critical thinking.

The children's questionnaire responses were presented by activity and, within each activity, divided into three sections: a general overview, a global results' analysis, and a partner-specific analysis. Globally, the results revealed traditional gender stereotypes associating the male gender with STEM (specially Engineering and Technology) were noted among the children. However, boys associated STEM fields more with the male gender whereas girls have a more balanced view of gender representation. When asked about their interest in STEM fields, boys expressed interest in all STEM fields, while girls showed greater interest specifically in Science, Technology, and Mathematics, with comparatively lower interest in Engineering. Nevertheless, this interest that girls demonstrate over these STEM fields does not translate into professional aspirations in these fields, as opposed to what happens among boys. These results are in line with what literature reveals to be forms of conditioning (implicit and explicit) imposed by society through stereotypes.

In Belgium, while some traditionally stereotyped views were present among the children, they generally had a balanced view of gender representation and inclusion in STEM fields. That however did not translate into equal interest and appreciation on the part of the children as girls showed less interest in STEM fields than boys. They were also less likely to think they might be able to work with STEM fields in the future than boys.

In Germany, girls associated Science and Technology more with their own gender, while boys displayed stronger alignment with traditional stereotypes, especially in Engineering. Girls were generally uninterested in Technology and Engineering and generally reported lower self-confidence in pursuing STEM careers, in contrast to what happens to boys. A shift in perception is noted from the control to the experimental group, particularly in recognizing shared competence in skills like Digital and Mathematical Skills.

In Italy, children generally have balanced gender views across most STEM fields, particularly in Mathematics and Science. While both boys and girls showed strong interest in STEM, girls were more likely to associate themselves with Science and less with Engineering. Digital skills were still perceived as male-dominated, particularly by boys. Across both control and experimental groups, the intervention seemed to have led to more balanced perceptions and to have increased children's interest in working with STEM fields in the future.

In Portugal, children's perceptions of STEM fields, particularly in Science and Mathematics were generally inclusive. A significant outcome of the intervention was an increase in interest in Mathematics among the experimental group. Boys showed greater confidence in pursuing STEM careers. Apart from Science, boys were more likely to think they will be able to have a STEM-related profession than girls. In any case, children in the experimental group seemed to have acquired a greater interest in working with STEM in the future, as well as self-confidence.

In Slovenia, persistent gender stereotypes across most STEM fields, especially in Engineering and Mechanics, were identified. Boys more frequently expressed interest and confidence in pursuing STEM careers, particularly in Technology and Engineering, though girls were more inclined toward Mathematics. Overall, boys were more likely than girls to think they will be able to work with STEM in the future than girls.

Chapter 4 offers a discussion of the results in the light of the literature and Chapter 5 represents a conclusion, highlighting the teachers' positive response to the materials developed in the project and to the promotion of STEM among children, the persistence of gender stereotypes around STEM fields among children and the promising methodology of the project.

Anyone interested can consult the “STEAM Tales” project website.

1. Theoretical context and background

The project "STEAM Tales: Enhancing STEAM education through storytelling and hands-on learning" is a European Union's Erasmus+ Programme, based on a collaboration between Belgium (LogoPsyCom), Germany (MIND), Italy (CESIE), Portugal (University of Porto), and Slovenia (GoINNO). The project aims to foster interest in the fields of Science, Technology, Engineering, Arts, and Mathematics (STEAM) among primary school children from six to nine years old, especially girls, and potentially promote STEAM professional choices in the future.

Children's growth and development is shaped by their environment and their interactions with family, teachers, peers, and society in general. These experiences influence children's self-concept and self-perception in different STEAM fields. This can lead to the development of stereotypes among children, creating an external barrier to how individuals perceive and categorise others. These stereotypes are perpetuated over time and within social groups, shaping attitudes and behaviours. The internalisation of these stereotypes creates a stereotype threat represents an internal barrier for an individual, whereby there is a risk of confirming a negative stereotype about their self-perception, and a concern that they will be judged or treated negatively based on this stereotype (Sebastián-Tirado et al., 2023; Spencer et al., 2016).

In the study by Gilchrist and Zhang (2022), children between 4 and 5 years of age listened to a series of short stories about various professions. Subsequently, they were asked to identify the gender of the characters. After listening to the stories, the children associated professions such as pilot with males only, nurse with females only, and scientist and police officer with males predominantly, and flight attendant and university English student with females predominantly.

The study by Vilia and Candeias (2020) involved evaluating competence factors according to self-efficacy in science fields, intellectual accessibility in the field of study and the ability self-concept in the field of study. The results revealed that abilities related to science, technology, engineering, and mathematics are typically associated with males, whereas those related to care, the arts and literature are more commonly associated with females (Farias, 2021; PISA, 2022; Vilia & Candeias, 2020). However, female representation and recognition in STEM fields, as well as in literature and the arts, is very low and scarce. For instance, less than 5% of Nobel Prizes in STEM have been awarded to women, and the situation is not much better in literature, with only 15% of awards going to Women (Nobel Prize Outreach AB, 2025).

In line with this, the project aims to present STEAM fields to girls and boys, and to combat gender stereotypes enhanced by the underrepresentation of women in these fields, as well as the lack of knowledge about female role models. To do so, the process is to empower teachers to enhance their students' STEAM knowledge by creating educational materials, such as guides, inspirational stories of women in STEAM fields, and lesson plans with hands-on activities. This project will support the development of high-quality education while also promoting interest and achievement in STEAM fields, through the combination of storytelling and hands-on activities.

In addition to the positive effects of STEAM education on children's futures through hands-on activities, the storytelling approach has been recognised as an effective means of teaching STEAM and capturing attention. Research has shown that children's interest in STEAM and scientific research increases when they are exposed to stories before participating in hands-on activities (Morais, 2020).

Integrating storytelling and hands-on activities into STEAM education is a novel approach. This approach combines two distinct elements: reading and hands-on activities. While these two approaches may seem contradictory, research has shown that they are complementary. For example, reading stories about inspiring women can encourage girls to conduct hands-on activities (Morais, 2015; 2020).

Therefore, the project introduces children to the stories of women who have excelled in STEAM fields based on their biographies, adapted into a short story format using the Hero's Journey Model (Campbell, 2008), and complemented with illustrations. These stories are accompanied by hands-on activities inspired by the work of these women role models, which lead children to explore the scientific method and learn about science, technology, engineering, and mathematics concepts.

Twelve female role models were chosen – from the different fields of science, technology, engineering, and maths and with different cultural, ethnic, and social backgrounds and career journeys – and to each of them were dedicated a story and two sets of hands-on activities.

2. Methods

In light of the objective of obtaining the finest possible materials, the evaluation of the STEAM Tales project involves a series of final pilots conducted by each partner to assess the materials and their implementation in different social, cultural, and educational contexts.

The target group of the project are primary school teachers and the projects intended to provide them with easy-to-follow and ready-to-use stories and lesson plans that would also be creative, innovative, and informative; support teachers with materials that will improve the curiosity and interest of children about STEAM fields. Having in consideration that our primary target group are teachers of primary education, and that the project ultimately aims to provide teachers with materials to combat stereotypes by presenting children with female role models and their work, we assessed the materials developed in the project with teachers from the different countries and environments.

We conducted interviews with the teachers to better contextualise the project and understand the profile of those participating in the activities. The interviews covered the teachers' opinions and experiences with and about STEAM, including their experience of implementing STEAM activities and how they identified the children's interests and difficulties among STEAM disciplines.

To assess the adaptability, content, learning outcomes, complexity and presentation of the educational materials developed during the project, we created a short questionnaire that enables primary school teachers to evaluate the quality of the materials for their classrooms and curriculum objectives, and interests. Fifteen criteria were created that evaluated the stories and lesson plans according to writing, presentation, clarity, creativity, content, and innovation. In this assessment, we can consider the research question as “What is the evaluation of teachers present in the pilot about the materials developed and presented?”.

Among the children that are our second target group, the aim was to map children's perceptions of gender representation in different STEM fields and diagnose stereotypes among children. So, the research question can be identified as "What are the children's perceptions about gender representation and gender roles in different fields, such as Science, Technology, Engineering and Mathematics?".

With the children, we conducted an experimental study with the post-test only group control. This implies that two random groups were established: R1 and R2. A post-test (O1) was implemented in the experimental group (R1) following the implementation of the activity (X). The control group (R2) was subjected to the same test (O1) without exposure to the activity (Campbell & Stanley, 1966). Following this evaluation, the activity (X) was implemented to achieve equality for children by providing them with access to a new activity within their school environment. The scheme is presented below:

R1 – X O1

R2 – O1 (X)

The objective of the test is to assess the children's perceptions of women's role in various occupations and tasks. To achieve this, a series of activities have been developed which address the following issues:

- Association of gender with professions using images
- Perceptions of different self-skills
- Interest and aspirations for future professions in STEM fields
- Examination of stereotypes, transversal to all the activities

In order to conduct this study, six activities were devised to explore the issues presented, in accordance with the above scheme.

2.1. Pilot site and context

A total of 20 pilots were conducted across partner countries, and Table 1 presents the number of pilots conducted by each one. A description of the schools in which the pilots were conducted is presented in Table 2.

Table 1.
Number of pilots conducted by each *project's partner.*

Partner	Number of pilots
LogoPsyCom (Belgium)	3
MIND (Germany)	4
CESIE (Italy)	4
U. Porto (Portugal)	4
GoINNO (Slovenia)	5

Table 2.
Pilots site and contexts of the schools in the partner countries.

Pilot site	Context	Number of pilots
Rural school	School of small size (less than 100 children and 10 teachers)	4
Suburban schools	School of medium size (more than 100 children and fewer than 300 teachers and more than 10 teachers and fewer than 20 teachers)	6
Urban schools	School of large size (more than 300 children and 20 teachers)	10

2.2. Participants

The participants in the pilots comprise 20 teachers and 341 children. The characterisation of children from each partner country is presented in Table 3, and the division of girls and boys by control and experimental groups is presented in Table 4. The characterisation of teachers is presented in Table 5.

Table 3.
Characterisation of the children's participants in the 20 pilots conducted by the project's partners.

	LogoPsyCom (Belgium)	MIND (Germany)	CESIE (Italy)	U. Porto (Portugal)	GoINNO (Slovenia)	Total
Girls	20	34	42	35	29	160
Boys	13	44	34	48	36	175
"I would rather not say"	4	–	–	1	1	6
Total	37	78	76	84	66	341

Table 4.
Characterisation of the participant children in all five countries.

Participants	n	%
Girls	160	
Control	79	49
Experimental	81	51
Boys	175	
Control	94	54
Experimental	81	46
"I would rather not say"	6	
Control	3	50
Experimental	3	50

Table 5.
Characterisation of the *teachers'* participants in the 20 *pilots conducted by the project's partners.*

Teachers	Age (years old)	Gender	Years of teaching experience	Academic background	Time teaching at the current school (years)
1	51-60	female	21-30	Bachelor's degree in primary education	Unspecified
2	41-50	female	11-20	Unspecified	11-20
3	41-50	female	11-20	Unspecified	Unspecified
4	31-40	male	1-10	Bachelor's degree in primary education	1-10
5	51-60	female	21-30	Master's degree in political sciences	1-10
6	51-60	female	21-30	Master's degree in Languages and Literature	1-10
7	51-60	female	21-30	Master's degree in foreign Languages	1-10
8	51-60	female	21-30	Bachelor's degree in primary education	1-10
9	41-50	female	21-30	Bachelor's and master's degree in primary education	21-30
10	41-50	female	11-20	Bachelor's degree in primary education	1-10
11	51-60	female	31-40	Bachelor's degree in primary education	1-10
12	41-50	female	21-30	Bachelor's degree in primary education	21-30
13	41-50	female	21-30	Bachelor's degree in primary education	21-30
14	51-60	female	31-40	Higher education	21-30
15	41-50	female	11-20	Bachelor's degree in primary education	11-20

Note: 20 teachers participated in the pilots, but only 15 agreed to be interviewed.

2.3. Instruments

2.3.1. Interview script for teachers' participation in the pilot project

The interview script is short and focused on collecting teachers' feedback on the STEM education to them and to children, giving the opportunity to the interviewees to expand and elaborate their views[1].

This interview was composed of five main sections, presented in Table 6.

Table 6.
Description of the five section comprising the interview script conducted with the teachers.

Interview section's name	Description
Personal information and background	Characterisation of the teachers participating in the project, such as their academic background, experience, and length of time in the school, is provided.
Teaching Confidence	Confidence of the interviewed teachers regarding the different disciplines of the first cycle of primary education curriculum, including associated STEAM disciplines such as Mathematics, Environmental Studies (topics involving Science and Engineering) and Technology.
Student Engagement and Perceived Difficulty	The interviewed teachers diagnosed their students' interest and difficulty in the different disciplines of the primary education curriculum.
STEM Education	Teachers' experience with STEM activities and initiatives in their schools. We also talked about their opinion of implementing these activities with children in the age group covered by our project (6-9 years old).
Lesson Plan Selection	Analysis of the choice of lesson plans and the selection form developed within the project,

[1] The interview script for teachers' participation in the pilot project is available in the Appendix A.

2.3.2. Evaluation instrument of the lesson plans' quality

The evaluation instrument of the lesson plans' quality was developed so that teachers could assess the lesson plans whose implementation they had witnessed or performed during the pilots through 15 criteria in a scale from 1 to 5 in which 1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good and 5 = Excellent, and where there is also the option "Not Applicable"[2]. We can group the 15 developed criteria into three assessment dimensions, presented in Table 7.

Table 7.
Description of the objectives of the three dimensions of the evaluation instrument of the lesson plans' quality.

Dimensions of the evaluation instrument **of the lesson plans' quality**	Evaluation objectives
Evaluation of the lesson plans	The lesson plans were evaluated according to the following criteria: objectives, clarity, understandability, suitability, adaptability, organisation, accessibility, relevance, innovation, creativity, and versatility.
Evaluation of the stories	The stories were evaluated in terms of how well they established connections with the female character, promoted feelings and emotions among children, demonstrated cultural contextualisation, promoted scientific accuracy, and had visual and graphic appeal.
Evaluation of the hands-on activities	The evaluation of hands-on activities focuses on assessing the promotion of participation and engagement, and the enhancement of creativity, curiosity, and critical thinking throughout the activity's development.

[2] The evaluation instrument of the lesson plans' quality is available in Appendix B.

2.3.3. Instrument to assess children's perceptions, interest, and motivation in STEM fields

The *Instrument to assess children's perceptions, interest, and motivation in STEM fields* consists of six activities[3], presented in Table 8.

Table 8.
Description of the activities of the *Instrument to assess children's perceptions, interest, and motivation* in STEM fields.

Activities	Description
Activity 1	Analyse children's implicit associations between gender and different STEM (Science, Technology, Engineering and Mathematics) fields by asking them to colour in four generic face-like icons representing people working in STEM fields using blue, pink, or purple (with blue and pink traditionally being associated with male and female genders, respectively, and purple being a combination of the two).
Activity 2	Diagnose children's perceptions of gender representation in STEM-related skills by associating a series of skills (reading, digital skills, writing skills, leadership skills, mathematical skills, and care skills) with exclusively boys, a mixture of boys and girls, and exclusively girls.
Activity 3	Express explicit associations of gender with different STEM fields, instructing children to return to Activity 1 and label each picture with the gender they associate with the face (e.g. "Girls", "Boys", or "Girls and Boys").

[3] The instrument to assess children's perceptions, interest, and motivation in STEM fields is available in Appendix C.

Activities	Description
Activity 4	Evaluate children's perceptions of the association between gender and different professions, such as STEM professions and those identified as having extreme gender representation. The following list contains a series of professional fields: Science, Mechanics, Technology, Kindergarten Education, Engineering and Mathematics, and an association for each field with "Boys", "Girls" or "Boys and Girls". The is for question asks children who they think generally works in the presented field (men, women, or both). The can be for question asks if they think people should work in the field.
Activity 5	Express children's interest about Science, Technology, Engineering and Maths.
Activity 6	Children indicate their professional aspirations, their professional expectations for the future, and their parents' professional expectations for the children.

This instrument is available for teachers to use in their classroom to diagnose the children's perception of gender representation in STEAM fields and choose the most adequate lesson plan, in the Assessment Protocol for Teachers.

2.4. Procedure

As part of the evaluation of the STEAM Tales project, the materials developed, including the lesson plans composed of stories and hands-on activities, it was planned to assess these by each partner organisation.

Description of implementation

In this section, we describe the story and lesson implemented in each of the partners' pilots, explaining how they were implemented by either the monitor or the teachers as presented in Table 9. A synthesis of the stories read and the lesson plans conducted is presented in Table 10.

Table 9.
Description of the implementation set for each partner's pilot, identifying the story and lesson plan conducted in it.

Partner	Pilot	Story and lesson plan	Implementation
LogoPsyCom (Belgium)	1st pilot	Rose, the desert flower and digital master mind + The World Wide Web game	Monitors carried out the story and the lesson plan
	2nd pilot	Samantha, the girl who went to space. Twice! + Make a space rocket	Monitors carry out the story and the lesson plan, with teachers' help.
	3rd pilot	Samantha, the girl who went to space. Twice! + Exploring the solar system	
MIND (Germany)	1st pilot	Andreja Gomboc: A professional stargazer + Why do stars twinkle?	Monitors carry out the story and the lesson plan.
	2nd pilot	Elvira Fortunato, the paper engineer + Fruit battery + The power of chemicals	Teacher read the story. Monitors did the lesson plan with the children.
	3rd/4th pilot	Domitila de Carvalho: A fearless trailblazer + Exploring geometry and architecture with the tower challenge	
CESIE (Italy)	1st pilot	From An Egg to the Nobel Prize: The Remarkable Journey of Rita-Levi Montalcini + Home-made microscope	Teacher read the story. Monitors did the lesson plan with the children.
	2nd pilot	From An Egg to the Nobel Prize: The Remarkable Journey of Rita-Levi Montalcini + Home-made microscope	Monitors carried out the story and the lesson plan, with teachers' help.
	3rd pilot	From An Egg to the Nobel Prize: The Remarkable Journey of Rita-Levi Montalcini + Five senses exploration kit	Teacher read the story. Monitors did the lesson plan with the children.
	4th pilot	Samantha, the girl who went to space. Twice! + Exploring the solar system	Monitors carried out the story and the lesson plan.
U. Porto (Portugal)	1st pilot	Elvira Fortunato, the paper engineer + Fruit battery	Monitors carried out the story and the lesson plan.
	2nd pilot	Zita, the scientist who searched for life in pieces of the Universe + Meteorite impact on Earth	
	3rd pilot	Elvira Fortunato, the paper engineer + The power of chemicals	
	4th pilot	Domitila de Carvalho: A fearless trailblazer + Lung model	

Partner	Pilot	Story and lesson plan	Implementation
GoINNO	1st pilot	Ana, the brave ~~princess~~ scientist + Making slime	Monitors carried out the story and the lesson plan.
	2nd pilot	Ana, the brave ~~princess~~ scientist + Solving dried markers	
	3rd pilot	Ángela, the guardian angel of nature + How flowers absorb water	Teachers read the story and did the lesson plan with the children.
	4th pilot	Ángela, the guardian angel of nature + Cleaning an oil spill	
	5th pilot	Samantha, the girl who went to space. Twice! + Make a space rocket	

Table 10.
Identification of the stories and lesson plans implemented in each of the 20 pilots.

Female Role Model	Story	Lesson Plan
Andreja Gomboc	Andreja Gomboc: A professional stargazer	Why do stars twinkle?
Samantha Cristoforetti	Samantha, the girl who went to space. Twice!	Exploring the solar system Make a space rocket
Elvira Fortunato	Elvira Fortunato, the paper engineer	Fruit battery The power of chemicals
Zita Martins	Zita, the scientist who searched for life in pieces of the Universe	Meteorite impact on Earth
Ana Mayer-Kansky	Ana, the brave ~~princess~~ scientist	Making slime Solving dried markers
Domitila de Carvalho	Domitila de Carvalho: A fearless trailblazer	Lung model Exploring geometry and architecture with the tower challenge
Rita-Levi Montalcini	From An Egg to the Nobel Prize: The Remarkable Journey of Rita-Levi Montalcini	Home-made microscope Five senses exploration kit
Ángela Piskernik	Ángela, the guardian angel of nature	Cleaning an oil spill How flowers absorb water
Rose Dieng-Kuntz	Rose, the desert flower and digital master mind	The World Wide Web game

Data analysis

We conducted a statistical analysis using SPSS and Excel, and a thematic content analysis using NVivo.

With teachers, we conducted structured interviews about their perceptions around STEAM fields and activities, analysed through NVivo 15 to conduct a content analysis of the answers given by the teachers during the interview and Statistical Package for Social Sciences software, IBM SPSS, version 29.0 to obtain the percentages of responses and for each response. Table 11 shows the coding system created for the content analysis applied to some of the teachers' answers.

Table 11.
Coding system for the teachers' answers' content analysis.

Categories	Subcategories	Description
A. Teaching Confidence	– --------------------------	Manifestation of specific challenges, experiences, or reasons influencing teacher's confidence levels.
B. Student Engagement and Perceived Difficulty	– --------------------------	Description of specific observations, experiences, or factors influencing your students' interest levels
C. STEM Education	C1. Experience	Description of experience with STEM activities and examples.
	C2. Initiatives or programs	Description of initiatives with STEM and examples.
	C3. Opinion	Teacher's opinion about STEM activities among children in this age range.
D. Lesson Plan Selection	– --------------------------	Teacher's criteria to select a specific lesson plan about STEM or opinion about the Selection form of the lesson *plan according to the teacher's needs and curriculum* objectives

In order to analyse the teachers' evaluation of the lesson plan quality, the Statistical Package for Social Sciences software, IBM SPSS, version 29.0, was used to obtain the percentages of responses for each discipline.

With children, the Statistical Package for Social Sciences software, IBM SPSS, version 29.0, was used to analyse the data of children's responses. This software was used to analyse descriptive statistics – through a characterisation of response frequencies, percentages, standard deviations. To test whether there were differences in the answers given in each activity according to gender or/and group (control or experimental), the non-parametric Chi-square test of independence was applied.

3. Findings

In the total, 20 pilots were conducted involving 20 teachers and 341 children, in different social, cultural, and educational contexts.

The findings are divided into two sets: the teachers' responses and children's responses.

3.1. Teachers' responses

3.1.1. Interview guide for teachers' participation in the pilot project[4]

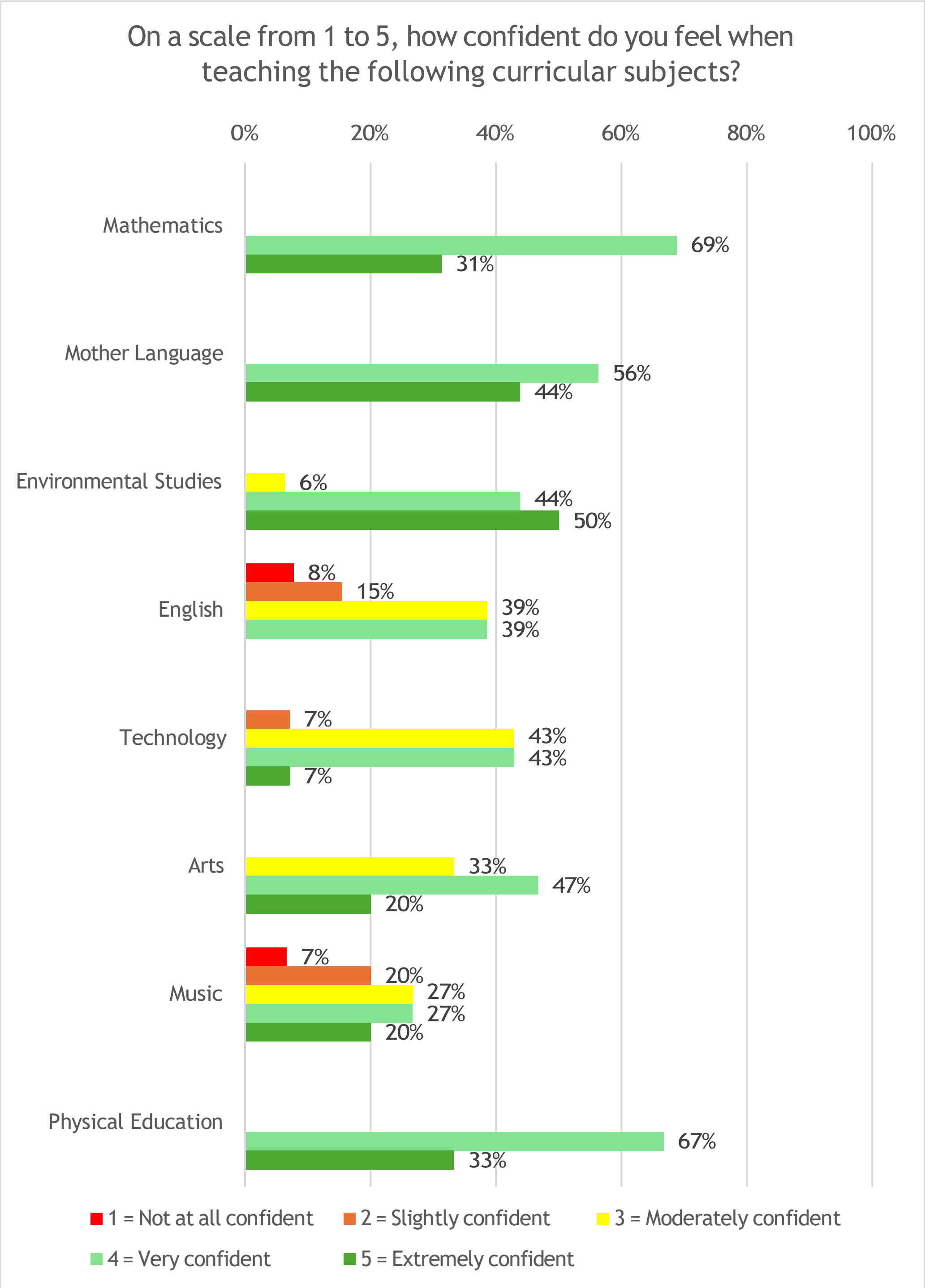
A. Teaching Confidence

In terms of teaching confidence, teachers generally feel most confident when teaching Mathematics, Mother Language, Environmental Studies, Arts and Physical Education. Music, Technology and English are the disciplines that teachers find the most challenging. Interestingly, teachers express confidence in teaching STEAM-related disciplines such as Mathematics, Environmental Studies (comprising Science and Engineering, as well as History and Geography), Arts and Mother Language, but not Technology, English, and Music.

Figure 1 shows the percentages of ratings that teachers gave to their confidence levels in teaching each discipline in the 1st cycle of primary education among the partner countries in detail.

[4] The analysis of these results is available in Appendix D.

Figure 1.
Ratings given by teachers on their level of confidence in teaching each discipline in the 1st cycle of the primary education curriculum.



Within the category A. Teaching Confidence, a total of 21 coded references were identified in which teachers reflected on the factors influencing their confidence levels when discussing specific challenges, experiences, or motivations. The main themes that emerged included personal preferences and enjoyment, prior knowledge and experience, continuous professional development, academic background, and student engagement.

Several teachers linked their confidence to personal interest and enjoyment in specific subjects. For instance, one teacher expressed strong motivation when teaching Mathematics, stating that it is “a motivating area for me, where I think I can pass on that enjoyment to the students” (Teacher 8). In contrast, a lack of interest in certain areas was also cited as a limiting factor, as illustrated by a teacher who admitted, “I do not have interest for exploring new technologies” (Teacher 13).

Confidence was also shaped by the level of prior training and knowledge. One teacher noted feeling less confident in Music due to limited formal preparation, explaining, “I have some knowledge, but not as much as I would like because I have relatively little training” (Teacher 8). On the other hand, ongoing professional development was seen as a source of confidence, with one teacher stating, “I feel confident because I’m always keeping up to date” (Teacher 10).

Finally, student engagement was mentioned as an external factor influencing teaching confidence. One teacher observed that “students are increasingly distracted and less motivated because of the way access to information is made easier for them” (Teacher 10), suggesting that shifts in student behaviour can impact teachers’ perceptions of their own effectiveness.

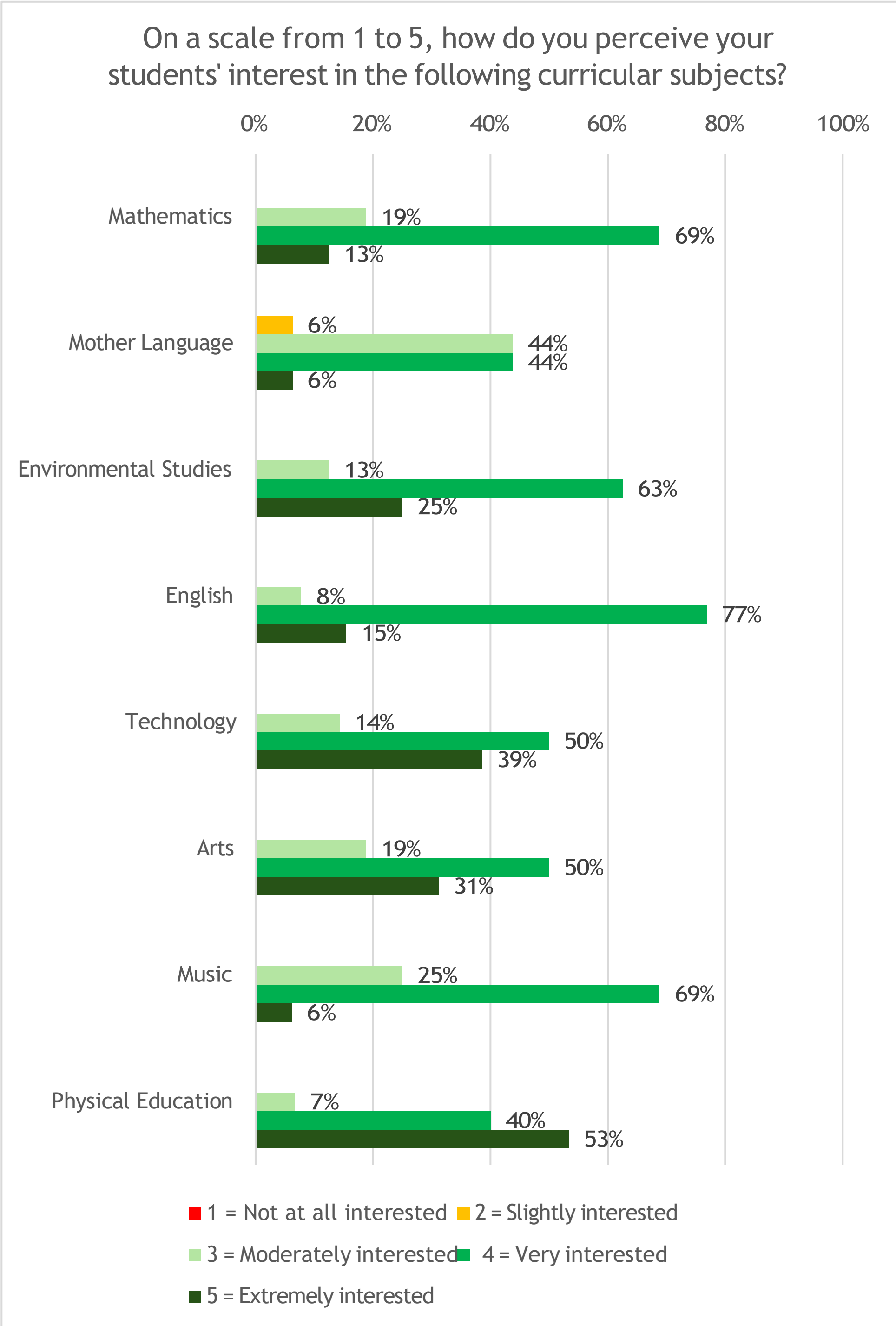
B. Student Engagement and Perceived Difficulty

Analysing the students’ engagement with the different disciplines of the curriculum, teachers consider that their students are considerably interest in all the disciplines, except Mother Language.

Figure 2 shows the percentages of ratings teachers gave to their students’ interest levels regarding each discipline.

Figure 2.

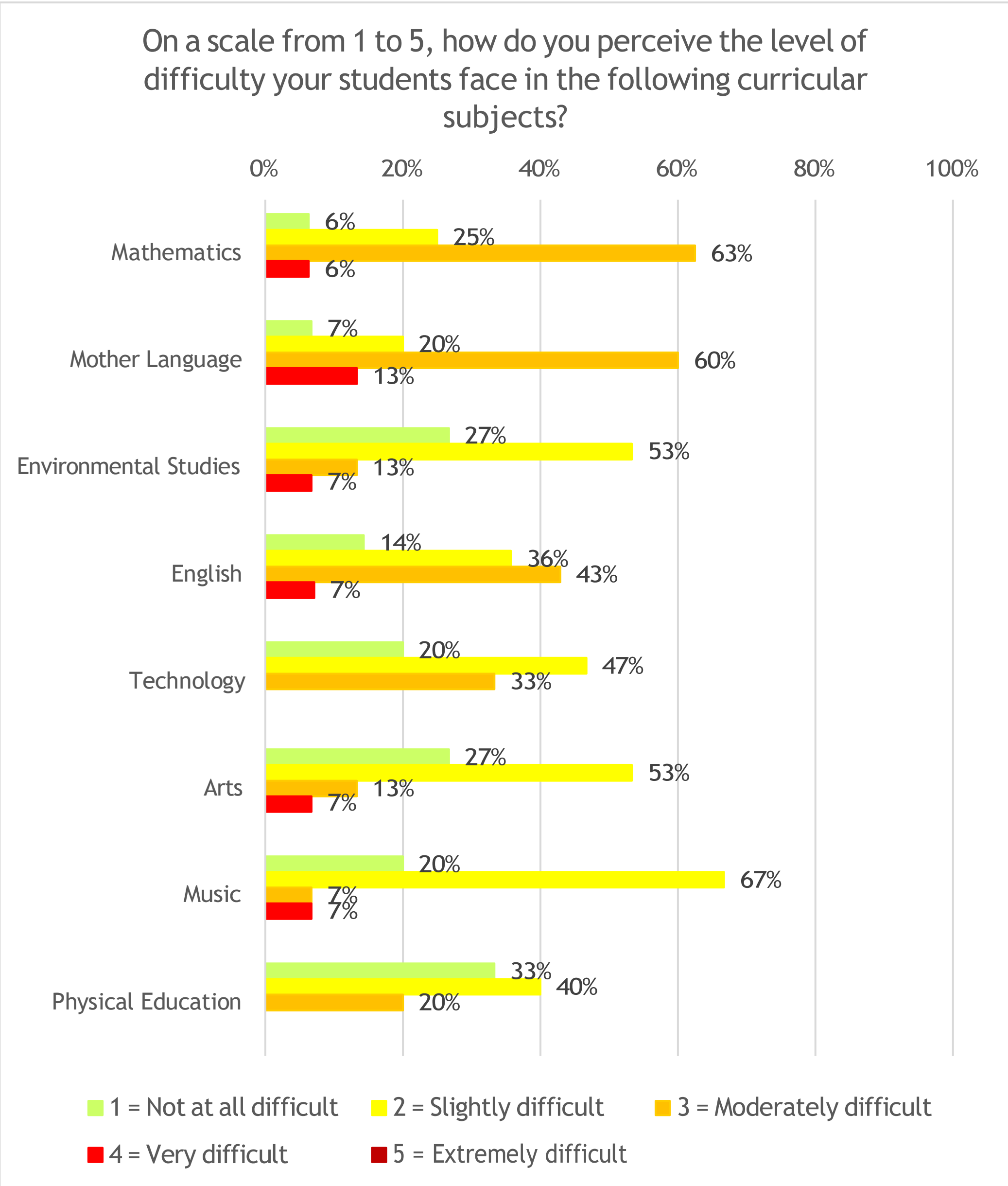
Ratings given by the teachers to their students' interest levels regarding each discipline in the 1st cycle of the primary education curriculum.



As the perceived difficulty of their students, none of the teachers considered any of the disciplines to be Extremely difficult for their students. The disciplines considered most difficult are Mother Language and Mathematics. Overall, teachers consider that their students feel that Environmental Studies and Technology are "Slightly difficult". Physical Education is the subject considered least difficult for the children.

Figure 3 shows at detail the percentages of ratings teachers gave to their students' difficulty levels regarding each discipline.

Figure 3.
Ratings given by the teachers to their students' difficulty levels regarding each discipline in the 1st cycle of the primary education curriculum.



When asked to comment on how interesting and difficult they thought the disciplines were for the children, the teachers mentioned several aspects that are worth emphasizing.

A total of 36 coded references were identified in which teachers discussed the subjects their students found most interesting or most challenging, along with the factors influencing these perceptions.

Subjects such as Physical Education, Technology, and the Arts were most frequently mentioned as areas of high student interest. This preference appears to be linked to students' enjoyment of hands-on activities, movement, and embodied learning. One teacher noted that students "show strong interest in hands-on and creative work (conducting experiments independently), in subjects or topics where there isn't just one result, but where students can act openly and reflect" (Teacher 2). This finding is particularly relevant to the STEAM Tales project, which promotes experiential learning and interdisciplinary approaches, as reflected in its inclusion of the Arts within the STEAM framework.

In contrast, Mother Language was most commonly identified as the subject students found most difficult. Teachers frequently cited challenges related to reading, spelling, and text interpretation, which were often associated with lower levels of engagement. For example, one teacher explained that students "have some difficulties with interpretation and are therefore less interested. Anything that involves interpretation they find more difficult at first" (Teacher 9).

C. STEM Education

C1. Experience

A total of 18 coded references were identified in which teachers discussed their experiences with implementing STEM in the classroom. In three of these instances, each involving a different teacher, it was noted that they had "very little" or "no" experience with STEM-related activities.

In all other cases, teachers reported having some level of experience with STEM implementation. In three occurrences, they described specific scientific hands-on activities conducted with students. For example, one teacher mentioned that children had built a wastewater treatment system themselves (Teacher 2), while another referred to classic experiments such as creating a volcano with baking soda and producing electricity using lemons (Teacher 10). Notably, this last example aligns closely with one of the hands-on activities included in the STEAM Tales lesson plans.

A third teacher described a more design-oriented activity in which students constructed houses out of cardboard, involving planning, drawing, cutting, building, and assembling an entire village (Teacher 12).

In addition to hands-on activities, one teacher described a classroom approach that closely mirrors the STEAM Tales emphasis on representation and storytelling. This teacher reported having led discussions about Margherita Hack, a renowned Italian astrophysicist and science communicator, as well as exploring the stories of local women in STEM. The activity culminated in a classroom visit from a student's mother, a veterinary doctor, whose personal story inspired and engaged the children (Teacher 5).

C2. Initiatives or programs

A total of 18 coded references described teachers' experiences with implementing STEM in the classroom. While three teachers reported having "very little" or "no" experience, the remaining accounts revealed a variety of hands-on activities already in practice.

These activities were typically experiential and student-centred, involving direct manipulation of materials, such as building a wastewater treatment system (Teacher 2), conducting volcano and lemon battery experiments (Teacher 10), or constructing cardboard houses that required planning, drawing, and assembling (Teacher 12). Many of these tasks reflected interdisciplinary integration, combining Science, Technology, Engineering, Arts, and Mathematics, and encouraged creativity, problem-solving, and collaboration.

One teacher also described an approach closely aligned with the STEAM Tales methodology, which emphasises inclusive storytelling and representation. In this case, students explored the life of Margherita Hack, a renowned Italian astrophysicist and science communicator, and engaged with stories of local women in STEM, including a classroom visit from a student's mother, a veterinary doctor, whose testimony inspired great enthusiasm (Teacher 5).

C3. Opinion

A total of 13 coded references reflected teachers' views on the promotion of STEM fields among children in this age group. All responses were consistently positive, with teachers highlighting the importance and benefits of early exposure to STEM. This aligns closely with the objectives of the STEAM Tales project.

Several teachers emphasized the value of introducing STEM from an early age. One teacher stated that "STEM can and should be included from an early age" (Teacher 5), while another noted that "children love to experiment and participate in interactive, playful activities," describing STEM as "a great opportunity to combine learning with play, making the learning process more engaging and impactful" (Teacher 6). Another teacher reinforced this view, describing STEM as "an asset" and stressing the need to "open up [children's] horizons so that they can learn about things they don't encounter in their day-to-day lives" (Teacher 8).

In addition, one teacher offered a direct endorsement of the STEAM Tales project itself, describing it as “very appealing” and noting that “children loved the activity” (Teacher 15).

These responses reinforce the relevance of the STEAM Tales approach and its potential to support meaningful, engaging, and inclusive STEM education from an early age.

D. Lesson Plan Selection

A total of 10 coded references were identified in which teachers commented on the selection process of the STEAM Tales lesson plans. These responses were grouped into two main areas: (1) evaluation of the Selection form of the lesson plan according *to the teacher’s needs and curriculum objectives* in relation to teachers’ needs and curriculum objectives, and (2) reasons for choosing specific stories or lesson plans to pilot in the classroom.

Regarding the selection form, all teachers provided positive feedback, highlighting its clarity, practicality, and alignment with curricular goals. One teacher praised the thematic organization, stating that “it’s great that you have the articulation between the scientists and the stories” (Teacher 8). Another noted that “this organisation could be a way of helping us and making lessons more dynamic” (Teacher 9), while a third described the instrument as “easy and practical to use” and appreciated how “the topics help you choose” (Teacher 11).

In terms of story and lesson plan selection, teachers cited curricular alignment, interest in specific hands-on activities, and connections with female role models as key factors. For example, one teacher selected the unit Why Stars Twinkle because it fit perfectly with an ongoing topic on “Stars and Planets” in general science (Teacher 1). Another chose the story of Domitila de Carvalho and the topic of towers to complement a unit on “building and constructing” (Teacher 2). Others were motivated by the potential for engaging experiments (Teacher 3) or by the opportunity to highlight a Slovenian scientist, which added cultural relevance (Teacher 12).

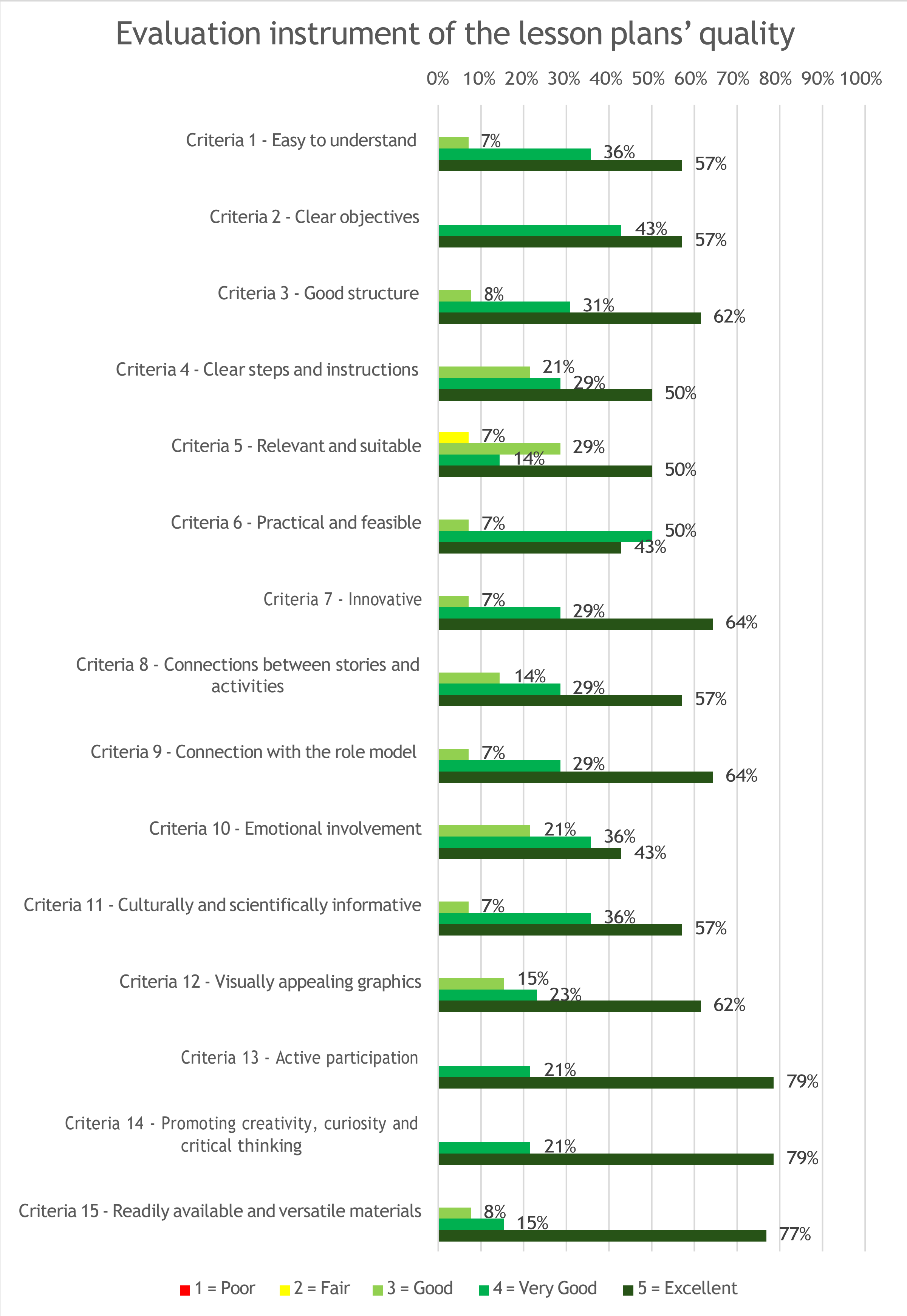
3.1.2. Evaluation instrument of the lesson plans' quality[5]

Figure 4 shows the percentages of the classification’s teachers gave to the fifteen criteria of evaluation of the lesson plans.

[5] The analysis of these results is available in Appendix E.

Figure 4.

Percentages of the classifications' teachers gave to the 15 criteria of evaluation of the lesson plans.



Overall, the evaluation that teachers made of the lesson plans considering the presented fifteen criteria is quite positive. The ratings given for each criterion range from “Good” to “Excellent”.

1 - Evaluation of the lesson plans

The lesson plan evaluation involves criteria 1 to 8 and 15. The teachers present at the implementation of the lesson plans evaluated them as "Excellent" (50 - 80%) in terms of ease of understanding, learning objectives, structure, clear steps and instructions, relevance, and suitability for the first cycle of primary education, practicality and feasibility, innovative ideas and approaches, and connections between theory and hands-on activities. Overall, 76.9% of teachers rated the materials as “Excellent” in terms of availability and versatility. In criterion 5, one teacher evaluated them as "Fair" and commented that the reason was that the lesson plans should be printed on only one side, which it is an understandable suggestion, however, due to project’s commitment to sustainability the use of digital copies is preferential and the documents are prepared to be digital interactively.

2 - Evaluation of the stories

The evaluation of the stories covers criteria 9 to 12. Between 80% and 95% of the teachers involved in the pilots across all partners considered the stories to be “Excellent” and “Very good” in terms of their ability to promote connections with female role models, encourage emotional involvement, present rigorous cultural and scientific information, and their visually appealing layout and graphics.

3 - Evaluation of the hands-on activities

The hands-on activities are highly rated, with 78.6% of teachers considering them effective in promoting active participation, creativity, curiosity, and critical thinking among their students.

3.2. Children's responses[6]

The project aimed to promote gender-inclusive representations in STEM fields. Therefore, we conducted analyses to determine whether the intervention was associated with more balanced gender representations than the control group.

Overall, the analysis revealed no statistically significant differences before or after the implementation of the story and lesson plans (control and experimental groups). However, the instrument helps to characterize children's perceptions. Therefore, we will characterise the perceptions of children in general and then explore the statistically significant differences between girls and boys. Interestingly while the overall analysis across all the project partners did not reveal statistically significant differences between conditions, a more detailed examination at the individual partner level uncovered meaningful variations in specific fields. These differences, although not visible in the aggregated data, suggest that local contexts may influence how STEM-related activities and the STEAM Tales project are perceived and implemented. This analysis of the partner level reveals that context-specific strengths, challenges and future opportunities can be identified based on various social, educational and cultural contexts, and on the story and lesson plan implemented with each children's group.

Considering this, for both analyses, we will focus on the statistically significant differences between the control and experimental groups, and between girls and boys, in order to delineate the children's perception of the gender representation panorama in STEM fields for each partner.

[6] More detailed information on the statistical tests applied in the children's answers can be found in the appendix F (global), appendix G (Belgium), appendix H (Germany), appendix I (Italy), appendix J (Portugal) and appendix K (Slovenia).

The results are organised by activity, with the three sets of analysis presented in the same order for each activity: 1. general results; 2. control and experimental groups results; and 3. results for girls and boys.

Activity 1

Activity 1 – The people below work in different fields. Paint each face according to the colour you think best suits the person: you can use pink, blue or purple – aimed to analyse children's implicit associations of gender with different STEM fields.

In Activity 1, all children implicitly associated STEM fields with the colour blue. This consistent association may reflect the influence of gendered cultural norms, in which blue is traditionally linked to boys. Such associations may reinforce existing stereotypes about who belongs in STEM. These findings highlight the presence of implicit gender-related colour associations among young children, suggesting that they may be internalising subtle gender cues through colour associations.

Control and Experimental Group

The global analysis showed no significant statistical differences between the control and experimental groups. However, a statistically significant difference was observed between the two groups in the Science field in Belgium, Italy and Slovenia (Figure 5).

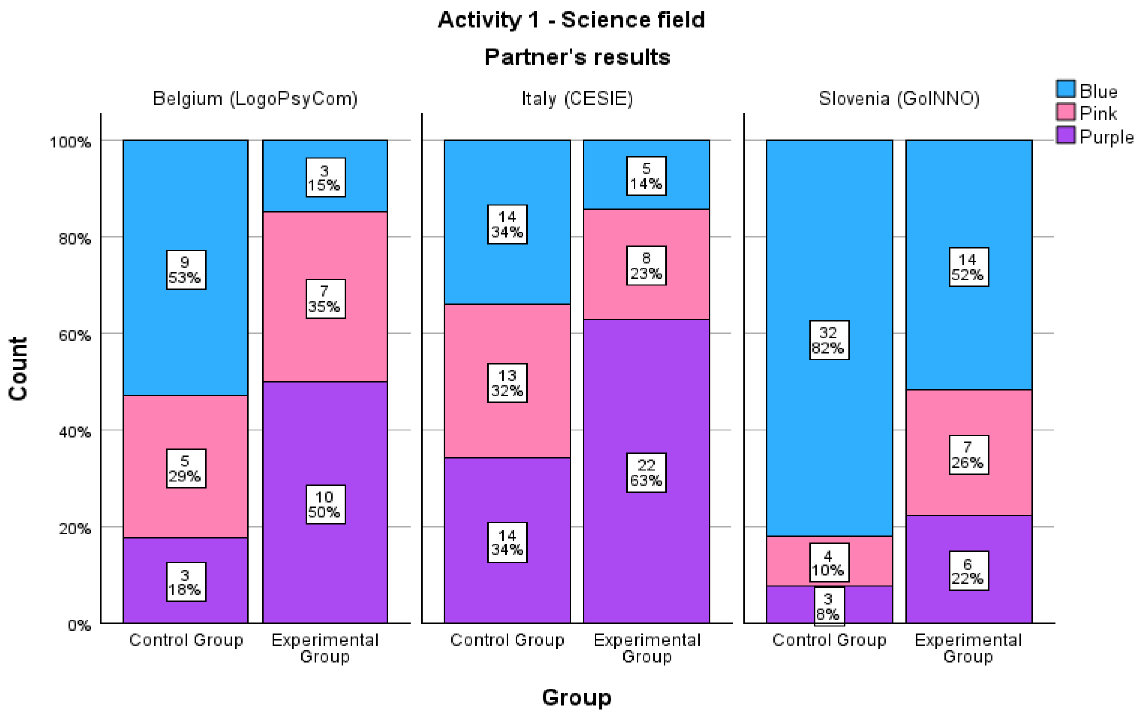
In Belgium, the most frequently associated colour in the control group was Blue, whereas in the experimental group it was Purple ($\chi^2(2, N = 33) = 8{,}18$, $p = .017$). This shift suggests a potential change in the symbolic or perceptual association with the Science field between the two groups.

In Italy, in the control group, the three colours were almost evenly distributed—34% chose Blue or Purple, and 32% chose Pink. In contrast, Purple was by far the most dominant colour in the experimental group, selected by 63% of the children ($\chi^2(2, N = 76) = 6.80$, $p = .033$). In the experimental groups' pilots, Italy presented an Italian scientist and an Italian astronomer, Rita Levi-Montalcini and Samantha Cristoforetti.

Among Slovenia, Blue is the most frequent answer in the control group (82%). Despite that in the experimental group, the major of answers it is still Blue, - the decrease in Blue from the control to the experimental group is a statistically significant difference ($\chi^2(2, N = 66) = 6.91, p = .032$). For its pilots with the experimental groups, Slovenia used Ana Mayer Kansky's story and Samantha Cristoforetti's story, both revolving around the topic of Science.

Figure 5.

Control and Experimental groups' answers regarding implicit association of colour with the Science field, in Belgium, Italy and Slovenia.

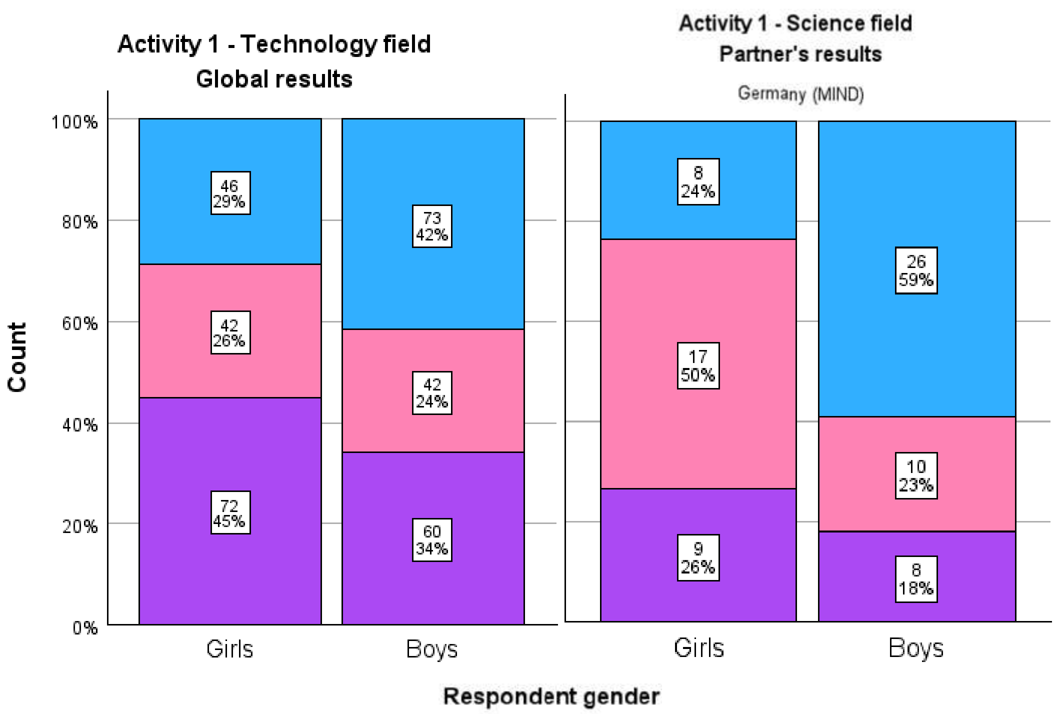


Girls and Boys

Among girls and boys, a statistically significant association was found between colours and STEM fields in the global results for the Technology field ($\chi^2(2, N = 335) = 6.56, p = .038$): girls were more likely to associate it with the colour Purple (45%), whereas boys were more likely to associate it with Blue (42%), as shown in the left panel of Figure 6. The fact that girls choose purple could suggest an implicit connection to a field that challenges traditional norms. By contrast, boys' choices are more closely linked to stereotypical associations.

Among the partners' results, specifically Germany, the association of gender-stereotyped colours and the Science field is statistically significant between girls and boys ($\chi^2(2, N = 78) = 10.29, p = .006$). Pink is the most frequently chosen colour among girls (50%), whereas Blue is the most common among boys (59%), as shown in the left panel of Figure 6. These preferences may reflect underlying implicit gender associations.

Figure 6.
Results from the implicit association of colours with the Technology field (global) and the Science field (Germany) among girls and boys.



Activity 2

Activity 2 – Please match the columns according to the gender you consider having the skills presented. The association made can be only Girls, Girls, and Boys, and only Boys – designed to diagnose the children's perceptions of gender representation in STEM-related skills.

In Activity 2, an analysis of the responses revealed a combination of patterns that both reinforce and challenge commonly held gender associations. Care skills were more frequently associated with Girls across all groups, while Digital skills were more commonly linked to Boys, reflecting persistent gendered perceptions in these fields. In contrast, Reading and Writing skills were generally associated with both Girls and Boys, suggesting a more balanced and inclusive view in these fields. The most variation was observed in the associations related to Mathematical and Leadership skills, with children tending to associate these abilities more strongly with their own gender.

Control and Experimental Groups

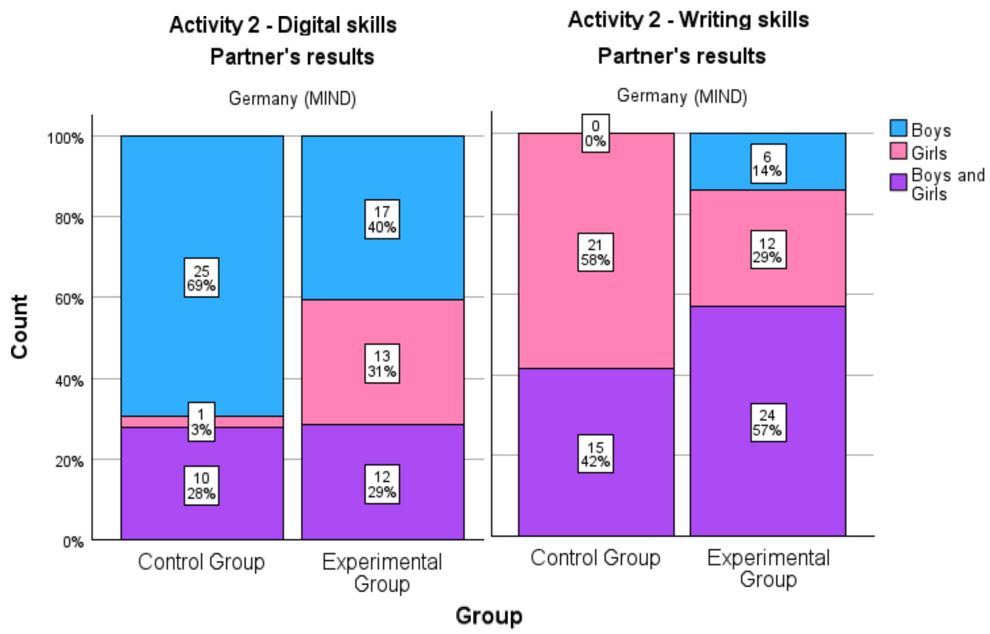
In the control and experimental groups, the global analysis showed no significant statistical differences.

Nevertheless, the comparative analysis of the German pilots indicated statistically significant associations between gender and perceived skills in the Digital and Writing skills across the control and experimental groups (Figure 7).

In Digital skills ($\chi^2(2, N = 78) = 11.60, p = .003$), in the control group, the highest percentage of responses indicated Boys (69%). In contrast, the experimental group showed a more balanced distribution across gender categories.

Regarding Writing skills ($\chi^2(2, N = 78) = 10.13, p = .006$), the control group predominantly associated it with Girls (58%). In the experimental group, Girls and Boys was the most frequent response (57%), indicating a more inclusive perception.

Figure 7.
Results from control and experimental groups regarding Digital and Writing skills in Germany.



Girls and Boys

In the global analysis of girls' and boys' responses regarding Digital skills, Leadership skills, and Mathematical skills, a statistically significant association was found between gender and perceived skills (Figure 8).

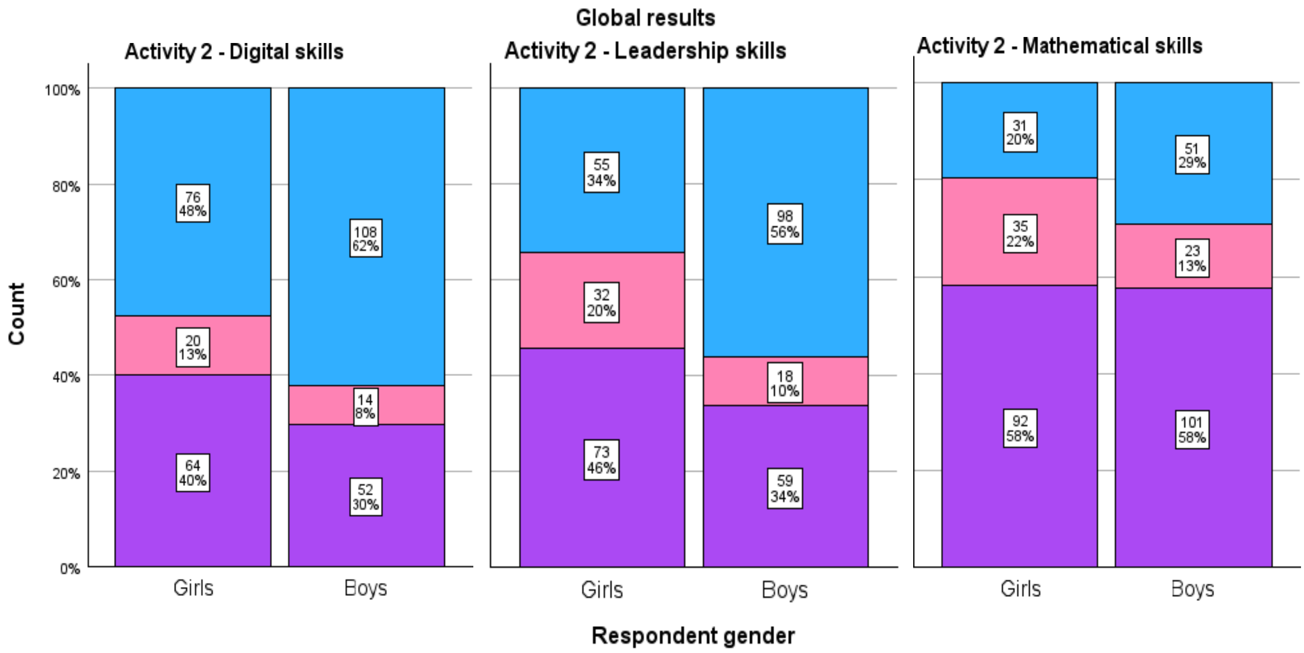
In the global girls' and boys' analysis, regarding Digital skills, Leadership skills and Mathematical skills, there was a statistically significant association between gender and perceives skills.

Although both girls and boys predominantly associated Digital skills ($\chi^2(2, N = 334) = 7.29, p = .026$) with Boys (46% of girls and 62% of boys), this perception was more strongly held among boys, indicating a more entrenched belief in male representation associated to this skill.

With regard to Leadership skills ($\chi^2(2, N = 335) = 16.85, p < .001$), the most common response among girls was Girls and Boys (46%), whereas among boys, the predominant association was with Boys (56%). This difference between the two groups indicated a gender-based divergence in perceptions of leadership.

In response to the question on Mathematical skills, the most frequently selected option by both groups was Girls and Boys, chosen by 58% of girls and 58% of boys. Among girls, the second most common response was Girls (22%), whereas among boys, it was Boys (29%). This response patterns between genders is statistically significant ($\chi^2(2, N = 333) = 6.93$, $p = .031$), suggesting subtle variations in gender-based perceptions of mathematical ability.

Figure 8.
Global results from girls and boys regarding Digital, Leadership, and Mathematical skills.



Among the partners, statistically significant associations were found between gender and Mathematical skills in Germany and Slovenia, between gender and Digital skills in Italy, and between gender and Leadership skills in Portugal (Figure 9).

In Germany, an analysis of the responses given by girls and boys in this activity revealed a statistically significance in the way Mathematical skills are perceived ($\chi^2(2, N = 78) = 7.42$, $p = .025$), where the most frequent answer among both girls and boys was Girls and Boys (59% of boys and 45% of girls). However, the second most frequent answer varied by gender. Among girls, the second most common response was Girls (29%), while among boys it was Boys (39%). These results suggest that although many children view mathematics as a field for both genders, there remains a tendency to associate mathematical skills more strongly with their own gender.

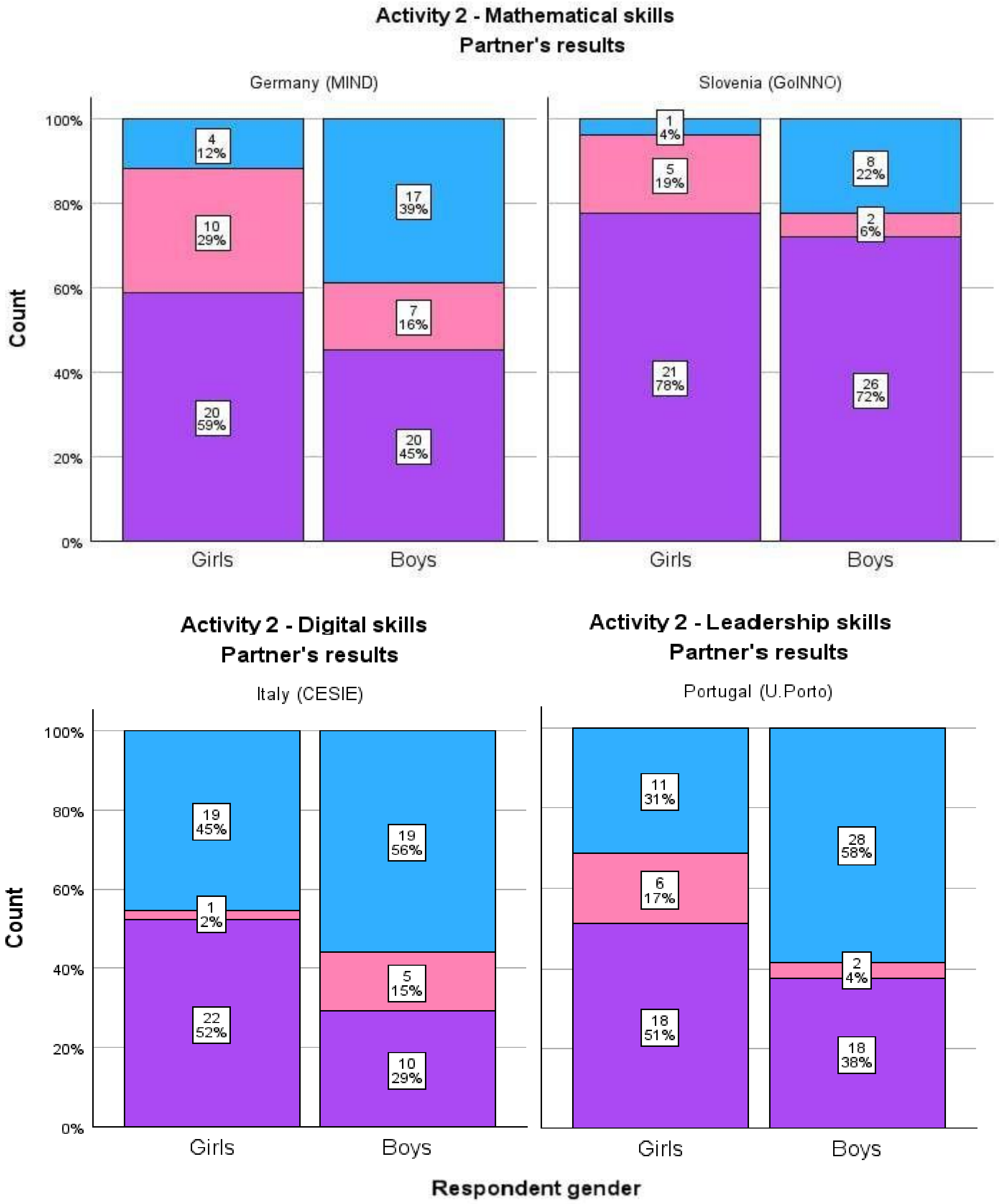
In Italy, the analysis of girls' and boys' responses, in the case of Digital skills ($\chi^2(2, N = 76) = 6.39, p = .041$), among girls, the most frequent answer was Girls and Boys (52%), suggesting a more inclusive view. In contrast, boys most commonly selected Boys (56%), indicating a more gender-specific perception of digital skill.

In Portugal, regarding to Leadership skills ($\chi^2(2, N = 83) = 7.56, p = .023$), while 58% of boys considered themselves to possess stronger leadership skills, this perception was not shared by girls. Instead, 51% of girls believed that Leadership skills are equally present in both genders.

In Slovenia, for Mathematical skills ($\chi^2(2, N = 65) = 6.10, p = .047$), Girls and Boys is the most frequent answer in the two groups (78% and 72%). However, it is followed among girls by Girls (19%) and among boys by Boys (22%).

Figure 9.

Girls' and boys' results regarding Mathematical skills in Germany (top left) and Slovenia (top right); and Digital skills in Italy (bottom left) and Leadership skills in Portugal (bottom right).



Activity 3

Activity 3 – Return to Activity 1 and write on the line below each picture which gender you thought of for the face. The options are Boys, Girls and Boys, and Girls – the aim is children to express explicit associations of gender with different STEM fields.

This activity, which involved explicit associations, showed that children associated Science and Mathematics with both girls and boys, suggesting a more inclusive perception of these fields. In contrast, Technology and Engineering were more frequently associated with boys, reflecting traditional gender stereotypes that continue to shape children's understanding of who typically occupies these professional roles.

Control and Experimental Groups

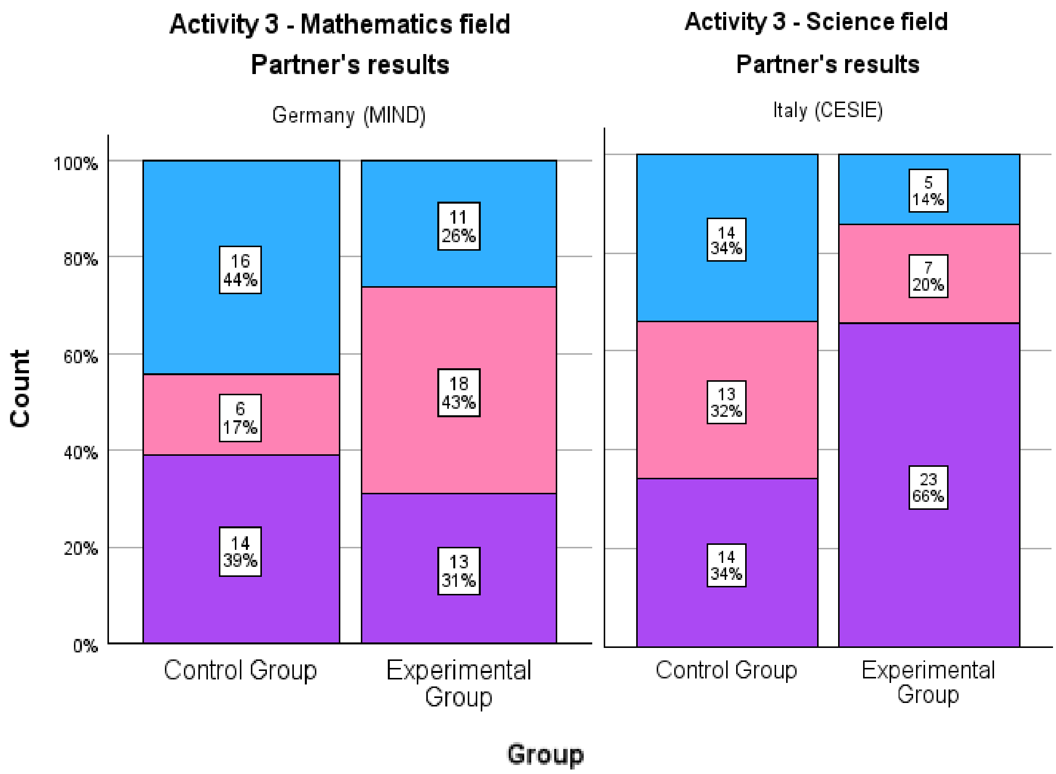
In the control and experimental groups, the global results showed no significant statistical differences.

Among the partner countries, statistically significant associations were identified in Germany and Italy between the control and experimental groups and their associations with the Mathematics and Science fields, respectively (Figure 10).

When comparing Germany's control and experimental groups in the field of Mathematics ($\chi^2(2, N = 78) = 6.54, p = .038$), the most frequent association in the control group was with Boys (44%), whereas in the experimental group, Girls was the most selected category (43%). These findings suggested that gender perceptions of mathematics representation can shift depending on context or exposure to activities. In one of Germany's experimental groups, the female role model presented was the mathematician Domitila de Carvalho, which may have influenced the observed shift in associations.

In Italy, the control and experimental groups, in the Science field ($\chi^2(2, N = 76) = 7.83, p = .020$), the answers Boys, Girls and Boys and Girls are almost evenly distributed (34%, 34% and 32% respectively) in the control group, whereas in the experimental group, Girls and Boys is the most common answer (66%). While this was an interesting result, the answers did not show a tendency to associate Science with only one gender. As previously mentioned, Italy included the female role model Rita Levi-Montalcini, a famous scientist, in some of their pilots.

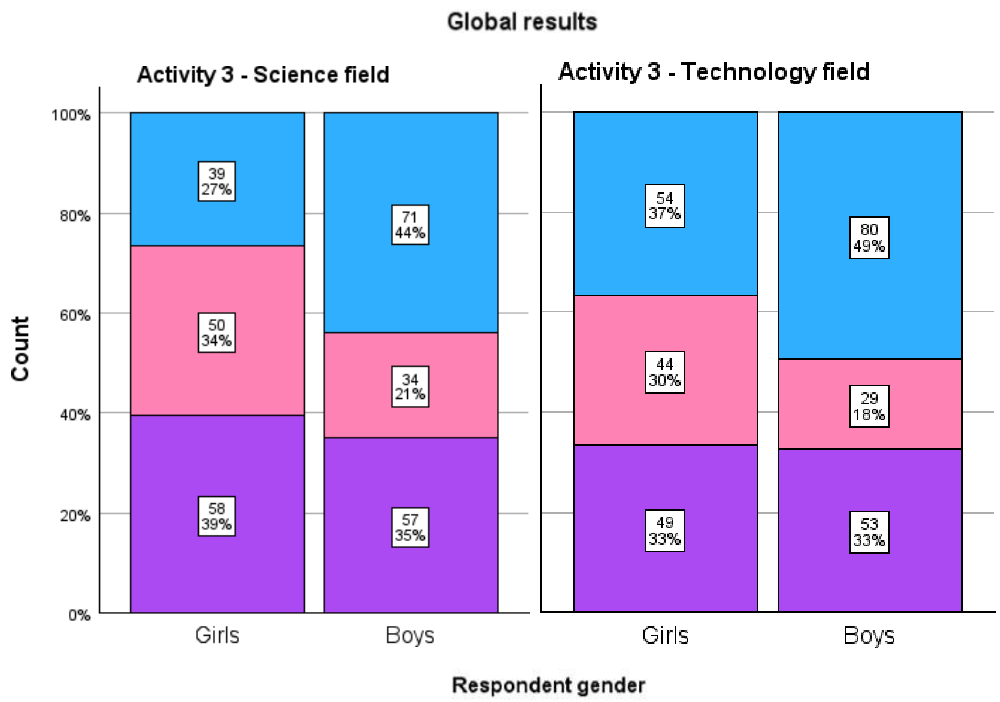
Figure 10.
Control and experimental groups' results for explicit associations in the Mathematics field in Germany (left) and the Science field in Italy (right).



Girls and Boys

Globally, statistically significant differences between girls and boys were found in the fields of Science ($\chi^2(2, N = 309) = 11.66, p = .003$) and Technology ($\chi^2(2, N = 309) = 7.57, p = .023$). In both cases, boys were more likely to associate these fields with their own gender (44% for Science and 49% for Technology), while girls' responses were more evenly distributed across categories, suggesting a less gendered perception (Figure 11).

Figure 11.
Global results from girls and boys regarding the Science and Technology fields.



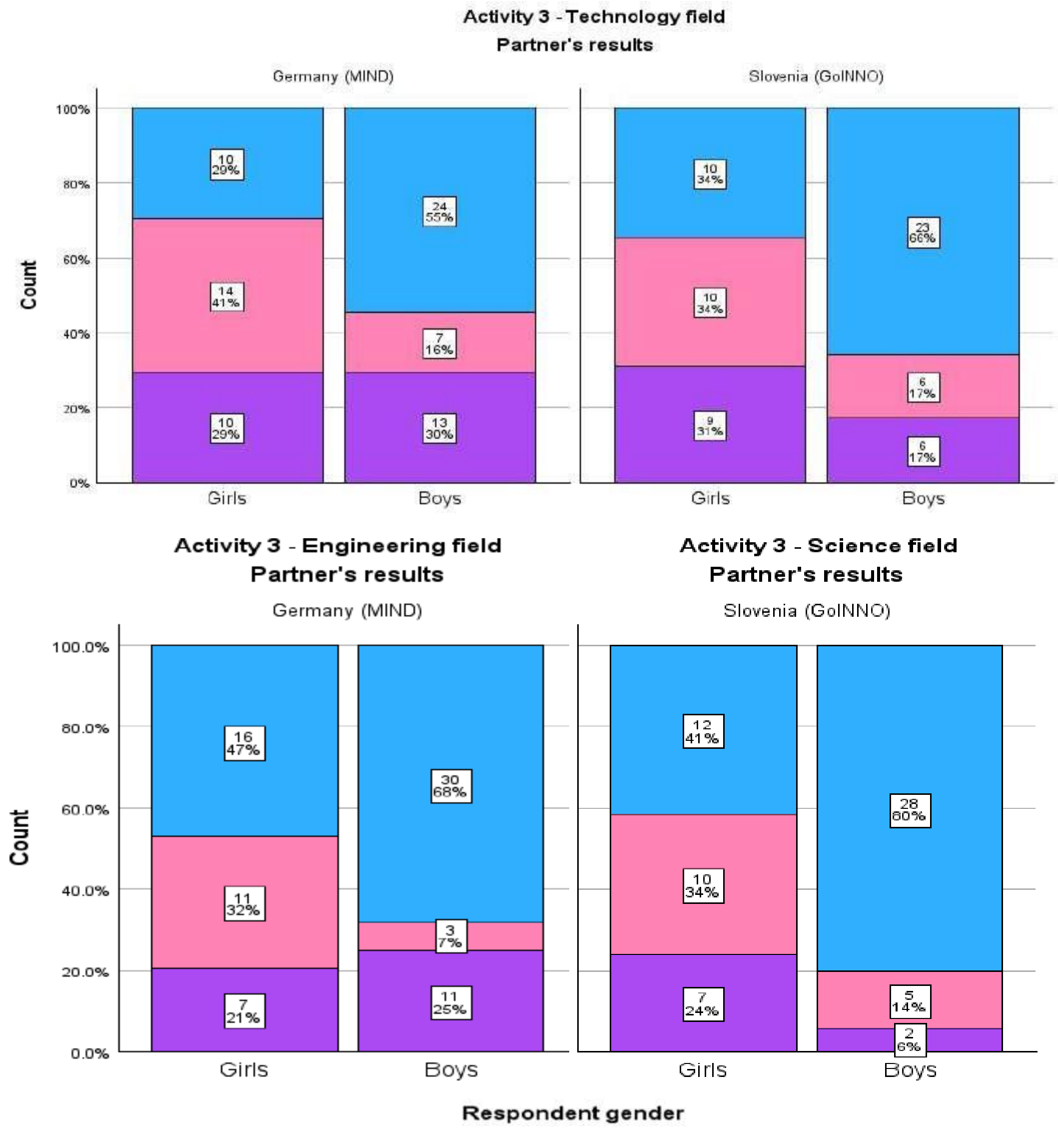
Among the partners' results, Germany showed a statistically significant explicit associations of gender with the Engineering and Technology fields, while Slovenia showed statistically significance in the explicit associations of gender with the Science and Technology fields (Figure 12).

In Germany, in Technology ($\chi^2(2, N = 78) = 7.33, p = .026$), girls were more likely to associate the field with the female gender (41%), and this may reflect a shift in perception among girls, challenging the traditional stereotype that technology is a male-dominated field. In contrast, boys predominantly associated Technology with the male gender (55%), reinforcing the conventional view of technology. In Engineering ($\chi^2(2, N = 78) = 8.58, p = .014$), both girls and boys primarily associated the field with Boys, further reinforcing the traditional belief that engineering is a male-oriented profession, though this association was stronger among boys (68%) than girls (47.1%).

Among Slovenia's children, in the Science field ($\chi^2(2, N = 65) = 10.37, p = .006$), Boys is by far the dominant answer among boys (80%), whereas among girls, although Boys is still the most frequent answer (41%), Girls (34%) and Girls and Boys (24%) had still a considerable representation.

In Technology, Boys is once again the dominant answer among boys (66%), whereas among girls there's a more even distribution of the three options, with Girls and Boys having the same percentage of respondents (34%) ($\chi^2(2, N = 65) = 6.21, p = .045$).

Figure 12.
Girls' and Boys' results regarding the Technology field in Germany and Slovenia (top), the Engineering field in Germany (bottom left), and the Science field in Slovenia (bottom right).



Activity 4

Activity 4 was designed to evaluate children's perceptions of the association between gender and different professions, including STEM professions and those identified as having extreme gender representation. In this activity, we have two main premises: *...is for...* and *...can be for...*. The is for question asks children who they think generally works in the presented field (Girls, Boys, or Girls and Boys). The can be for question asks them if they think people should work in the field (Girls, Boys, or Girls and Boys).

In Activity 4, when children were asked who each field is for, their responses followed the same pattern observed in previous activities: across both groups and genders, children tended to associate Science and Mathematics with both Girls and Boys. Mechanics and Engineering were more commonly linked to Boys, while Kindergarten Education was associated with Girls. Technology was generally seen as gender-neutral, though slightly more associated with Boys.

These patterns reflect familiar gender representations present in society. Yet, when children were invited to reflect on how these fields should be in the future, they associated all STEM fields—as well as Mechanics and Kindergarten Education—with both male and female professionals. This shift suggests a progression in thinking, from traditional views of current roles to more inclusive ideas about future possibilities.

Control and Experimental Groups

In the control and experimental groups, the global results showed no significant statistical differences.

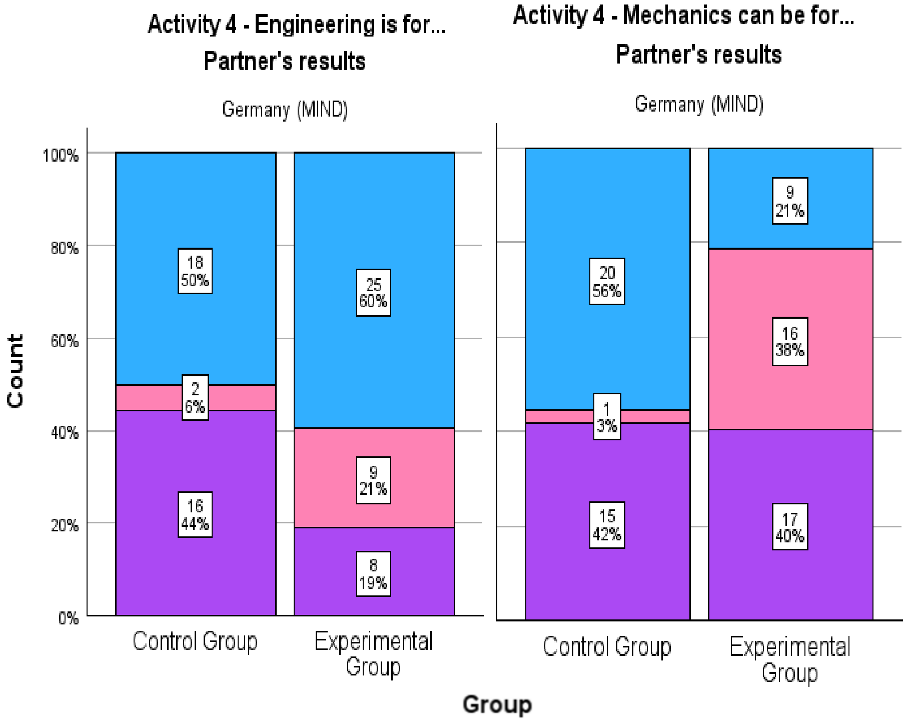
Among the partners, Germany showed statistically significant associations between gender and the statement *Engineering is for...*, as well as between gender and the statement *Mechanics can be for...* (Figure 13).

In Germany, an analysis of the responses to the question is for revealed a statistically significance between the control and experimental groups in the field of Engineering ($\chi^2(2, N = 78) = 7.84, p = .020$). While Boys was the most frequently selected category in both groups (50% in the control group and 60% in the experimental group), the experimental group showed a notably higher percentage of respondents selecting Girls (21%) compared to the control group (6%). This suggests a possibility of a shift toward more inclusive perceptions of gender roles in Engineering among participants exposed to the activity.

For the can be for questions, in the case of Mechanics, there is a statistically significant shift ($\chi^2(2, N = 78) = 17.17, p < .001$), between the groups: in the control group, the most frequent response was Boys (56%), whereas in the experimental group, it shifted to Girls and Boys (40%). This suggests a meaningful change in perception toward greater gender equity in a traditionally male-dominated field.

Figure 13.

Results from the control and experimental groups in response to the question ...is for... in the Engineering field (left) and to the question ...can be for... in the Mechanics field (right), in Germany.

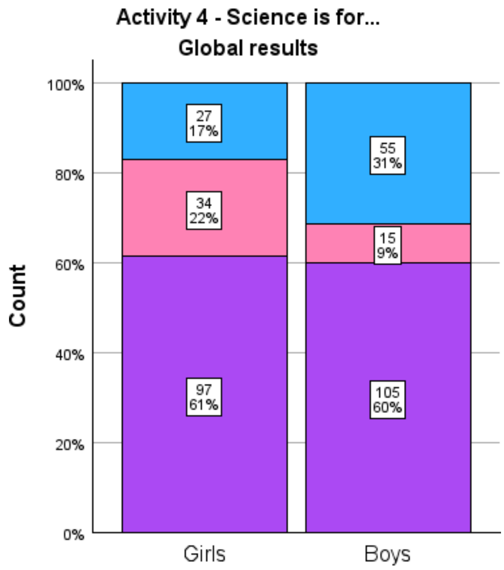


Girls and Boys

In the girls and boys global analysis, in the case of Science, the most common answer is Girls and Boys both among girls (61%) and boys (60%), but among girls is followed by Girls (22%) and among boys is Boys (31%), and there is a statistically significant difference here ($\chi^2(2, N = 333) = 16.42, p < .001$), suggesting that while Science is broadly seen as inclusive, underlying gendered perceptions still influence how children relate to the field (Figure 14).

Figure 14.

Results from all girls and boys in response to the question ...is for... in the Science field.



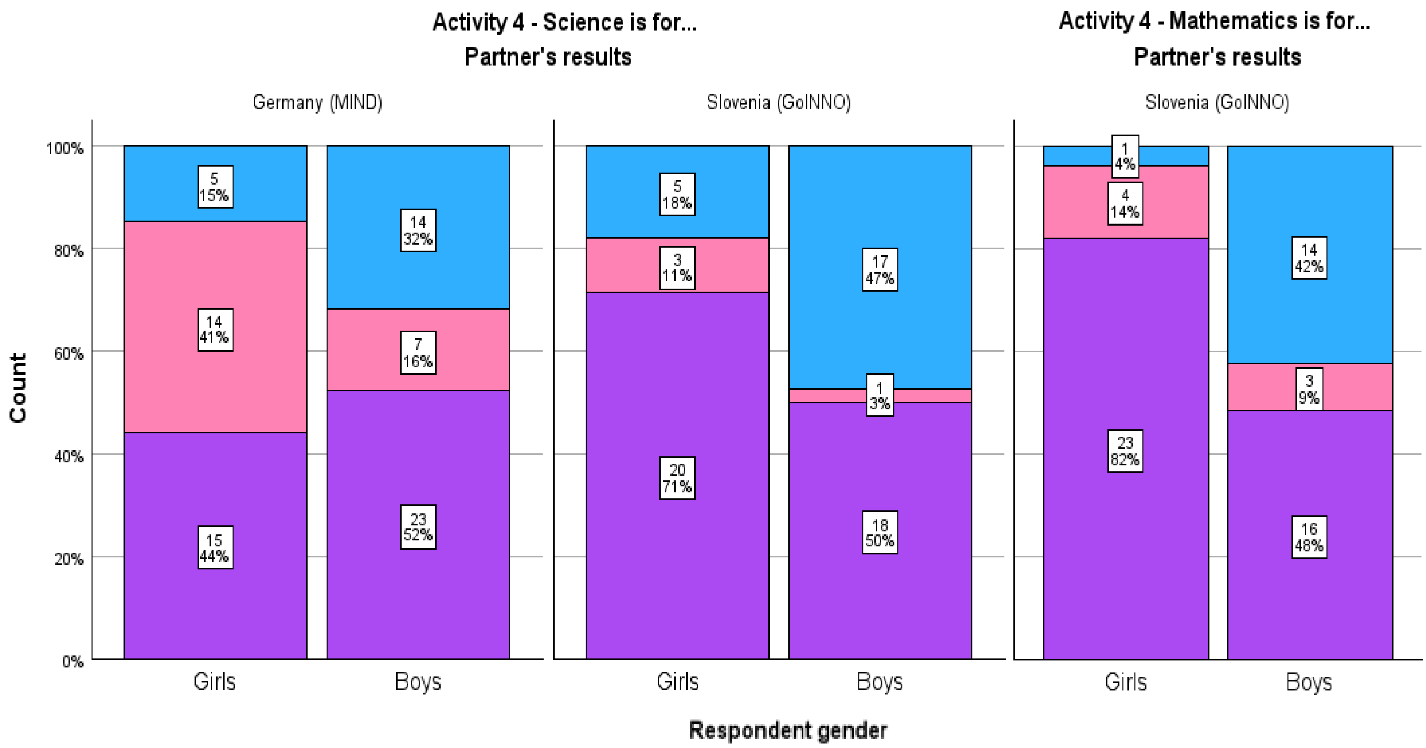
Among the partners, Germany and Slovenia presented statistically significant associations of gender with STEM fields—specifically, Science for Germany, and both Science and Mathematics for Slovenia (Figure 15).

In Germany, Science ($\chi^2(2, N = 78) = 7.12, p = .029$) is predominantly considered a field for Girls and Boys by both girls (44%) and boys (52%). However, the second most frequent response differs by gender: girls tend to associate Science with Girls (41%), while boys more often associate it with Boys (32%), suggesting that gendered perceptions of Science may still persist despite a general trend toward inclusivity.

In Slovenia, in the case of is for questions, for Science ($\chi^2(2, N = 65) = 6.76, p = .034$), Girls and Boys is the most frequent answer among both genders, but it is clearly more so among girls (71%) than among boys (50%). It is followed in both cases by Boys (18% and 47%).

In the Mathematics field ($\chi^2(2, N = 65) = 12.34, p = .002$), Girls and Boys is by far the dominant choice among girls (82%), whereas among boys it is the most frequent choice (48%) but is closely followed by Boys (42%).

Figure 15.
Results for the statement Science is for... in Germany (left) and Slovenia (middle), and for the statement Mathematics is for... in Slovenia (right).



Activity 5

Activity 5 - Are you interested in the fields of science, technology, engineering, and maths? - intended to analyse the interest of children about STEM fields.

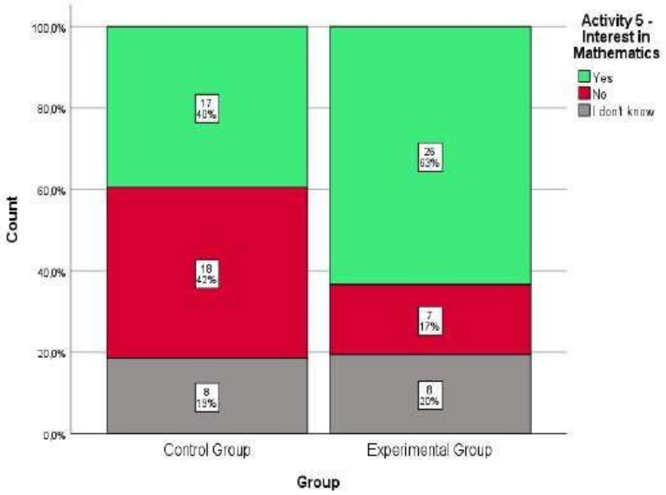
In Activity 5, all children in general demonstrate an interest in STEM fields. However, when looking at gender differences, we observed that boys expressed interest in all STEM fields, while girls showed greater interest specifically in Science, Technology, and Mathematics, with comparatively lower interest in Engineering. This suggests that while overall engagement with STEM is high, gendered preferences may still influence how children relate to specific fields within STEM.

Control and Experimental Groups

In the control and experimental groups, the global results showed no significant statistical differences.

In Portugal, the most notable difference emerged in the field of Mathematics. In the control group, the most frequent response was No (42%). In contrast, the experimental group showed a clear preference for Yes (63%). This difference is statistically significant ($\chi^2(2, N = 84) = 6.68, p = .035$), indicating that participants in the experimental group were more likely to express interest in Mathematics compared to those in the control group (Figure 16).

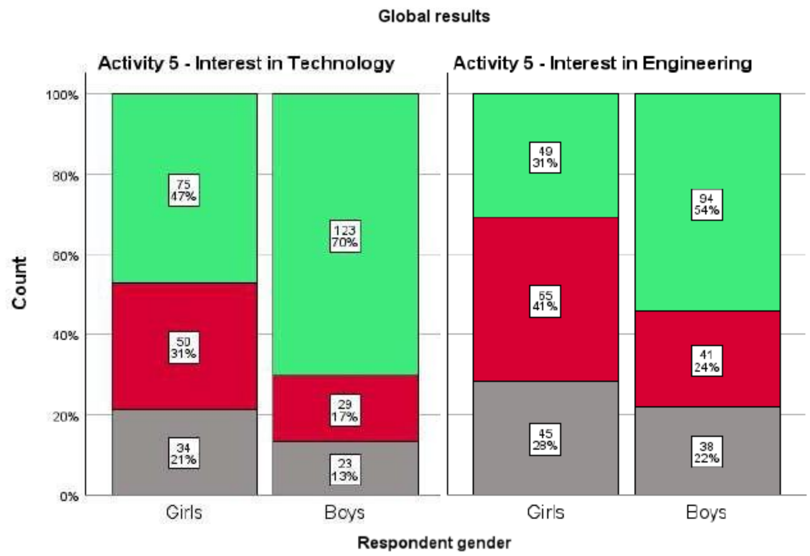
Figure 16.
Results from the control and experimental groups regarding interest in the Mathematics field, in Portugal.



Girls and Boys

Among all girls and boys, in the field of Technology, Yes was again the most frequent answer for both groups—47% among girls and 70% among boys. However, the notably higher percentage of boys expressing interest in this field represents a statistically significant difference ($\chi^2(2, N = 334) = 18.62, p < .001$), suggesting that gender disparities in interest may begin to emerge more clearly in this field (Figure 34). In the field of Engineering, the most common response among girls was No (41%), whereas among boys, the most frequent answer was Yes (54%). This contrast reveals a statistically significant difference between girls and boys ($\chi^2(2, N = 332) = 19.63, p < .001$), suggesting that gendered perceptions or interests in Engineering may already be present at this early stage (Figure 17).

Figure 17.
Girls' and Boys' global answers about the interest in the Technology and Engineering fields.



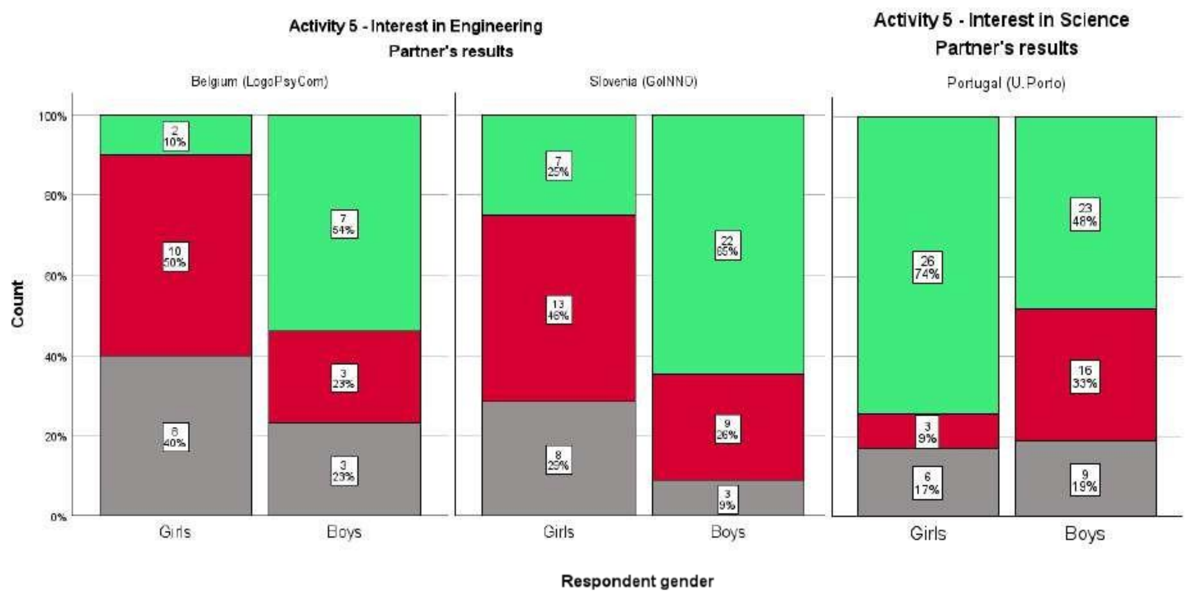
Among the partners, Portugal showed a statistically significant association between gender and interest in the Science field, while Belgium and Slovenia showed significant associations between gender and interest in the Engineering field (Figure 18).

In Belgium, in responses related to the field of Engineering ($\chi^2(2, N = 33) = 7{,}68$, $p = .021$), among girls, the most frequent answer was No (50%), followed by *I don't know* (40%), indicating lower levels of interest or uncertainty. In contrast, among boys, the most common response was Yes (4%), suggesting a higher level of interest in Engineering.

In Portugal, the most frequently selected response among both girls and boys for the fields of Science was Yes—with 74% of girls and 48% of boys affirming this in the case of Science. However, in Science, the second most common response differed by gender: among girls, it was *I don't know* (17%), while among boys, it was No (33%) ($\chi^2(2, N = 83) = 7.83$, $p = .020$), indicating a notable divergence in confidence or perception between genders.

In Slovenia, for Engineering, No is the most frequent answer among girls (46%), whereas among boys it is Yes (65%). This is the only field where there is a statistically significant difference between the two genders for Slovenia ($\chi^2(2, N = 65) = 10.27$, $p = .006$).

Figure 18.
Results from girls and boys regarding interest in the Engineering field in Belgium (left) and Slovenia (middle), and interest in the Science field in Portugal (right).



Activity 6

Activity 6 aimed to analyse children's professional aspirations, children's professional expectations for the future, and their parents' professional expectations. The options to these questions are: Science, Technology, Engineering, Mathematics, Mechanics, Kindergarten Education and Other.

In general, in Activity 6, when asked about their professional aspirations, children tended to refer to professions related to sports, health, arts, digital and safety related professions. Among the STEM fields, Science was the most popular choice.

Control and Experimental Groups

In the control and experimental groups, the global and partners' results showed no significant statistical differences.

Girls and Boys

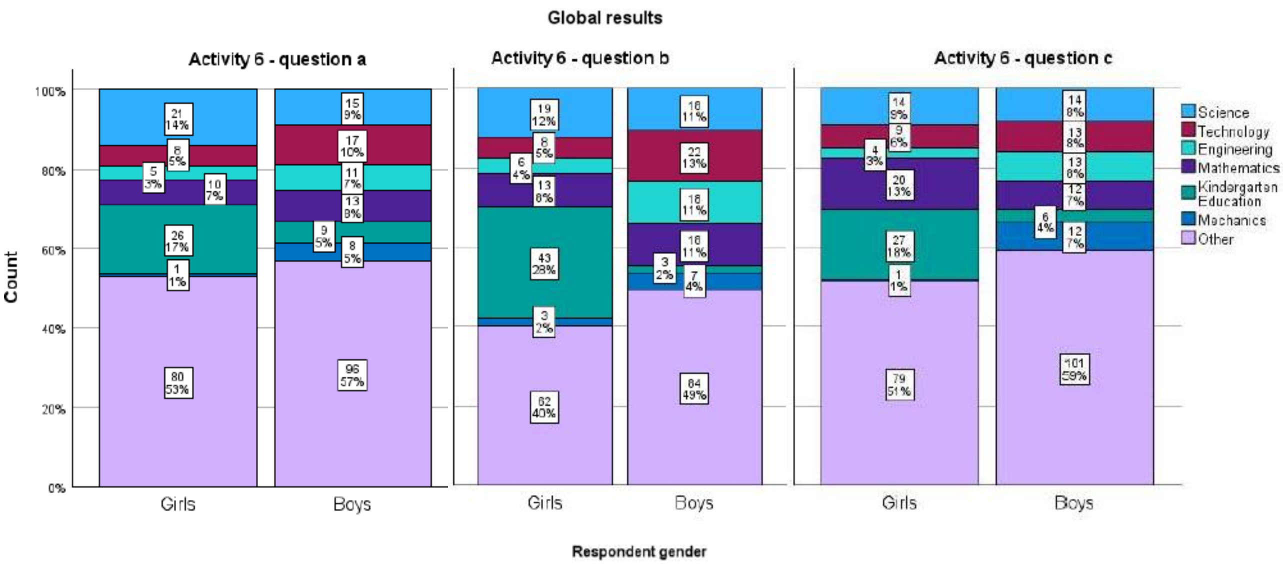
Among girls and boys, in the global results there are statistically significant differences regarding question a) In the future, the profession I would like to have is in the field of..., b) In the future, I think I will have a profession in the field of...,) In *the future, my parents want me to have a have a profession in the field of ...* (Figure 19).

In response to the question a) In the future, the profession I would like to have is in the field of... ($\chi^2(6, N = 320) = 21.09, p = .002$), girls showed a greater interest in the fields of Science and Kindergarten Education (17% for girls vs. 5% for boys). In contrast, boys were more likely to express interest in Technology (5% for girls vs.10% for boys), Engineering (3% for girls vs. 7% for boys), and Mathematics (7% for girls vs. 8% for boys).

In response to question b) In the future, I think I will have a profession in the field of... ($\chi^2(6, N = 324) = 52.40, p < 0.001$), girls were significantly more likely than boys to believe they might work in Kindergarten Education (28% for girls vs. 2% for boys). In contrast, boys were considerably more likely than girls to envision a future profession in Technology (5.% for girls vs. 13% for boys) , Engineering (4% for girls vs. 11% for boys), and Mechanics (2% for girls vs. 4% for boys). Overall, the responses to question 6b closely mirror those given to question 6a.

To the question c) In the future, my parents want me to have a have a *profession in the field of …* ($\chi^2(6, N = 325) = 32.05$, $p = .001$), the most conspicuous difference is in the fields of Engineering, Mathematics and Kindergarten Education. In Engineering, there is a greater perception on the part of boys that their parents want them to work in that field (7.6% against 2.6% of girls). For Mathematics and Kindergarten Education, there is a statistically significant difference between Girls and Boys, as girls are more likely to say their parents want them to work in those fields than boys: 13.0% of girls against 7.0% of boys for Mathematics and 17.5% of girls against 3.5% of boys for Kindergarten Education.

Figure 19.
Results from girls and boys regarding: question a) the professions they would like to have in the future; question b) the professions they believe they will have; and question c) the professions their parents would like them to have.



Among the partners, Belgium, Germany, Portugal, and Slovenia showed statistically significant associations between gender and future career aspirations in their responses.

In Belgium, regarding question b) ($\chi^2(2, N = 25) = 7{,}68, p = .037$), in the field of Science, the percentages of girls (12%) and boys (12%) are similar. But whereas no girl chose Engineering, 25% of boys chose it and whereas 47% of girls chose Kindergarten Education, no boy chose the field.

For question c) ($\chi^2(2, N = 23) = 7{,}68, p = .014$), the fields of Technology and Engineering were not represented at all among girls, whereas each of those two fields had 11% of boys choosing them. While 71% of girls reported their parents thought they might be able to work with Kindergarten Education, no boy said so.

In Germany, regarding question a) ($\chi^2(2, N = 78) = 17.67, p = .007$), boys were also more likely to express a desire to pursue a profession in the fields of Technology, Engineering, and Mathematics. In contrast, girls tended to be more inclined towards Science and Kindergarten Education. Notably, no girl expressed interest in pursuing a profession in the field of Mechanics.

To the answer of question b) ($\chi^2(2, N = 78) = 25.20, p < .001$), overall boys think they will be able to work in STEM fields in the future much more frequently (59%) than girls (35%). Girls were more likely to think they will be able to work in Science (23%) than boys (13%), but boys were more likely than girls to think they will be able to work in Technology (23% of boys against 3% of girls), Engineering (9% against 3%) and Mathematics (14% against 6%).

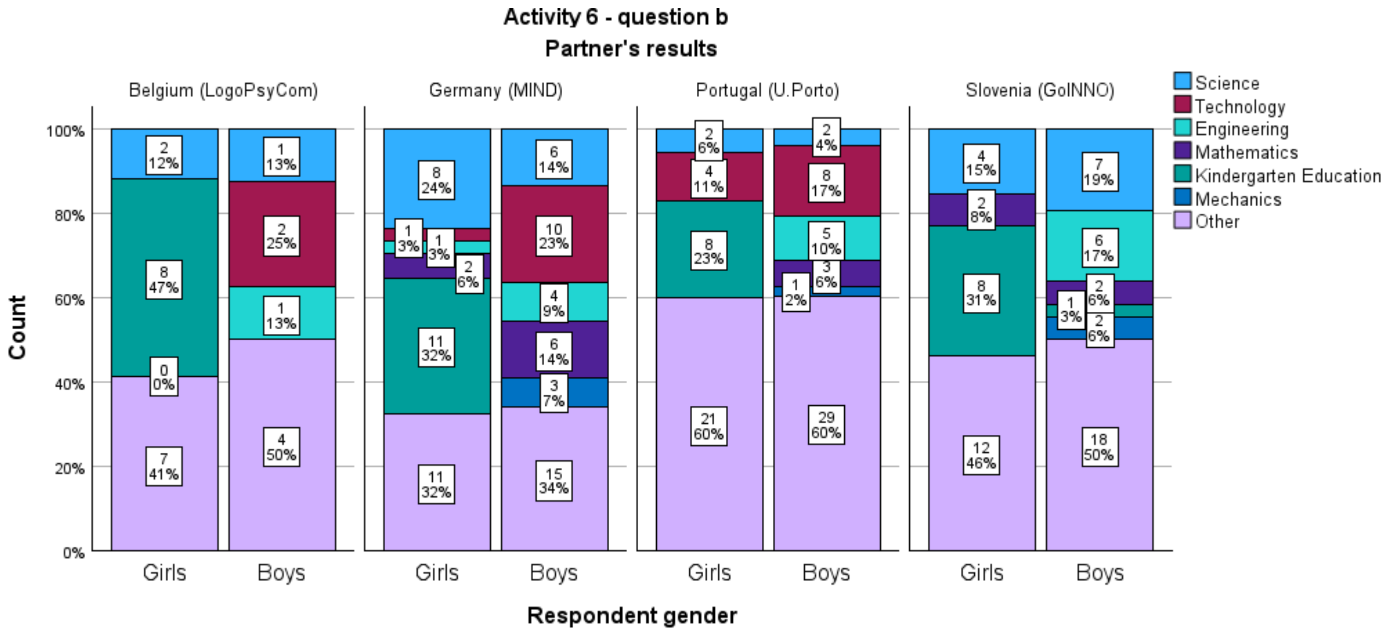
In question c) ($\chi^2(2, N = 78) = 15.03, p = .020$), in the field of Science, the percentages of girls (24%) and boys (20%) were relatively similar. However, Technology was more frequently associated with boys (9%) than with girls (3%). Engineering was mentioned by 7% of boys, while no girls selected this field. A higher percentage of girls (9%) reported that their parents believe they might pursue a career in Mathematics, compared to boys (7%). A similar trend was observed in Kindergarten Education, with 24% of girls choosing it, versus only 3% of boys. Mechanics was not mentioned by any girls, but it was selected by 11% of boys.

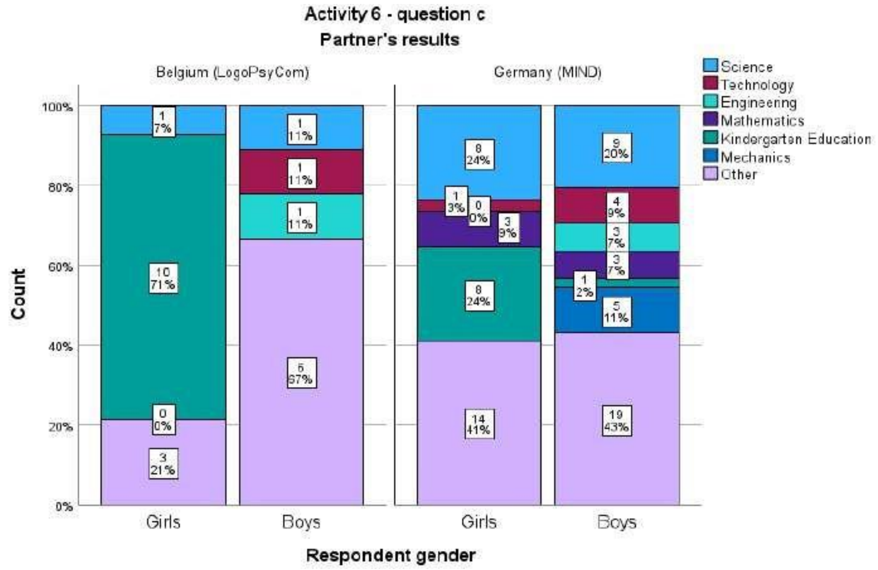
Among Portugal's children, regarding the question b) ($\chi^2(2, N = 83) = 18.02$, $p = .006$), girls were more likely to think they will be able to work in Science (6%) than boys (4%), but boys were more likely than girls to think they will be able to have a profession related to Technology (17% against 11% of girls), Engineering (10% against 0% of girls), Mathematics (6% against 0% of girls) or Mechanics (2% against 0% of girls). Among girls, 23% thought they would be able to work with Kindergarten education whereas no boy thought the same.

In Slovenia, regarding the question b) ($\chi^2(2, N = 65) = 14.22$, $p = .014$), boys were more likely than girls to say they think they will be able to work with Science (19% against 15% of girls) and Engineering (17% against 0% of girls), whereas girls were more likely than boys to say they think they will be able to work with Mathematics (8% against 6% of boys). Neither girls nor boys thought they might be able to work with Technology.

Figure 20.

Girls' and boys' responses about the professions they believe they will have in the future, in Belgium, Germany, Portugal, and Slovenia (top). Girls' and boys' responses about the professions their parents would like them to have in the future, in Belgium and Germany (bottom).





4. Discussion

4.1. Teachers' opinions towards STEM fields and lesson plans quality

Teachers expressed confidence in teaching Mathematics, Environmental Studies, and the Arts, but reported less confidence in Technology.

Mathematics is central in teacher education, and despite conceptual difficulties, students remain interested, suggesting that while engagement is high, results may not always reflect this (Hacieminoglu, 2013). Environmental Studies scored highly, likely due to its interdisciplinary nature (as it covers topics that go from natural sciences to the humanities: history, geography, etc.) and media coverage of environmental issues, which can increase intrinsic motivation (Young & LaFollette, 2019). Teachers also reported student engagement in this subject. The Arts, similarly, generated confidence among teachers and enthusiasm among students. These subjects promote critical thinking, creativity, and collaboration (Novak Djokovic Foundation, 2023). By contrast, Technology received low confidence ratings from teachers, primarily due to limited training, although students are often adept, having been exposed to technology early at home (Romero-Tena et al., 2022; Plowman et al., 2010).

These results are also in line with the material developed through the project, and the teachers' evaluation of the quality of the lesson plans is overall very positive in terms of content, objectives, innovation, accessibility, connection with female role models, and the materials' cultural and scientific informativeness, as well as their ability to promote creativity, curiosity, and critical thinking. This is important because it provides teachers with the materials they need to explore STEM disciplines with confidence.

4.2. Children’s perceptions, interest, and motivation in STEM fields

The analysis of children’s responses across STEM-related activities reveals persistent gender stereotypes, aligned with a growing body of literature examining gendered expectations in STEM from early educational stages. Such results are in line with what literature reveals to be a conditioning performed on children by society through a vicious cycle of female underrepresentation in STEM fields, stereotyping around it, and the detrimental fuelling of girl’s loss of interest through their educational development and alienation from such professional fields (Borsotti, 2018; Botella et al., 2019; Farias, 2021; Gilchrist & Zhang, 2022; OECD, 2022; OECD, 2024; PISA, 2022; Piloto, 2023).

The comparative analysis between control and experimental groups across all six activities reveals that, while global differences were not always statistically significant, several partner-specific results indicate meaningful shifts in gender perceptions when children were exposed to female role models and interactive interventions combining storytelling and hands-on activities (Morais, 2015; 2020).

For instance, in Activity 1, Italy introduced stories about Rita Levi-Montalcini, an Italian scientist, during the experimental sessions. This intervention likely explain the selection of the colour purple suggesting a perceptual shift in how children associate gender with science. Similarly, Slovenia presented the story of Ana Mayer-Kansky, a pioneering female scientist, and observed a statistically significant decrease in the selection of blue in the experimental group, indicating a weakening of traditional male-coded associations with science.

These findings underscore the positive impact of targeted, narrative-based interventions in challenging and reshaping traditional gender stereotypes in STEM fields from an early age.

At the same time, in Activity 1, children associated STEM fields with the colour Blue more frequently than Pink or Purple, especially boys. Further on, on Activity 2, we can see that boys frequently associated Leadership, Digital and Mathematical skills with their own gender. Prior studies highlight higher boys' self-perceptions in STEM, even when objective performance shows no significant gender difference (Adamecz et al., 2025; Leder, 2017). Leder (2017), in particular, emphasizes that boys tend to rate their Mathematical skills higher than girls, regardless of actual achievement, suggesting that confidence often drives engagement in these fields.

Conversely, girls tended to underestimate their skills in Digital and Mathematical fields. Ferreira et al. (2023) and Ferreira and Silva (2021) have already explored girls' tendency to have lower self-perceived Digital skills compared to boys, whereas a vast corpus of literature has shown that girls begin to lose confidence in STEM fields during the early school years (Luo and So, 2023; OECD, 2022; OECD, 2024; Shenouda et al., 2024; Spencer et al., 2016).

After listening the stories and participated in the hand-on activities, children showed a more balanced view of gender representation related to these skills. For instance, in Germany's results in digital and writing skills. Initially, the stereotypes associated digital skills with boys, but this changed to a more balanced representation. In the case of Writing skills, the stereotypical association is with girls, which was transposed to both girls and boys.

In Activities 3 and 4, where children were asked to explicitly associate gender with STEM fields, stereotypes were even more pronounced. Science and Technology are fields that boys tend to associate it more strongly with their own gender. Once again, this is in line with stereotypes that are widespread in society regarding gender representation in STEM fields (Borsotti, 2018; Botella et al., 2019; Farias, 2021; Gilchrist & Zhang, 2022; PISA, 2022; Piloto, 2023).

In Activity 3, it is particularly relevant to highlight the interchangeability in the representation of Mathematics between the control and experimental groups in the German pilot. In the control group, Mathematics was most frequently associated with boys, whereas in the experimental group, girls became the most selected category. This shift coincided with the inclusion of the story of Domitila de Carvalho, a prominent female mathematician, in one of the experimental pilots. These results suggest that exposure to inclusive narratives and female role models can effectively influence children's perceptions of gender representation in STEM. It demonstrates that such perceptions are not fixed, but rather responsive to the context and content of the activities presented.

Notably, when asked about the utopian gender representation in STEM fields, girls were more likely than boys to perceive these fields as inclusive and accessible to both genders. This is a positive and encouraging finding, suggesting a greater openness among girls to reimagining gender roles and resisting socialised expectations. Literature on stereotype malleability supports this interpretation: girls often exhibit more flexible beliefs and are more receptive to counter-stereotypical messages, especially when interventions include female role models or participatory storytelling (Shenouda et al., 2024; Young & LaFollette, 2019). In contrast, boys demonstrated a tendency to maintain traditional gender divisions. This remained the case even after exposure to interventions designed to challenge stereotypes. Law et al. (2021) and Newall et al. (2018) found that boys often maintain stereotypical views of gender representation in STEM fields, even when subjected to efforts to reshape them, indicating a form of cognitive resistance. This may be partly due to a perception that acknowledging girls' presence in STEM somehow threatens boys' own sense of belonging within these fields.

One of the most telling discrepancies between boys and girls was not in their stated interest, which was generally high across the board (particularly in science, technology, and mathematics), but in their career aspirations. Many girls expressed enthusiasm for STEM learning when answering to Activity 5 but did not envision themselves pursuing STEM-related professions when answering to Activity 6. Factors that might contribute to girls' withdrawal of STEM include the underrepresentation of women in STEM careers, the lack of encouragement from adults, and persistent cultural messaging that casts STEM as male fields (Farias, 2021; Sebastián-Tirado et al., 2023; OECD, 2022).

Boys, by contrast, were more likely to aspire to STEM careers, particularly in Engineering and Technology, and believed that significant others, especially parents, expected them to pursue such paths. This confidence and external validation are powerful predictors of future engagement (Gilchrist & Zhang, 2022; Sullivan et al., 2015). These findings align with gender schema theory, which posits that children internalise social norms and expectations about what is appropriate for their gender, shaping both their aspirations and sense of self-efficacy.

In summary, these results serve as a map of children's perceptions of gender representation in science, technology, engineering and mathematics, and help to identify the prevailing stereotypes among boys and girls, and the greater flexibility of girls in response to these interventions than boys. In the future, as Wood et al. (2021) argue, gender equity in STEM fields requires a dual strategy: promoting the visibility and legitimacy of women and girls in STEM fields while simultaneously disrupting the cultural assumptions that limit boys' capacity to embrace equity and recognise women place in these fields. In addition, the combination of storytelling and hands-on activities emerges as a particularly effective approach for engaging children at this developmental stage. These methods not only foster curiosity and participation but also create meaningful opportunities to challenge existing stereotypes. The presentation of female role models within these activities has proven to be a successful strategy in shifting children's perceptions of gender representation across diverse STEM fields. By embedding inclusive storytelling into interactive hands-on activities, children are encouraged to reimagine who can belong and succeed in science, technology, engineering, and mathematics.

5. Conclusion

The project aims to provide teachers with materials to combat stereotypes by presenting children with female role models and their work. This gives rise to the question: "What do the teachers involved in the pilot think of the materials developed and presented?"

Teachers responded positively to the project materials, recognising their pedagogical value and their potential to increase student engagement in STEM disciplines, viewing the promotion of STEM fields to children as important and beneficial, regardless of their own experience of implementing STEM activities.

The aim with the children was to map their perceptions of gender representation in different STEM fields and diagnose stereotypes among children. So, the research question can be identified as "What are the children's perceptions about gender representation and gender roles in different fields, such as Science, Technology, Engineering and Mathematics?".

The findings of the STEAM Tales project highlight the persistence of gender stereotypes in children's perceptions of STEM fields. Boys consistently associated science, technology, engineering, and mathematics with their own gender, while girls demonstrated a more inclusive vision, particularly after being exposed to stories about female role models in STEM fields. This suggests that the project's approach—combining storytelling with hands-on activities—has the potential to positively influence children's perceptions, however, one-off interventions may not be sufficient to challenge deeply rooted stereotypes.

Children showed a general interest in STEM fields, particularly science and mathematics. Regardless, this interest did not always translate into future career aspirations, especially among girls. This disconnect may reflect the influence of societal expectations, parental perceptions, and the lack of visible female role models in STEM professions. The project's emphasis on the female representation across STEM fields is therefore a crucial step toward addressing these barriers.

The project's innovative methodology—integrating storytelling with hands-on learning—proved effective in capturing students' interest and supporting teachers in delivering inclusive STEM education. Teachers across all participating countries expressed strong support for the project and its materials, also noting that students were particularly engaged by practical, creative, and innovative-based activities.

References

Adamecz A., Jerrim J., Pingault J.-B., Shure N. (2025). Peers, parents, and self-perceptions: the gender gap in mathematics self-assessment. Journal of Population Economics, 38 (1), art. no. 33. https://doi.org/10.1007/s00148-025-01087-2

Adams A.-M., Simmons F.R. (2019). Exploring individual and gender differences in early writing performance. Reading and Writing, 32 (2), pp. 235 - 263. https://doi.org/10.1007/s11145-018-9859-0

Borsotti, V. (2018). Barriers to gender diversity in software development education: Actionable insights from a Danish case study. In Proceedings of the 40th International Conference on Software Engineering: Software Engineering Education and Training (pp. 146-152).

Botella, C., Rueda, S., López-Iñesta, E., & Marzal, P. (2019). Gender diversity in STEM disciplines: A multiple factor problem. Entropy, 21(1), 30. https://doi.org/10.3390/e21010030

Farias, S. S. (2021). O PISA 2018 e a educação STEM das raparigas. Instituto de Sociologia da Universidade do Porto. http://www.barometro.com.pt/2021/08/02/o-pisa-2018-e-a-educacao-stem-das-raparigas/

Ferreira E., Marôpo L., Delgado C., do Rosàrio Rodrigues M., Dias P., Torres J. (2021). Digital practices, young people, and gender. First Monday, 26 (12). https://doi.org/10.5210/fm.v26i12.11787

Ferreira E., Silva M.J. (2023). Young people's digital competences: does gender matter? 25th International Symposium on Computers in Education, SIIE 2023. https://doi.org/10.1109/SIIE59826.2023.10423691

Gilchrist, E., & Zhang, K. C. (2022). Gender stereotypes in the UK primary schools: Student and teacher perceptions. International Journal of Educational Reform. https://doi.org/10.1177/10567879221114889

Hacieminoglu E. (2013). Expansion of environmental education through field trips. School of the wild. Journal of Environmental Protection and Ecology, 14 (3A), pp. 1396 - 1402. https://www.scopus.com/inward/record.uri?eid=2-s2.0-

84892687771&partnerID=40&md5=68229132d7add3b15f93024b654dc7ca ~

Law F., McGuire L., Winterbottom M., Rutland A. (2021). Children's Gender Stereotypes in STEM Following a One-Shot Growth Mindset Intervention in a Science Museum. Frontiers in Psychology, 12 (641695). https://doi.org/10.3389/fpsyg.2021.641695

Leder G.C. (2017). Do girls count in mathematics? Educating Girls: Practice and Research, 20, pp. 84 – 97. https://doi.org/10.4324/9781315168395

Logan S., Johnston R. (2009). Gender differences in reading ability and attitudes: Examining where these differences lie. Journal of Research in Reading, 32 (2), pp. 199 – 214. https://doi.org/10.1111/j.1467-9817.2008.01389.x

Logan S., Medford E. (2011). Gender differences in the strength of association between motivation, competency beliefs and reading skill. Educational Research, 53 (1), pp. 85 – 94. https://doi.org/10.1080/00131881.2011.552242

Luo, T., & So, W. W. M. (2023). Elementary students' perceptions of STEM professionals. International Journal of Technology and Design Education, 33, 1369-1388. https://doi.org/10.1007/s10798-022-09791-w

Manu M., Torppa M., Vasalampi K., Lerkkanen M.-K., Poikkeus A.-M., Niemi P. (2023). Reading Development from Kindergarten to Age 18: The Role of Gender and Parental Education. Reading Research Quarterly, 58 (4), pp. 505 – 538. https://doi.org/10.1002/rrq.518

Master, A., Cheryan, S., & Meltzoff, A. N. (2020). Girls in STEM: Is It a Female Role-Model Thing? Frontiers in Psychology, 11, 2204. https://doi.org/10.3389/fpsyg.2020.02204

Morais, C. (2015). Storytelling with Chemistry and Related Hands-On Activities: Informal Learning Experiences To Prevent "Chemophobia" and Promote Young Children's Scientific Literacy. Journal of Chemical Education, 92(1), 58-65. https://doi.org/10.1021/ed5002416

Morais, C. (2020). Storytelling and hands-on activities boosting young children's awareness and understanding of chemistry. L'Actualité chimique, 447, 43-47.

Newall C., Gonsalkorale K., Walker E., Forbes G.A., Highfield K., Sweller N. (2018). Science education: Adult biases because of the child's gender and gender stereotypicality. Contemporary Educational Psychology, 55, pp. 30 – 41. https://doi.org/10.1016/j.cedpsych.2018.08.003

Nobel Prize Outreach AB. (2025). Nobel Prize-awarded women. NobelPrize.org. https://www.nobelprize.org/prizes/lists/nobel-prize-awarded-women/

Novak Djokovic Foundation Authors. (2023, April 5).The benefits of art and creativity in early childhood education. Novak Djokovic Foundation. https://novakdjokovicfoundation.org/the-benefits-of-art-and-creativity-in-early-childhood-education/

OECD. (2022). Gender stereotypes in education: Policies and practices to address gender stereotyping across OECD education systems (OECD Education Working Papers No. 271). https://doi.org/10.1787/a46ae056-en

OECD. (2024). Challenging social inequality through career guidance. https://doi.org/10.1787/619667e2-en

Ozturk G., Hill S., Yates G.C.R. (2015). Girls, boys, and early reading: Parents' gendered views about literacy and children's attitudes towards reading. Early Child Development and Care, 186 (5), pp. 703 – 715. https://doi.org/10.1080/03004430.2015.1053477

Piloto, C. (2023). The gender gap in STEM. MIT Professional Education. https://professionalprograms.mit.edu/blog/leadership/the-gender-gap-in-stem/

PISA. (2022). PISA 2022 results (Volume I): The state of learning and equity in education. OECD. https://www.oecd-ilibrary.org/sites/53f23881-en/index.html

Plowman L., Stephen C., McPake J. (2010). Growing Up with Technology: Young Children Learning in a Digital World, pp. 1 – 175. https://doi.org/10.4324/9780203863619

Rackoff G.N., Lagoni D.W., Shoshany M.F., Moursi N.A., Hennefield L. (2022). The impact of informant gender on children's endorsement of scientific and non-scientific information. British Journal of Developmental Psychology, 40 (1), pp. 170 – 186. https://doi.org/10.1111/bjdp.12397

Romero-Tena R., Barragán-Sánchez R., Martínez-Pérez S., Palacios-Rodríguez A. (2022). Habits, norms, and use of technologies at home from a gender perspective in early childhood. Digital Education Review, (41), pp. 19 – 31. https://doi.org/10.1344/DER.2022.41.19-31

Shenouda C.K., Patel K.S., Danovitch J.H. (2024). Who Can Do STEM?: Children's Gendered Beliefs about STEM and Non-STEM Competence and Learning. Sex Roles, 90 (8), pp. 1063 – 1074. https://doi.org/10.1007/s11199-024-01493-y,

Spencer, S. J. et al. (2016). Stereotype threat. Annual Review of Psychology, 67(1), 415-437. https://doi.org/10.1146/annurev-psych-073115-103235

Wolter I., Braun E., Hannover B. (2015). Reading is for girls!? The negative impact of preschool teachers' traditional gender role attitudes on boys' reading related motivation and skills. Frontiers in Psychology, 6 (1267). https://doi.org/10.3389/fpsyg.2015.01267

Williams G.J., Larkin R.F. (2013). Narrative writing, reading and cognitive processes in middle childhood: What are the links? Learning and Individual Differences, 28, pp. 142 – 150. https://doi.org/10.1016/j.lindif.2012.08.003

Wood, L. A., Hutchison, J., Aitken, M., & Cunningham, S. J.. (2022). Gender stereotypes in UK children and adolescents: Changing patterns of knowledge and endorsement. British Journal of Social Psychology, 61(3), 768-789. https://doi.org/10.1111/bjso.12510

Young R.M., LaFollette S. (2009). Assessing the Status of Environmental Education in Illinois Elementary Schools. Environmental Health Insights, 3. https://doi.org/10.4137/EHI.S3502

APPENDIXES

APPENDIX A – Interview guide for teachers' participation in the pilot project

Personal information and background

Age	Gender	Years of teaching experience	Academic background	Time teaching at the current school

A. Teaching Confidence

On a scale from 1 to 5, how confident do you feel when teaching the following curricular subjects?

	1 = Not at all confident	2 = Slightly confident	3 = Moderately confident	4 = Very confident	5 = Extremely confident	Not Applicable
Mathematics						
Mother Language						
Environmental Studies (topics involving Science, History, Geography, and Civism)						
English						
Technology						
Arts						
Music						
Physical Education						
Other subject:____________						

Could you please comment on your answers? (e.g., specific challenges, experiences, or reasons influencing your confidence levels).

B. Student Engagement and Perceived Difficulty

On a scale from 1 to 5, how do you perceive your students' interest in the following curricular subjects?

	1 = Not at all interested	2 = Slightly interested	3 = Moderately interested	4 = Very interested	5 = Extremely interested	Not Applicable
Mathematics						
Mother Language						
Environmental Studies (topics involving Science, History, Geography, and Civism)						
English						
Technology						
Arts						
Music						
Physical Education						
Other subject:____________						

Could you please comment on your answers? (e.g., specific observations, experiences, or factors influencing your students' interest levels).

On a scale from 1 to 5, how do you perceive the level of difficulty your students face in the following curricular subjects?

	1 = Not at all difficult	2 = Slightly difficult	3 = Moderately difficult	4 = Very difficult	5 = Extremely difficult	Not Applicable
Mathematics						
Mother Language						
Environmental Studies (topics involving Science, History, Geography, and Civism)						
English						
Technology						
Arts						
Music						
Physical Education						
Other subject:____________						

Could you please comment on your answers? (e.g., specific challenges, observations, or reasons that influence your perception of the difficulty levels).

C. STEM Education

What is your experience with implementing STEM (Science, Technology, Engineering, and Mathematics) activities in the classroom? Have you previously conducted STEM activities with your students?

If yes, please provide a brief example.

Are there any initiatives or programs at your school that promote STEM among students? If yes, please describe one example.

What is your opinion on promoting STEM among children in this age range?

D. Lesson Plan Selection

Could you please describe the criteria you used to select a specific area within the STEM field for us to implement a lesson plan with your students?

Could you provide feedback on the developed instrument designed to support teachers in selecting a lesson plan that best suits their needs and objectives (This question will allow us to evaluate the effectiveness of the “Selection form of the lesson plan” instrument)

APPENDIX B – Evaluation instrument of the **lesson plans' quality**

1 – Poor ; 2 – Fair; 3 – Good; 4 – Very Good; 5 – Excellent

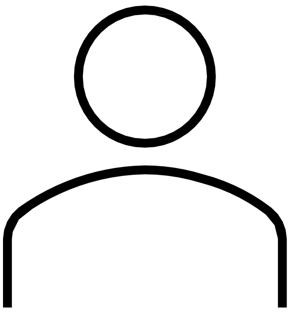
Criteria	1	2	3	4	5	Not Applicable
1. The lesson plans are easy to understand and follow, with clear objectives.						
2. The lesson plan objectives are clearly stated.						
3. The structure of the lesson plan is well-organized and logical, with steps and instructions unambiguous.						
4. The instructions and steps provided are clear and unambiguous.						
5. The content is relevant for primary school teachers and suitable for the age group and learning level of the students.						
6. The lesson plans are practical and feasible for use in the classroom, allowing adaptations based on student needs or classroom context.						
7. The lesson plans provide innovative approaches to teaching.						
8. The connection between the story and the hands-on activity is well-defined and supports the overall learning objectives.						
9. The stories promote a strong connection with female role models.						
10. The stories evoke emotional involvement, fostering feelings and meaningful connections.						
11. The stories are culturally and scientifically informative, as well as emotionally involving.						
12. The stories are visually appealing and graphically well-designed.						
13. The hands-on activities promote active participation and engagement of children.						
14. The activities inspire creativity, curiosity, and critical thinking.						
15. The resources and materials suggested are readily available and versatile.						

APPENDIX C – Instrument to assess children's perceptions, interest, and motivation in STEM Fields

Gender: ☐ Male ☐ Female ☐ I would rather not say

1. The people below work in different fields. Paint each face according to the colour you think best suits the person: you can use pink, blue or purple.

Science field



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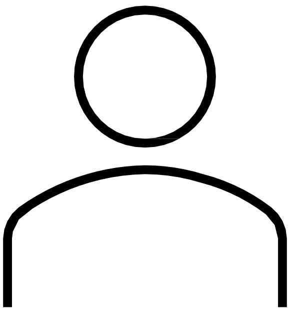
Technology field



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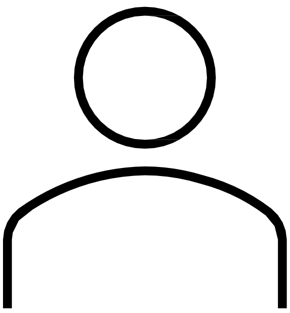
Engineering field



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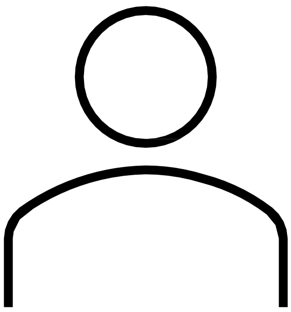
Mathematics field



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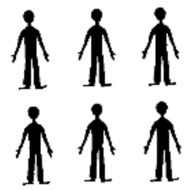
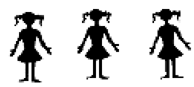
2. Please match the columns according to the gender you consider having the skills presented.

Reading skills
Who reads well?

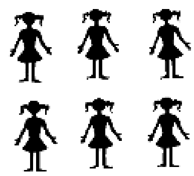


Digital skills
Who is good at surfing the web or handling technology like computers, cell phones, etc?



Writing skills
Who is good at writing?

Leadership skills
In the schoolyard, who is more likely to be the leader or captain of a play?



Mathematical skills
Who is good at maths?

Care skills
Who is good at taking care of others?

3. Return to Activity 1 and write on the line below each picture which gender you thought of for the face.

4. For each profession, place an X in one of the options (boys, girls, boys, and girls) to help us complete each sentence.

		Boys	Girls	Boys and Girls
Science	is for …			
	can be for ...			
Mechanics	is for …			
	can be for ...			
Technology	is for …			
	can be for ...			
Kindergarten Education	is for …			
	can be for ...			
Engineering	is for …			
	can be for ...			
Mathematics	is for …			
	can be for ...			

5. Are you interested in the fields of science, technology, engineering, and maths? Put an X in the option that apply to you.

	Yes	No	I don't know
Science			
Technology			
Engineering			
Mathematics			

6. Put an X in the option that apply to you.

In the future, the profession I want to have is in the field of …

- [ ] … science
- [ ] … technology
- [ ] … engineering
- [ ] … mathematics
- [ ] … kindergarten education
- [ ] … mechanics
- [ ] Other: ____________________

In the future, I think I will have a profession in the field of …

- [ ] … science
- [ ] … technology
- [ ] … engineering
- [ ] … mathematics
- [ ] … kindergarten education
- [ ] … mechanics
- [ ] Other: ____________________

In the future, my parents want me to have a have a profession in the field of …

- [ ] … science
- [ ] … technology
- [ ] … engineering
- [ ] … mathematics
- [ ] … kindergarten education
- [ ] … mechanics
- [ ] Other: ____________________

APPENDIX D – SPSS Outputs: **Teachers' answers to the Interview guide for teachers' participation in the pilot project**

The following tables present the frequencies and percentages of the answers given by teachers to the three sets of closed-answer questions in the Interview guide for teachers' participation in the pilot project.

A. Teaching Confidence

Table 1.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how confident do you feel when teaching Mathematics?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very confident	11	68,8	68,8	68,8
	Extremely confident	5	31,3	31,3	100,0
	Total	16	100,0	100,0	

Table 2.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how confident do you feel when teaching (your) Mother Language?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very confident	9	56,3	56,3	56,3
	Extremely confident	7	43,8	43,8	100,0
	Total	16	100,0	100,0	

Table 3.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how confident do you feel when teaching Environmental Studies?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Moderately confident	1	6,3	6,3	6,3
	Very confident	7	43,8	43,8	50,0
	Extremely confident	8	50,0	50,0	100,0
	Total	16	100,0	100,0	

Table 4.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how confident do you feel when teaching Technology?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Slightly confident	1	6,3	6,3	6,3
	Moderately confident	6	37,5	37,5	43,8
	Very confident	6	37,5	37,5	81,3
	Extremely confident	1	6,3	6,3	87,5
	NA	2	12,5	12,5	100,0
	Total	16	100,0	100,0	

Table 5.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how confident do you feel when teaching Arts?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Moderately confident	5	31,3	31,3	31,3
	Very confident	7	43,8	43,8	75,0
	Extremely confident	3	18,8	18,8	93,8
	NA	1	6,3	6,3	100,0
	Total	16	100,0	100,0	

B. Student Engagement and Perceived Difficulty

Students' Engagement

Table 6.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how do you perceive your students' interest in Mathematics?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Moderately confident	3	18,8	18,8	18,8
	Very confident	11	68,8	68,8	87,5
	Extremely confident	2	12,5	12,5	100,0
	Total	16	100,0	100,0	

Table 7.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how do you perceive your students' interest in (your) Mother Language?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Slightly confident	1	6,3	6,3	6,3
	Moderately confident	7	43,8	43,8	50,0
	Very confident	7	43,8	43,8	93,8
	Extremely confident	1	6,3	6,3	100,0
	Total	16	100,0	100,0	

Table 8.

Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how do you perceive your students' interest in Environmental Studies?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Moderately confident	2	12,5	12,5	12,5
	Very confident	10	62,5	62,5	75,0
	Extremely confident	4	25,0	25,0	100,0
	Total	16	100,0	100,0	

Table 9.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how do you perceive your students' interest in Technology?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Moderately confident	2	12,5	12,5	12,5
	Very confident	7	43,8	43,8	56,3
	Extremely confident	5	31,3	31,3	87,5
	NA	2	12,5	12,5	100,0
	Total	16	100,0	100,0	

Table 10.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how do you perceive your students' interest in Arts?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Moderately confident	3	18,8	18,8	18,8
	Very confident	8	50,0	50,0	68,8
	Extremely confident	5	31,3	31,3	100,0
	Total	16	100,0	100,0	

Students' Perceived Difficulty

Table 11.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how do you perceive the level of difficulty your students face in Mathematics?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all confident	1	6,3	6,3	6,3
	Slightly confident	4	25,0	25,0	31,3
	Moderately confident	10	62,5	62,5	93,8
	Very confident	1	6,3	6,3	100,0
	Total	16	100,0	100,0	

Table 12.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how do you perceive the level of difficulty your students face in (your) Mother Language?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all confident	1	6,3	6,3	6,3
	Slightly confident	3	18,8	18,8	25,0
	Moderately confident	9	56,3	56,3	81,3
	Very confident	2	12,5	12,5	93,8
	NA	1	6,3	6,3	100,0
	Total	16	100,0	100,0	

Table 13.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how do you perceive the level of difficulty your students face in Environmental Studies?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all confident	4	25,0	26,7	26,7
	Slightly confident	8	50,0	53,3	80,0
	Moderately confident	2	12,5	13,3	93,3
	Very confident	1	6,3	6,7	100,0
	Total	15	93,8	100,0	
Missing	System	1	6,3		
Total		16	100,0		

Table 14.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how do you perceive the level of difficulty your students face in Technology?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all confident	3	18,8	18,8	18,8
	Slightly confident	7	43,8	43,8	62,5
	Moderately confident	5	31,3	31,3	93,8
	NA	1	6,3	6,3	100,0
	Total	16	100,0	100,0	

Table 15.
Frequencies and percentages of answers given by teachers to the question "On a scale from 1 to 5, how do you perceive the level of difficulty your students face in Arts?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all confident	4	25,0	26,7	26,7
	Slightly confident	8	50,0	53,3	80,0
	Moderately confident	2	12,5	13,3	93,3
	Very confident	1	6,3	6,7	100,0
	Total	15	93,8	100,0	
Missing	System	1	6,3		
Total		16	100,0		

APPENDIX E –SPSS Outputs: Teachers' answers to the Evaluation instrument of the lesson **plans' quality**

Table 1.

Frequencies and percentages of answers given by teachers to the Criteria 1 "The lesson plans are easy to understand and follow, with clear objectives".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	1	6,7	7,1	7,1
	Very good	5	33,3	35,7	42,9
	Excellent	8	53,3	57,1	100,0
	Total	14	93,3	100,0	
Missing	System	1	6,7		
Total		15	100,0		

Table 2.

Frequencies and percentages of answers given by teachers to the Criteria 2 "The lesson plan objectives are clearly stated".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very good	6	40,0	42,9	42,9
	Excellent	8	53,3	57,1	100,0
	Total	14	93,3	100,0	
Missing	System	1	6,7		
Total		15	100,0		

Table 3.

Frequencies and percentages of answers given by teachers to the Criteria 3 "The structure of the lesson plan is well-organized and logical, with steps and instructions unambiguous".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	1	6,7	7,7	7,7

	Very good	4	26,7	30,8	38,5
	Excellent	8	53,3	61,5	100,0
	Total	13	86,7	100,0	
Missing	System	2	13,3		
Total		15	100,0		

Table 4.

Frequencies and percentages of answers given by teachers to the Criteria 4 "The instructions and steps provided are clear and unambiguous".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	3	20,0	21,4	21,4
	Very good	4	26,7	28,6	50,0
	Excellent	7	46,7	50,0	100,0
	Total	14	93,3	100,0	
Missing	System	1	6,7		
Total		15	100,0		

Table 5.

Frequencies and percentages of answers given by teachers to the Criteria 5 "The content is relevant for primary school teachers and suitable for the age group and learning level of the students".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Fair	1	6,7	7,1	7,1
	Good	4	26,7	28,6	35,7
	Very good	2	13,3	14,3	50,0
	Excellent	7	46,7	50,0	100,0
	Total	14	93,3	100,0	
Missing	System	1	6,7		
Total		15	100,0		

Table 6.

Frequencies and percentages of answers given by teachers to the Criteria 6 "The lesson plans are practical and feasible for use in the classroom, allowing adaptations based on student needs or classroom context".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	1	6,7	7,1	7,1
	Very good	7	46,7	50,0	57,1
	Excellent	6	40,0	42,9	100,0
	Total	14	93,3	100,0	
Missing	System	1	6,7		
Total		15	100,0		

Table 7.

Frequencies and percentages of answers given by teachers to the Criteria 7 "The lesson plans provide innovative approaches to teaching".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	1	6,7	7,1	7,1
	Very good	4	26,7	28,6	35,7
	Excellent	9	60,0	64,3	100,0
	Total	14	93,3	100,0	
Missing	System	1	6,7		
Total		15	100,0		

Table 8.

Frequencies and percentages of answers given by teachers to the Criteria 8 "The connection between the story and the hands-on activity is well-defined and supports the overall learning objectives".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	2	13,3	14,3	14,3
	Very good	4	26,7	28,6	42,9
	Excellent	8	53,3	57,1	100,0
	Total	14	93,3	100,0	

Missing	System	1	6,7		
Total		15	100,0		

Table 9.

Frequencies and percentages of answers given by teachers to the Criteria 9 "The stories promote a strong connection with female role models".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	1	6,7	7,1	7,1
	Very good	4	26,7	28,6	35,7
	Excellent	9	60,0	64,3	100,0
	Total	14	93,3	100,0	
Missing	System	1	6,7		
Total		15	100,0		

Table 10.

Frequencies and percentages of answers given by teachers to the Criteria 10 "The stories evoke emotional involvement, fostering feelings and meaningful connections".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	3	20,0	21,4	21,4
	Very good	5	33,3	35,7	57,1
	Excellent	6	40,0	42,9	100,0
	Total	14	93,3	100,0	
Missing	System	1	6,7		
Total		15	100,0		

Table 11.

Frequencies and percentages of answers given by teachers to the Criteria 11 "The stories are culturally and scientifically informative, as well as emotionally involving".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	1	6,7	7,1	7,1

	Very good	5	33,3	35,7	42,9
	Excellent	8	53,3	57,1	100,0
	Total	14	93,3	100,0	
Missing	System	1	6,7		
Total		15	100,0		

Table 12.

Frequencies and percentages of answers given by teachers to the Criteria 12 "The stories are visually appealing and graphically well-designed".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	2	13,3	15,4	15,4
	Very good	3	20,0	23,1	38,5
	Excellent	8	53,3	61,5	100,0
	Total	13	86,7	100,0	
Missing	System	2	13,3		
Total		15	100,0		

Table 13.

Frequencies and percentages of answers given by teachers to the Criterion 13 "The hands-on activities promote active participation and engagement of children".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very good	3	20,0	21,4	21,4
	Excellent	11	73,3	78,6	100,0
	Total	14	93,3	100,0	
Missing	System	1	6,7		
Total		15	100,0		

Table 14.

Frequencies and percentages of answers given by teachers to the Criteria 14 "The activities inspire creativity, curiosity, and critical thinking".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very good	3	20,0	21,4	21,4
	Excellent	11	73,3	78,6	100,0
	Total	14	93,3	100,0	
Missing	System	1	6,7		
Total		15	100,0		

Table 15.

Frequencies and percentages of answers given by teachers to the Criteria 15 "The resources and materials suggested are readily available and versatile".

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	1	6,7	7,7	7,7
	Very good	2	13,3	15,4	23,1
	Excellent	10	66,7	76,9	100,0
	Total	13	86,7	100,0	
Missing	System	2	13,3		
Total		15	100,0		

APPENDIX F –SPSS Tables: **Children's answers**

The following tables present the output from SPSS when the Chi-square test of independence is performed on the answers given to the Instrument to assess children's perceptions, interest, and motivation in STEM Fields. The Chi-square test of independence is a statistical test used to determine if there is a significant association between two categorical variables. One of the variables will be the answers given by the students and the other will be the gender or the group . If p-value < .05, the two variables are not independent.

Activity 1

Comparison between girls and boys

Table 1.
Percentages of answers to Activity 1 by gender for Technology field.

			Blue	Pink	Purple	Total
Respondent gender	Boys	Count	73	42	60	175
		Expected Count	62,2	43,9	69,0	175,0
		% within Respondent gender	41,7%	24,0%	34,3%	100,0%
	Girls	Count	46	42	72	160
		Expected Count	56,8	40,1	63,0	160,0
		% within Respondent gender	28,7%	26,3%	45,0%	100,0%
Total		Count	119	84	132	335
		Expected Count	119,0	84,0	132,0	335,0

% within Respondent gender	35,5%	25,1%	39,4%	100,0%

Table 2.
Output for the chi-squared test of independence, testing whether association of colour is independent of gender, in the Technology field.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6,558[a]	2	,038
Likelihood Ratio	6,600	2	,037
Linear-by-Linear Association	6,248	1	,012
N of Valid Cases	335		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 40,12.

Activity 2

Comparison between girls and boys

Table 3.

Percentages of answers to Activity 2 by gender for Digital skills.

			Boys	Girls	Boys and Girls	
Respondent gender	Boys	Count	108	14	52	174
		Expected Count	95,9	17,7	60,4	174,0
		% within Respondent gender	62,1%	8,0%	29,9%	100,0%

Girls	Count	76	20	64	160
	Expected Count	88,1	16,3	55,6	160,0
	% within Respondent gender	47,5%	12,5%	40,0%	100,0%
Total	Count	184	34	116	334
	Expected Count	184,0	34,0	116,0	334,0
	% within Respondent gender	55,1%	10,2%	34,7%	100,0%

Table 4.
Output for the chi-square test of independence to test if the answer is independent of gender.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7,291[a]	2	,026
Likelihood Ratio	7,315	2	,026
Linear-by-Linear Association	5,910	1	,015
N of Valid Cases	334		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 16,29.

Table 5.

Percentages of answers to Activity 2 by gender for Leadership skills.

	Boys	Girls	Boys and Girls

Respondent gender	Boys	Count	98	18	59	175
		Expected Count	79,9	26,1	69,0	175,0
		% within Respondent gender	56,0%	10,3%	33,7%	100,0%
	Girls	Count	55	32	73	160
		Expected Count	73,1	23,9	63,0	160,0
		% within Respondent gender	34,4%	20,0%	45,6%	100,0%
Total		Count	153	50	132	335
		Expected Count	153,0	50,0	132,0	335,0
		% within Respondent gender	45,7%	14,9%	39,4%	100,0%

Table 6.
Output for the chi-square test of independence to test if the answer is independent of gender.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	16,852[a]	2	<,001
Likelihood Ratio	17,038	2	<,001
Linear-by-Linear Association	11,067	1	<,001
N of Valid Cases	335		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 23,88.

Table 7.

Percentages of answers to Activity 2 by gender for Mathematical skills.

			Boys	Girls	Boys and Girls	
Respondent gender	Boys	Count	51	23	101	175
		Expected Count	43,1	30,5	101,4	175,0
		% within Respondent gender	29,1%	13,1%	57,7%	100,0%
	Girls	Count	31	35	92	158
		Expected Count	38,9	27,5	91,6	158,0
		% within Respondent gender	19,6%	22,2%	58,2%	100,0%
Total		Count	82	58	193	333
		Expected Count	82,0	58,0	193,0	333,0
		% within Respondent gender	24,6%	17,4%	58,0%	100,0%

Table 8.
Output for the chi-square test of independence to test if the answer is independent of gender.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6,931[a]	2	,031
Likelihood Ratio	6,980	2	,031

Linear-by-Linear Association	1,167	1	,280
N of Valid Cases	333		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 27,52.

Activity 3

Comparison between girls and boys

Table 9.

Percentages of answers to Activity 3 by gender for Science field.

			Boys	Girls	Boys and Girls	
Respondent gender	Boys	Count	71	34	57	162
		Expected Count	57,7	44,0	60,3	162,0
		% within Respondent gender	43,8%	21,0%	35,2%	100,0%
	Girls	Count	39	50	58	147
		Expected Count	52,3	40,0	54,7	147,0
		% within Respondent gender	26,5%	34,0%	39,5%	100,0%
Total		Count	110	84	115	309
		Expected Count	110,0	84,0	115,0	309,0
		% within Respondent gender	35,6%	27,2%	37,2%	100,0%

Table 10.

Output for the chi-square test of independence to test if the answer is independent of gender.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11,665[a]	2	,003
Likelihood Ratio	11,792	2	,003
Linear-by-Linear Association	4,909	1	,027
N of Valid Cases	309		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 39,96.

Table 11.

Percentages of answers to Activity 3 by gender for Technology field.

			Boys	Girls	Boys and Girls	Total
Respondent gender	Boys	Count	80	29	53	162
		Expected Count	70,3	38,3	53,5	162,0
		% within Respondent gender	49,4%	17,9%	32,7%	100,0%
	Girls	Count	54	44	49	147

	Expected Count	63,7	34,7	48,5	147,0
	% within Respondent gender	36,7%	29,9%	33,3%	100,0%
Total	Count	134	73	102	309
	Expected Count	134,0	73,0	102,0	309,0
	% within Respondent gender	43,4%	23,6%	33,0%	100,0%

Table 12.

Output for the chi-square test of independence to test if the answer is independent of gender.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7,574[a]	2	,023
Likelihood Ratio	7,610	2	,022
Linear-by-Linear Association	1,795	1	,180
N of Valid Cases	309		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 34,73.

Activity 4

"…is for…" questions

Comparison between girls and boys

Table 13.

Percentages of answers to Activity 4's "is for question" for Science field by gender.

			Boys	Girls	Boys and Girls	
Respondent gender	Boys	Count	55	15	105	175
		Expected Count	43,1	25,8	106,2	175,0
		% within Respondent gender	31,4%	8,6%	60,0%	100,0%
	Girls	Count	27	34	97	158
		Expected Count	38,9	23,2	95,8	158,0
		% within Respondent gender	17,1%	21,5%	61,4%	100,0%
Total		Count	82	49	202	333
		Expected Count	82,0	49,0	202,0	333,0
		% within Respondent gender	24,6%	14,7%	60,7%	100,0%

Table 14.

Output for the chi-square test of independence to test if the answer is independent of gender.

	Value	df	Asymptotic Significance (2-sided)

Pearson Chi-Square	16,420[a]	2	<,001
Likelihood Ratio	16,769	2	<,001
Linear-by-Linear Association	2,834	1	,092
N of Valid Cases	333		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 23,25.

Activity 5

Comparison between girls and boys

Table 15.

Percentages of answers to the Technology field, by gender.

			Yes	No	I don't know	Total
Respondent gender	Boys	Count	123	29	23	175
		Expected Count	103,7	41,4	29,9	175,0
		% within Respondent gender	70,3%	16,6%	13,1%	100,0%
	Girls	Count	75	50	34	159
		Expected Count	94,3	37,6	27,1	159,0
		% within Respondent gender	47,2%	31,4%	21,4%	100,0%

Total	Count	198	79	57	334
	Expected Count	198,0	79,0	57,0	334,0
	% within Respondent gender	59,3%	23,7%	17,1%	100,0%

Table 16.

Output for the chi-square test of independence to test if the answer is independent of gender.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	18,618[a]	2	<,001
Likelihood Ratio	18,772	2	<,001
Linear-by-Linear Association	13,954	1	<,001
N of Valid Cases	334		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 27,13.

Table 17.

Percentages of answers to the Engineering field, by gender.

			Yes	No	I don't know	
Respondent gender	Boys	Count	94	41	38	173
		Expected Count	74,5	55,2	43,3	173,0

		% within Respondent gender	54,3%	23,7%	22,0%	100,0%
	Girls	Count	49	65	45	159
		Expected Count	68,5	50,8	39,8	159,0
		% within Respondent gender	30,8%	40,9%	28,3%	100,0%
Total		Count	143	106	83	332
		Expected Count	143,0	106,0	83,0	332,0
		% within Respondent gender	43,1%	31,9%	25,0%	100,0%

Table 18.

Output for the chi-square test of Independence to test if the answer is independent of gender.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	19,630[a]	2	<,001
Likelihood Ratio	19,886	2	<,001
Linear-by-Linear Association	11,360	1	<,001
N of Valid Cases	332		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 39,75.

Activity 6

Question 6a

Comparison between girls and boys

Table 19.

Percentages of answers to the question a) In the future, I would like to have a profession in the field *of..., by gender.*

Respondent gender * Activity 6 - In the future, I would like to have a profession in the field of ... Crosstabulation

			Activity 6 - In the future, I would like to have a profession in the field of ...							
			Science	Technology	Engineering	Mathematics	Kindergarten Education	Mechanics	Other	Total
Respondent gender	Boys	Count	15	17	11	13	9	8	96	169
		% within Respondent gender	8,9%	10,1%	6,5%	7,7%	5,3%	4,7%	56,8%	100,0%
	Girls	Count	21	8	5	10	26	1	80	151
		% within Respondent gender	13,9%	5,3%	3,3%	6,6%	17,2%	0,7%	53,0%	100,0%
Total		Count	36	25	16	23	35	9	176	320
		% within Respondent gender	11,3%	7,8%	5,0%	7,2%	10,9%	2,8%	55,0%	100,0%

Table 20.

Output for the chi-square test of Independence to test if the answer is independent of gender.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	21.092[a]	6	.002
Likelihood Ratio	22.275	6	.001
Linear-by-Linear Association	.164	1	.685
N of Valid Cases	320		

a. 2 cells (14.3%) have expected count less than 5. The minimum expected count is 4.25.

Question 6b

Comparison between girls and boys

Table 21.

Percentages of answers to the question a) In the future, I think I will be able to have a profession in the *field of..., by gender.*

Respondent gender * Activity 6 - In the future, I think I will be able to have a profession in the field of ... Crosstabulation

			Activity 6 - In the future, I think I will be able to have a profession in the field of ...							
			Science	Technology	Engineering	Mathematics	Kindergarten Education	Mechanics	Other	Total
Respondent gender	Boys	Count	18	22	18	18	3	7	84	170
		% within Respondent gender	10,6%	12,9%	10,6%	10,6%	1,8%	4,1%	49,4%	100,0%
	Girls	Count	19	8	6	13	43	3	62	154
		% within Respondent gender	12,3%	5,2%	3,9%	8,4%	27,9%	1,9%	40,3%	100,0%
Total		Count	37	30	24	31	46	10	146	324
		% within Respondent gender	11,4%	9,3%	7,4%	9,6%	14,2%	3,1%	45,1%	100,0%

Table 22.

Output for the chi-square test of Independence to test if the answer is independent of gender.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	52.402[a]	6	<.001
Likelihood Ratio	59.682	6	<.001
Linear-by-Linear Association	.211	1	.646
N of Valid Cases	324		

a. 1 cells (7.1%) have expected count less than 5. The minimum expected count is 4.75.

Question 6c

Comparison between girls and boys

Table 23.

Percentages of answers to the question a) In the future, my parents think I might have a profession in *the field of…, by gender.*

Respondent gender * Activity 6 - In the future, my parents think I might have a profession in the field of ... Crosstabulation

			Activity 6 - In the future, my parents think I might have a profession in the field of ...							
			Science	Technology	Engineering	Mathematics	Kindergarten Education	Mechanics	Other	Total
Respondent gender	Boys	Count	14	13	13	12	6	12	101	171
		% within Respondent gender	8,2%	7,6%	7,6%	7,0%	3,5%	7,0%	59,1%	100,0%
	Girls	Count	14	9	4	20	27	1	79	154
		% within Respondent gender	9,1%	5,8%	2,6%	13,0%	17,5%	0,6%	51,3%	100,0%
Total		Count	28	22	17	32	33	13	180	325
		% within Respondent gender	8,6%	6,8%	5,2%	9,8%	10,2%	4,0%	55,4%	100,0%

Table 24.

Output for the chi-square test of Independence to test if the answer is independent of gender.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	32.051[a]	6	<.001
Likelihood Ratio	35.001	6	<.001
Linear-by-Linear Association	.483	1	.487
N of Valid Cases	325		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.16.

Appendix G – LogoPsyCom (Belgium)

Activity 1

Table 1.

Percentages of answers to Activity 1 by group for Science (LogoPsyCom).

Crosstab

			Activity 1 - Science field			
			Blue	Pink	Purple	Total
Group	Control Group	Count	8	5	2	15
		Expected Count	4,5	5,5	5,0	15,0
		% within Group	53,3%	33,3%	13,3%	100,0%
	Experimental Group	Count	2	7	9	18
		Expected Count	5,5	6,5	6,0	18,0
		% within Group	11,1%	38,9%	50,0%	100,0%
Total		Count	10	12	11	33
		Expected Count	10,0	12,0	11,0	33,0
		% within Group	30,3%	36,4%	33,3%	100,0%

Table 2.

Output for the Chi-square test of independence to test if colour is independent of gender).

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8,183[a]	2	,017
Likelihood Ratio	8,735	2	,013
Linear-by-Linear Association	7,770	1	,005
N of Valid Cases	33		

a. 1 cells (16,7%) have expected count less than 5. The minimum expected count is 4,55.

Activity 5

Table 3.

Percentages of answers to Activity 5 (Engineering) by gender (LogoPsyCom).

Crosstab

			Activity 5 - Interest in Engineering			
			Yes	No	I don't know	Total
Respondent gender	Boys	Count	7	3	3	13
		Expected Count	3,5	5,1	4,3	13,0
		% within Respondent gender	53,8%	23,1%	23,1%	100,0%
	Girls	Count	2	10	8	20
		Expected Count	5,5	7,9	6,7	20,0
		% within Respondent gender	10,0%	50,0%	40,0%	100,0%
Total		Count	9	13	11	33
		Expected Count	9,0	13,0	11,0	33,0
		% within Respondent gender	27,3%	39,4%	33,3%	100,0%

Table 4.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7,680[a]	2	,021
Likelihood Ratio	7,781	2	,020
Linear-by-Linear Association	4,684	1	,030
N of Valid Cases	33		

a. 2 cells (33,3%) have expected count less than 5. The minimum expected count is 3,55.

Activity 6

Table 5.

Frequencies of answers given by boys and girls to Activity 6b (LogoPsyCom).

Respondent gender * Activity 6 - In the future, I think I will be able to have a profession in the field of ... Crosstabulation

			Activity 6 - In the future, I think I will be able to have a profession in the field of ...					
			Science	Technology	Engineering	Kindergarten Education	Other	Total
Respondent gender	Boys	Count	1	2	1	0	4	8
		% within Respondent gender	12,5%	25,0%	12,5%	0,0%	50,0%	100,0%
	Girls	Count	2	0	0	8	7	17
		% within Respondent gender	11,8%	0,0%	0,0%	47,1%	41,2%	100,0%
Total		Count	3	2	1	8	11	25
		% within Respondent gender	12,0%	8,0%	4,0%	32,0%	44,0%	100,0%

Table 6.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10,238[a]	4	,037
Likelihood Ratio	13,104	4	,011
N of Valid Cases	25		

a. 8 cells (80,0%) have expected count less than 5. The minimum expected count is ,32.

Table 7.

Frequencies of answers given by boys and girls to Activity 6c (LogoPsyCom).

Respondent gender * Activity 6 - In the future, my parents think I might have a profession in the field of ... Crosstabulation

			Activity 6 - In the future, my parents think I might have a profession in the field of ...					
				Science	Technology	Kindergarten Education	Other	Total
Respondent gender	Boys	Count	0	0	1	0	5	6
		% within Respondent gender	0,0%	0,0%	16,7%	0,0%	83,3%	100,0%
	Girls	Count	1	1	0	5	3	10
		% within Respondent gender	10,0%	10,0%	0,0%	50,0%	30,0%	100,0%
Total		Count	1	1	1	5	8	16
		% within Respondent gender	6,3%	6,3%	6,3%	31,3%	50,0%	100,0%

Table 8.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12,504[a]	4	,014
Likelihood Ratio	16,559	4	,002
N of Valid Cases	23		

a. 8 cells (80,0%) have expected count less than 5. The minimum expected count is ,39.

Appendix H – MIND (Germany)

Activity 1

Table 1.

Percentages of answers to Activity 1 by gender for Science (MIND).

Crosstab

			Activity 1 - Science field			
			Blue	Pink	Purple	Total
Respondent gender	Boys	Count	26	10	8	44
		Expected Count	19,2	15,2	9,6	44,0
		% within Respondent gender	59,1%	22,7%	18,2%	100,0%
	Girls	Count	8	17	9	34
		Expected Count	14,8	11,8	7,4	34,0
		% within Respondent gender	23,5%	50,0%	26,5%	100,0%
Total		Count	34	27	17	78
		Expected Count	34,0	27,0	17,0	78,0
		% within Respondent gender	43,6%	34,6%	21,8%	100,0%

Table 2.

Output for the Chi-square test of independence to test if colour is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10,290[a]	2	,006
Likelihood Ratio	10,643	2	,005
Linear-by-Linear Association	6,004	1	,014
N of Valid Cases	78		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 7,41.

Activity 2

Table 3.

Percentages of answers to Activity 2 by gender for Mathematical skills (MIND).

Crosstab

			Activity 2 - Mathematical Skills			
			Boys	Girls	Boys and Girls	Total
Respondent gender	Boys	Count	17	7	20	44
		Expected Count	11,8	9,6	22,6	44,0
		% within Respondent gender	38,6%	15,9%	45,5%	100,0%
	Girls	Count	4	10	20	34
		Expected Count	9,2	7,4	17,4	34,0
		% within Respondent gender	11,8%	29,4%	58,8%	100,0%
Total		Count	21	17	40	78
		Expected Count	21,0	17,0	40,0	78,0
		% within Respondent gender	26,9%	21,8%	51,3%	100,0%

Table 4.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7,417[a]	2	,025
Likelihood Ratio	7,908	2	,019
Linear-by-Linear Association	4,242	1	,039
N of Valid Cases	78		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 7,41.

Table 5.

Percentages of answers to Activity 2 by group for Digital skills (MIND).

Crosstab

			Activity 2 - Digital Skills			
			Boys	Girls	Boys and Girls	Total
Group	Control Group	Count	25	1	10	36
		Expected Count	19,4	6,5	10,2	36,0
		% within Group	69,4%	2,8%	27,8%	100,0%
	Experimental Group	Count	17	13	12	42
		Expected Count	22,6	7,5	11,8	42,0
		% within Group	40,5%	31,0%	28,6%	100,0%
Total		Count	42	14	22	78
		Expected Count	42,0	14,0	22,0	78,0
		% within Group	53,8%	17,9%	28,2%	100,0%

Table 6.

Output for the Chi-square test of independence to test if the answer is independent of group.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11,598[a]	2	,003
Likelihood Ratio	13,456	2	,001
Linear-by-Linear Association	2,246	1	,134
N of Valid Cases	78		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 6,46.

Table 7.

Percentages of answers to Activity 2 by group for Writing skills (MIND).

Group * Activity 2 - Writing Skills Crosstabulation

			Activity 2 - Writing Skills			
			Boys	Girls	Boys and Girls	Total
Group	Control Group	Count	0	21	15	36
		Expected Count	2,8	15,2	18,0	36,0
		% within Group	0,0%	58,3%	41,7%	100,0%
	Experimental Group	Count	6	12	24	42
		Expected Count	3,2	17,8	21,0	42,0
		% within Group	14,3%	28,6%	57,1%	100,0%
Total		Count	6	33	39	78
		Expected Count	6,0	33,0	39,0	78,0
		% within Group	7,7%	42,3%	50,0%	100,0%

Table 8.

Output for the Chi-square test of independence to test if the answer is independent of group.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10,130[a]	2	,006
Likelihood Ratio	12,437	2	,002
Linear-by-Linear Association	,007	1	,934
N of Valid Cases	78		

a. 2 cells (33,3%) have expected count less than 5. The minimum expected count is 2,77.

Activity 3

Table 9.

Percentages of answers to Activity 3 by gender for Technology (MIND).

Crosstab

			Activity 3 - Technology field			
			Boys	Girls	Boys and Girls	Total
Respondent gender	Boys	Count	24	7	13	44
		Expected Count	19,2	11,8	13,0	44,0
		% within Respondent gender	54,5%	15,9%	29,5%	100,0%
	Girls	Count	10	14	10	34
		Expected Count	14,8	9,2	10,0	34,0
		% within Respondent gender	29,4%	41,2%	29,4%	100,0%
Total		Count	34	21	23	78
		Expected Count	34,0	21,0	23,0	78,0
		% within Respondent gender	43,6%	26,9%	29,5%	100,0%

Table 10.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7,328[a]	2	,026
Likelihood Ratio	7,425	2	,024
Linear-by-Linear Association	1,665	1	,197
N of Valid Cases	78		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 9,15.

Table 11.

Percentages of answers to Activity 3 by gender for Engineering (MIND).

Crosstab

			Activity 3 - Engineering field			
			Boys	Girls	Boys and Girls	Total
Respondent gender	Boys	Count	30	3	11	44
		Expected Count	25,9	7,9	10,2	44,0
		% within Respondent gender	68,2%	6,8%	25,0%	100,0%
	Girls	Count	16	11	7	34
		Expected Count	20,1	6,1	7,8	34,0
		% within Respondent gender	47,1%	32,4%	20,6%	100,0%
Total		Count	46	14	18	78
		Expected Count	46,0	14,0	18,0	78,0
		% within Respondent gender	59,0%	17,9%	23,1%	100,0%

Table 12.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8,580[a]	2	,014
Likelihood Ratio	8,800	2	,012
Linear-by-Linear Association	,764	1	,382
N of Valid Cases	78		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 6,10.

Table 13.

Percentages of answers to Activity 3 by group for Mathematics (MIND).

Crosstab

			Activity 3 - Mathematics field			
			Boys	Girls	Boys and Girls	Total
Group	Control Group	Count	16	6	14	36
		Expected Count	12,5	11,1	12,5	36,0
		% within Group	44,4%	16,7%	38,9%	100,0%
	Experimental Group	Count	11	18	13	42
		Expected Count	14,5	12,9	14,5	42,0
		% within Group	26,2%	42,9%	31,0%	100,0%
Total		Count	27	24	27	78
		Expected Count	27,0	24,0	27,0	78,0
		% within Group	34,6%	30,8%	34,6%	100,0%

Table 14.

Output for the Chi-square test of independence to test if the answer is independent of group.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6,540[a]	2	,038
Likelihood Ratio	6,785	2	,034
Linear-by-Linear Association	,294	1	,588
N of Valid Cases	78		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 11,08.

Activity 4

Table 15.

Percentages of answers to Activity 4's "is for question" (Science) by gender (MIND).

Crosstab

			Activity 4 - Science is for...			
			Boys	Girls	Boys and Girls	Total
Respondent gender	Boys	Count	14	7	23	44
		Expected Count	10,7	11,8	21,4	44,0
		% within Respondent gender	31,8%	15,9%	52,3%	100,0%
	Girls	Count	5	14	15	34
		Expected Count	8,3	9,2	16,6	34,0
		% within Respondent gender	14,7%	41,2%	44,1%	100,0%
Total		Count	19	21	38	78
		Expected Count	19,0	21,0	38,0	78,0
		% within Respondent gender	24,4%	26,9%	48,7%	100,0%

Table 16.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7,116[a]	2	,029
Likelihood Ratio	7,229	2	,027
Linear-by-Linear Association	,226	1	,634
N of Valid Cases	78		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 8,28.

Table 17.

Percentages of answers to Activity 4's "is for question" (Engineering) by group (MIND).

Crosstab

			Activity 4 - Engineering is for...			
			Boys	Girls	Boys and Girls	Total
Group	Control Group	Count	18	2	16	36
		Expected Count	19,8	5,1	11,1	36,0
		% within Group	50,0%	5,6%	44,4%	100,0%
	Experimental Group	Count	25	9	8	42
		Expected Count	23,2	5,9	12,9	42,0
		% within Group	59,5%	21,4%	19,0%	100,0%
Total		Count	43	11	24	78
		Expected Count	43,0	11,0	24,0	78,0
		% within Group	55,1%	14,1%	30,8%	100,0%

Table 18.

Output for the Chi-square test of independence to test if the answer is independent of group.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7,846[a]	2	,020
Likelihood Ratio	8,219	2	,016
Linear-by-Linear Association	2,918	1	,088
N of Valid Cases	78		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 5,08.

Table 19.

Percentages of answers to Activity 4's "can be for question" (Technology) by group (MIND).

Crosstab

			Activity 4 - Technology can be for...			
			Boys	Girls	Boys and Girls	Total
Group	Control Group	Count	4	0	32	36
		Expected Count	6,0	3,7	26,3	36,0
		% within Group	11,1%	0,0%	88,9%	100,0%
	Experimental Group	Count	9	8	25	42
		Expected Count	7,0	4,3	30,7	42,0
		% within Group	21,4%	19,0%	59,5%	100,0%
Total		Count	13	8	57	78
		Expected Count	13,0	8,0	57,0	78,0
		% within Group	16,7%	10,3%	73,1%	100,0%

Table 20.

Output for the Chi-square test of independence to test if the answer is independent of group.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10,383[a]	2	,006
Likelihood Ratio	13,464	2	,001
Linear-by-Linear Association	5,202	1	,023
N of Valid Cases	78		

a. 2 cells (33,3%) have expected count less than 5. The minimum expected count is 3,69.

Table 21.

Percentages of answers to Activity 4's "can be for question" (Mechanics) by group (MIND).

Crosstab

			Activity 4 - Mechanics can be for...			
			Boys	Girls	Boys and Girls	Total
Group	Control Group	Count	20	1	15	36
		Expected Count	13,4	7,8	14,8	36,0
		% within Group	55,6%	2,8%	41,7%	100,0%
	Experimental Group	Count	9	16	17	42
		Expected Count	15,6	9,2	17,2	42,0
		% within Group	21,4%	38,1%	40,5%	100,0%
Total		Count	29	17	32	78
		Expected Count	29,0	17,0	32,0	78,0
		% within Group	37,2%	21,8%	41,0%	100,0%

Table 22.

Output for the Chi-square test of independence to test if the answer is independent of group.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17,173[a]	2	<,001
Likelihood Ratio	19,902	2	<,001
Linear-by-Linear Association	2,659	1	,103
N of Valid Cases	78		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 7,85.

Activity 6

Table 21.

Frequencies of answers given by boys and girls to Activity 6a.

Respondent gender * Activity 6 - In the future, I would like to have a profession in the field of ... Crosstabulation

Count

		Activity 6 - In the future, I would like to have a profession in the field of ...							
		Science	Technology	Engineering	Mathematics	Kindergarten Education	Mechanics	Other	Total
Respondent gender	Boys	6	7	3	4	1	2	21	44
	Girls	9	2	1	1	10	0	11	34
Total		15	9	4	5	11	2	32	78

Table 22.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17,675[a]	6	,007
Likelihood Ratio	19,732	6	,003
Linear-by-Linear Association	,588	1	,443
N of Valid Cases	78		

a. 8 cells (57,1%) have expected count less than 5. The minimum expected count is ,87.

Table 23.

Frequencies of answers given by boys and girls to Activity 6b.

Respondent gender * Activity 6 - In the future, I think I will be able to have a profession in the field of ... Crosstabulation

Count

		Activity 6 - In the future, I think I will be able to have a profession in the field of ...							
		Science	Technology	Engineering	Mathematics	Kindergarten Education	Mechanics	Other	Total
Respondent gender	Boys	6	10	4	6	0	3	15	44
	Girls	8	1	1	2	11	0	11	34
Total		14	11	5	8	11	3	26	78

Table 24.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	25,197[a]	6	<,001
Likelihood Ratio	31,595	6	<,001
Linear-by-Linear Association	,305	1	,581
N of Valid Cases	78		

a. 8 cells (57,1%) have expected count less than 5. The minimum expected count is 1,31.

Table 25.

Frequencies of answers given by boys and girls to Activity 6c.

Respondent gender * Activity 6 - In the future, my parents think I might have a profession in the field of ... Crosstabulation

Count

		Activity 6 - In the future, my parents think I might have a profession in the field of ...							
		Science	Technology	Engineering	Mathematics	Kindergarten Education	Mechanics	Other	Total
Respondent gender	Boys	9	4	3	3	1	5	19	44
	Girls	8	1	0	3	8	0	14	34
Total		17	5	3	6	9	5	33	78

Table 26.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	15,026[a]	6	,020
Likelihood Ratio	18,749	6	,005
Linear-by-Linear Association	,002	1	,966
N of Valid Cases	78		

a. 9 cells (64,3%) have expected count less than 5. The minimum expected count is 1,31.

Appendix I – CESIE (Italy)

Activity 1

Table 1.

Percentages of answers to Activity 1 by gender for Science (CESIE).

Crosstab

			Activity 1 - Science field			
			Blue	Pink	Purple	Total
Group	Control Group	Count	14	13	14	41
		Expected Count	10,3	11,3	19,4	41,0
		% within Group	34,1%	31,7%	34,1%	100,0%
	Experimental Group	Count	5	8	22	35
		Expected Count	8,8	9,7	16,6	35,0
		% within Group	14,3%	22,9%	62,9%	100,0%
Total		Count	19	21	36	76
		Expected Count	19,0	21,0	36,0	76,0
		% within Group	25,0%	27,6%	47,4%	100,0%

Table 2.

Output for the Chi-square test of independence to test if colour is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6,800[a]	2	,033
Likelihood Ratio	6,959	2	,031
Linear-by-Linear Association	6,525	1	,011
N of Valid Cases	76		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 8,75.

Activity 2

Table 3.

Percentages of answers to Activity 2 by gender for Digital skills (CESIE).

Crosstab

			Activity 2 - Digital Skills			
			Boys	Girls	Boys and Girls	Total
Respondent gender	Boys	Count	19	5	10	34
		Expected Count	17,0	2,7	14,3	34,0
		% within Respondent gender	55,9%	14,7%	29,4%	100,0%
	Girls	Count	19	1	22	42
		Expected Count	21,0	3,3	17,7	42,0
		% within Respondent gender	45,2%	2,4%	52,4%	100,0%
Total		Count	38	6	32	76
		Expected Count	38,0	6,0	32,0	76,0
		% within Respondent gender	50,0%	7,9%	42,1%	100,0%

Table 4.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6,395[a]	2	,041
Likelihood Ratio	6,679	2	,035
Linear-by-Linear Association	2,290	1	,130
N of Valid Cases	76		

a. 2 cells (33,3%) have expected count less than 5. The minimum expected count is 2,68.

Activity 3

Table 5.

Percentages of answers to Activity 3 by group for Science (CESIE).

Crosstab

			Activity 3 - Science field			
			Boys	Girls	Boys and Girls	Total
Group	Control Group	Count	14	13	14	41
		Expected Count	10,3	10,8	20,0	41,0
		% within Group	34,1%	31,7%	34,1%	100,0%
	Experimental Group	Count	5	7	23	35
		Expected Count	8,8	9,2	17,0	35,0
		% within Group	14,3%	20,0%	65,7%	100,0%
Total		Count	19	20	37	76
		Expected Count	19,0	20,0	37,0	76,0
		% within Group	25,0%	26,3%	48,7%	100,0%

Table 6.

Output for the Chi-square test of independence to test if the answer is independent of group.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7,827[a]	2	,020
Likelihood Ratio	8,004	2	,018
Linear-by-Linear Association	7,240	1	,007
N of Valid Cases	76		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 8,75.

Appendix J – U. Porto (Portugal)

Activity 2

Table 1.

Percentages of answers to Activity 2 by gender for Leadership skills (U. Porto).

Crosstab

			Activity 2 - Leadership Skills			
			Boys	Girls	Boys and Girls	Total
Respondent gender	Boys	Count	28	2	18	48
		Expected Count	22,6	4,6	20,8	48,0
		% within Respondent gender	58,3%	4,2%	37,5%	100,0%
	Girls	Count	11	6	18	35
		Expected Count	16,4	3,4	15,2	35,0
		% within Respondent gender	31,4%	17,1%	51,4%	100,0%
Total		Count	39	8	36	83
		Expected Count	39,0	8,0	36,0	83,0
		% within Respondent gender	47,0%	9,6%	43,4%	100,0%

Table 2.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7,560[a]	2	,023
Likelihood Ratio	7,713	2	,021
Linear-by-Linear Association	3,695	1	,055
N of Valid Cases	83		

a. 2 cells (33,3%) have expected count less than 5. The minimum expected count is 3,37.

Activity 5

Table 3.

Percentages of answers to Activity 5 (Science) by gender (U. Porto).

Crosstab

			Activity 5 - Interest in Science			Total
			Yes	No	I don't know	
Respondent gender	Boys	Count	23	16	9	48
		Expected Count	28,3	11,0	8,7	48,0
		% within Respondent gender	47,9%	33,3%	18,8%	100,0%
	Girls	Count	26	3	6	35
		Expected Count	20,7	8,0	6,3	35,0
		% within Respondent gender	74,3%	8,6%	17,1%	100,0%
Total		Count	49	19	15	83
		Expected Count	49,0	19,0	15,0	83,0
		% within Respondent gender	59,0%	22,9%	18,1%	100,0%

Table 4.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7,834[a]	2	,020
Likelihood Ratio	8,509	2	,014
Linear-by-Linear Association	2,594	1	,107
N of Valid Cases	83		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 6,33.

Table 5.

Percentages of answers to Activity 5 (Mathematics) by gender (U. Porto).

Crosstab

			Activity 5 - Interest in Mathematics			
			Yes	No	I don't know	Total
Group	Control Group	Count	17	18	8	43
		Expected Count	22,0	12,8	8,2	43,0
		% within Group	39,5%	41,9%	18,6%	100,0%
	Experimental Group	Count	26	7	8	41
		Expected Count	21,0	12,2	7,8	41,0
		% within Group	63,4%	17,1%	19,5%	100,0%
Total		Count	43	25	16	84
		Expected Count	43,0	25,0	16,0	84,0
		% within Group	51,2%	29,8%	19,0%	100,0%

Table 6.

Output for the Chi-square test of independence to test if the answer is independent of group.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6,680[a]	2	,035
Likelihood Ratio	6,860	2	,032
Linear-by-Linear Association	1,827	1	,176
N of Valid Cases	84		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 7,81.

Activity 6

Table 7.

Frequencies of answers given by boys and girls to Activity 6b (U. Porto).

Respondent gender * Activity 6 - In the future, I think I will be able to have a profession in the field of ... Crosstabulation

			Activity 6 - In the future, I think I will be able to have a profession in the field of ...							
			Science	Technology	Engineering	Mathematics	Kindergarten Education	Mechanics	Other	Total
Respondent gender	Boys	Count	2	8	5	3	0	1	29	48
		% within Respondent gender	4,2%	16,7%	10,4%	6,3%	0,0%	2,1%	60,4%	100,0%
	Girls	Count	2	4	0	0	8	0	21	35
		% within Respondent gender	5,7%	11,4%	0,0%	0,0%	22,9%	0,0%	60,0%	100,0%
Total		Count	4	12	5	3	8	1	50	83
		% within Respondent gender	4,8%	14,5%	6,0%	3,6%	9,6%	1,2%	60,2%	100,0%

Table 8.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	18,019[a]	6	,006
Likelihood Ratio	24,167	6	<,001
Linear-by-Linear Association	,495	1	,482
N of Valid Cases	83		

a. 10 cells (71,4%) have expected count less than 5. The minimum expected count is ,42.

Appendix K – GoINNO (Slovenia)

Activity 1

Table 1.

Percentages of answers to Activity 1 by gender for Technology (GoINNO).

Crosstab

			Activity 1 - Technology field			
			Blue	Pink	Purple	Total
Respondent gender	Boys	Count	19	11	6	36
		Expected Count	15,0	8,3	12,7	36,0
		% within Respondent gender	52,8%	30,6%	16,7%	100,0%
	Girls	Count	8	4	17	29
		Expected Count	12,0	6,7	10,3	29,0
		% within Respondent gender	27,6%	13,8%	58,6%	100,0%
Total		Count	27	15	23	65
		Expected Count	27,0	15,0	23,0	65,0
		% within Respondent gender	41,5%	23,1%	35,4%	100,0%

Table 2.

Output for the Chi-square test of independence when test if colour is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12,399[a]	2	,002
Likelihood Ratio	12,739	2	,002
Linear-by-Linear Association	9,315	1	,002
N of Valid Cases	65		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 6,69.

Table 3.

Percentages of answers to Activity 1 by group for Science (GoINNO).

Crosstab

			Activity 1 - Science field			
			Blue	Pink	Purple	Total
Group	Control Group	Count	32	4	3	39
		Expected Count	27,2	6,5	5,3	39,0
		% within Group	82,1%	10,3%	7,7%	100,0%
	Experimental Group	Count	14	7	6	27
		Expected Count	18,8	4,5	3,7	27,0
		% within Group	51,9%	25,9%	22,2%	100,0%
Total		Count	46	11	9	66
		Expected Count	46,0	11,0	9,0	66,0
		% within Group	69,7%	16,7%	13,6%	100,0%

Table 4.

Output for the Chi-square test of independence when test if colour is independent of group.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6,908[a]	2	,032
Likelihood Ratio	6,889	2	,032
Linear-by-Linear Association	6,057	1	,014
N of Valid Cases	66		

a. 2 cells (33,3%) have expected count less than 5. The minimum expected count is 3,68.

Activity 2

Table 5.

Percentages of answers to Activity 2 by gender for Mathematical skills (GoINNO).

Crosstab

			Activity 2 - Mathematical Skills			
			Boys	Girls	Boys and Girls	Total
Respondent gender	Boys	Count	8	2	26	36
		Expected Count	5,1	4,0	26,9	36,0
		% within Respondent gender	22,2%	5,6%	72,2%	100,0%
	Girls	Count	1	5	21	27
		Expected Count	3,9	3,0	20,1	27,0
		% within Respondent gender	3,7%	18,5%	77,8%	100,0%
Total		Count	9	7	47	63
		Expected Count	9,0	7,0	47,0	63,0
		% within Respondent gender	14,3%	11,1%	74,6%	100,0%

Table 6.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6,101[a]	2	,047
Likelihood Ratio	6,769	2	,034
Linear-by-Linear Association	1,676	1	,195
N of Valid Cases	63		

a. 3 cells (50,0%) have expected count less than 5. The minimum expected count is 3,00.

Activity 3

Table 7.

Percentages of answers to Activity 3 by gender for Science (GoINNO).

Crosstab

			Activity 3 - Science field			
			Boys	Girls	Boys and Girls	Total
Respondent gender	Boys	Count	28	5	2	35
		Expected Count	21,9	8,2	4,9	35,0
		% within Respondent gender	80,0%	14,3%	5,7%	100,0%
	Girls	Count	12	10	7	29
		Expected Count	18,1	6,8	4,1	29,0
		% within Respondent gender	41,4%	34,5%	24,1%	100,0%
Total		Count	40	15	9	64
		Expected Count	40,0	15,0	9,0	64,0
		% within Respondent gender	62,5%	23,4%	14,1%	100,0%

Table 8.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10,373[a]	2	,006
Likelihood Ratio	10,660	2	,005
Linear-by-Linear Association	9,567	1	,002
N of Valid Cases	64		

a. 2 cells (33,3%) have expected count less than 5. The minimum expected count is 4,08.

Table 9.

Percentages of answers to Activity 3 by gender for Technology (GoINNO).

Crosstab

			Activity 3 - Technology field			
			Boys	Girls	Boys and Girls	Total
Respondent gender	Boys	Count	23	6	6	35
		Expected Count	18,0	8,8	8,2	35,0
		% within Respondent gender	65,7%	17,1%	17,1%	100,0%
	Girls	Count	10	10	9	29
		Expected Count	15,0	7,3	6,8	29,0
		% within Respondent gender	34,5%	34,5%	31,0%	100,0%
Total		Count	33	16	15	64
		Expected Count	33,0	16,0	15,0	64,0
		% within Respondent gender	51,6%	25,0%	23,4%	100,0%

Table 10.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6,213[a]	2	,045
Likelihood Ratio	6,314	2	,043
Linear-by-Linear Association	4,738	1	,030
N of Valid Cases	64		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 6,80.

Activity 4

Table 11.

Percentages of answers to Activity 4's "is for question" (Science) by gender (GoINNO).

Crosstab

			Activity 4 - Science is for... Boys	Girls	Boys and Girls	Total
Respondent gender	Boys	Count	17	1	18	36
		Expected Count	12,4	2,3	21,4	36,0
		% within Respondent gender	47,2%	2,8%	50,0%	100,0%
	Girls	Count	5	3	20	28
		Expected Count	9,6	1,8	16,6	28,0
		% within Respondent gender	17,9%	10,7%	71,4%	100,0%
Total		Count	22	4	38	64
		Expected Count	22,0	4,0	38,0	64,0
		% within Respondent gender	34,4%	6,3%	59,4%	100,0%

Table 12.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6,756[a]	2	,034
Likelihood Ratio	7,065	2	,029
Linear-by-Linear Association	4,571	1	,033
N of Valid Cases	64		

a. 2 cells (33,3%) have expected count less than 5. The minimum expected count is 1,75.

Table 13.

Percentages of answers to Activity 4's "is for question" (Mathematics) by gender (GoINNO).

Crosstab

			Activity 4 - Mathematics is for...			
			Boys	Girls	Boys and Girls	Total
Respondent gender	Boys	Count	14	3	16	33
		Expected Count	8,1	3,8	21,1	33,0
		% within Respondent gender	42,4%	9,1%	48,5%	100,0%
	Girls	Count	1	4	23	28
		Expected Count	6,9	3,2	17,9	28,0
		% within Respondent gender	3,6%	14,3%	82,1%	100,0%
Total		Count	15	7	39	61
		Expected Count	15,0	7,0	39,0	61,0
		% within Respondent gender	24,6%	11,5%	63,9%	100,0%

Table 14.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12,339[a]	2	,002
Likelihood Ratio	14,443	2	<,001
Linear-by-Linear Association	10,725	1	,001
N of Valid Cases	61		

a. 2 cells (33,3%) have expected count less than 5. The minimum expected count is 3,21.

Activity 5

Table 15.

Percentages of answers to Activity 5 (Engineering) by gender (GoINNO).

Crosstab

			Activity 5 - Interest in Engineering			Total
			Yes	No	I don't know	
Respondent gender	Boys	Count	22	9	3	34
		Expected Count	15,9	12,1	6,0	34,0
		% within Respondent gender	64,7%	26,5%	8,8%	100,0%
	Girls	Count	7	13	8	28
		Expected Count	13,1	9,9	5,0	28,0
		% within Respondent gender	25,0%	46,4%	28,6%	100,0%
Total		Count	29	22	11	62
		Expected Count	29,0	22,0	11,0	62,0
		% within Respondent gender	46,8%	35,5%	17,7%	100,0%

Table 16.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10,274[a]	2	,006
Likelihood Ratio	10,656	2	,005
Linear-by-Linear Association	9,521	1	,002
N of Valid Cases	62		

a. 1 cells (16,7%) have expected count less than 5. The minimum expected count is 4,97.

Activity 6

Table 17.

Frequencies of answers given by boys and girls to Activity 6b.

Respondent gender * Activity 6 - In the future, I think I will be able to have a profession in the field of ... Crosstabulation

			Activity 6 - In the future, I think I will be able to have a profession in the field of ...						
			Science	Engineering	Mathematics	Kindergarten Education	Mechanics	Other	Total
Respondent gender	Boys	Count	7	6	2	1	2	18	36
		% within Respondent gender	19,4%	16,7%	5,6%	2,8%	5,6%	50,0%	100,0%
	Girls	Count	4	0	2	8	0	12	26
		% within Respondent gender	15,4%	0,0%	7,7%	30,8%	0,0%	46,2%	100,0%
Total		Count	11	6	4	9	2	30	62
		% within Respondent gender	17,7%	9,7%	6,5%	14,5%	3,2%	48,4%	100,0%

Table 18.

Output for the Chi-square test of independence to test if the answer is independent of gender.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14,220[a]	5	,014
Likelihood Ratio	17,705	5	,003
Linear-by-Linear Association	,330	1	,566
N of Valid Cases	62		

a. 8 cells (66,7%) have expected count less than 5. The minimum expected count is ,84.

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