Case Studies Report

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General Introduction

Work Package 2 (WP2) – STEAM promotion for girls: Methodological Framework for EU-countries represents a crucial hub of the EITIC_EU project. The ambition driving it is clear: to reduce the gender gap in scientific and technological disciplines, encouraging girls aged 10 to 16 to pursue educational and professional paths in the STEAM field. This objective is part of a broader framework defined by the project's general goals. The first of these (OG1) concerns promoting girls' access to university STEM careers, by building confidence, providing inspiration through concrete experiences, and overcoming the belief that science is an exclusive territory for males. The second general objective (OG2) is the valorization of role models and success stories of women who, thanks to innovation and entrepreneurship, have found in technology a tool for empowerment and social and professional inclusion. Finally, OG4 focuses on changing the dominant discourse: dismantling the stereotype that "STEM is not for girls," replacing it with positive and inclusive messages capable of drawing girls and adolescents closer to these disciplines.

Alongside these general objectives is a specific project goal: the creation of a methodological guide for alternative pedagogy, intended for teachers and education professionals. This guide must be based on an analysis of local needs, an understanding of the cultural and social context of girls, and the identification of innovative practices to promote access to STEM. This is the framework for the two sub-objectives of WP2: to investigate innovative methods already tested in the various partner countries (OE2.1) and to offer guidelines and concrete tools for teachers working with girls aged 10 to 16 (OE2.2).

To achieve these goals, a qualitative approach was chosen based on the collection of national case studies, developed by each consortium partner. Each case is based on a body of interviews with teachers and female role models. The questions explored various aspects: the interest and motivation of female students, cultural and family stereotypes, teaching practices considered effective, difficulties encountered in the classroom, the role of families, social influences, and the perception of possible future paths. The responses were recorded and organized in sheets called Interview data, where each row represents an individual contribution, enriched with notes and key insights that summarize the key points that emerged. In parallel, the Interview tracker sheets documented the entire process: participant codes, completion dates, and interview progress status. In this way, the project ensured transparency, systematicity, and verifiability.

The methodological value of WP2 does not lie solely in the collection of opinions, but in the ability to transform qualitative data into operational recommendations. Each response was read not only as an individual testimony but as a signal of a collective need or a transferable good practice. In this sense, the case studies are not just simple stories, but pieces of a larger mosaic, which allows for glimpsing convergences and differences between countries, identifying common patterns, and recognizing local specificities.

The comparative logic is, in fact, the distinctive feature of this work. In Italy, through the experience of Scuola di Robotica, the role of hands-on, co-teaching, and educational robotics as a lever for inclusion strongly emerges. In Romania, the case of Colegiul Tehnic "Edmond Nicolau" highlights the fear of mathematics and the importance of consistency between school and family messages. In Spain, Fundación Cibervoluntarios documents the effectiveness of gamification, digital projects, and challenges, but also the constraints related to resource scarcity. In Greece, YMITTOU EDUQUEST shows the still-living weight of cultural and religious stereotypes, but also stories of resilience and determination. Finally, G4G collects a set of international testimonies that confirm the value of role models, the need for continuous mentoring, and the effectiveness of active methodologies.

This set of materials constitutes a broad and comparable empirical basis, which will be translated into a European methodological guide for promoting STEM among girls. The link to the expected results of WP2 is direct: the report on good practices (RE2.1) and the methodological guide (RE2.2) draw sustenance from the data collected here, from the voices of teachers and role models, from the difficulties encountered and the solutions tested. Published on platforms such as the European School Education Platform and EPALE, these products will serve to disseminate the evidence collected and make the most effective experiences replicable.

The general introduction to Chapter 4 therefore has a dual function: on one hand, to contextualize the case studies as an integral part of WP2; on the other, to make it clear that every quote, every insight, and every proposal reported in the following chapters stems directly from the research documents, without external additions. This ensures the methodological coherence and scientific soundness of the work, laying the foundation for the creation of a shared pedagogical model at a European level.

Chapter 1.1 – Scuola di Robotica (Italy)

Introduction

The Italian case study was developed by Scuola di Robotica (SdR), the leading partner of Work Package 2, based on interviews collected with primary and secondary school teachers. The information comes exclusively from the Interview data and Interview tracker sheets of the dedicated file.

The Interview tracker sheet ensures transparency in the process by reporting participant codes, dates, and interview progress status. The Interview data sheet, on the other hand, contains the core content: questions, answers, and especially "Key Insights/Notes," which are operational summaries reflecting the teachers' opinions.

Phrases like "School-family consistency crucial to STEAM interest," "Hands-on increases student attention," and "Compresences vital for effective laboratories" summarize the main points developed in this chapter: the role of the family, the centrality of the hands-on method, the need for adequate human resources, the scarcity of female role models, and the effectiveness of multimedia and blended projects.

The Impact of Educational Robotics

All interviewed teachers agree: the introduction of educational robotics has had a transformative impact. As early as 2016–2017, when coding and robotics began to systematically enter curricula, a tangible reduction in the gender gap was observed.
A note from the dataset summarizes it this way: "Robotics reduces concretely the gender gap in classes." In other words, the presence of girls in scientific activities increased, and with it, their confidence in their own abilities.

Laboratory activities made previously invisible skills visible. Some female students, described as quiet and passive during frontal lessons, emerged as leaders in work groups. They coordinated peers, organized time, and documented progress. This confirms that robotics is not just a technical tool, but also a context in which girls can develop organizational and leadership skills.

Teachers clearly distinguish between curricular and extracurricular robotics. When robotics was offered as an optional club, often with a fee, female participation remained low. When it was included in official programs, however, girls participated consistently. A summary from the dataset clearly states: "If robotics is part of the curriculum, girls feel it belongs to them too; if it is an optional club, participation drops."

The Role of Primary School and the Critical Threshold of 13

Up to age 13, no substantial differences emerge between boys and girls. A note from the dataset highlights this: “Up to 13, motivation is equal.” In primary and lower secondary school, female students participate with curiosity, ask questions, and stand out for creativity and precision.

The problem emerges during orientation toward upper secondary school. This is where social and family pressures come into play. One teacher stated: “Family pressure at the moment of choice can nullify school effort.” In other words, the school's effort can be nullified if prejudices or lack of support prevail at home.

Many teachers recounted similar episodes: motivated girls, enthusiastic about robotics, who at the moment of choice preferred more “traditional” paths because they were not encouraged at home. This dynamic represents a true critical threshold: while the school maintains balance up to age 13, at the time of future choices, the voice of the family becomes decisive.

Family and Cultural Stereotypes

The dataset strongly highlights the importance of the family context. “School-family consistency crucial to STEAM interest” summarizes this concept well. If the school encourages but the family discourages, girls' motivation tends to fade.

Many teachers reported episodes of female students being called "tomboys" for their passion for technology. This language, often used superficially, sends a clear message: science is not a space for women.

School books also reinforce stereotypes. A note from the dataset states: “New female but hyper-feminized representations.” The few female figures represented in textbooks are described as extraordinary exceptions or in hyper-feminized forms. This produces two opposite but equally harmful effects: on one hand, the denigration of girls interested in STEM, on the other, the creation of glamorous and unattainable models, far from the real lives of female students.

Human Resources and School Infrastructure

Teachers clearly described the difficulty of managing robotics labs with large classes and only one teacher. A note states: “Insufficient human resources for hands-on teaching.”
Many spoke of the need for “vital co-presences”: two adults in the classroom, with differentiated roles, allow for better group management, quick resolution of technical problems, and individual support for girls who need it most.

Infrastructures are often lacking. Another note reads: "School infrastructure often inadequate." Small labs, outdated computers, insufficient kits: these conditions limit the impact of activities and create inequalities between schools. Some teachers stated they used personal tools to compensate for the shortcomings, a sign of strong individual commitment but also systemic precariousness.

Effective Methodologies: Hands-on, Multimedia, and Blended

The hands-on method is one of the cornerstones of the SdR case study. Several notes reiterate this: "Hands-on increases student attention," "Hands-on approaches and targeted investments increase attention."

Teachers observed that after 15 minutes of frontal lessons, attention wanes, while during practical activities, students remain focused for up to two hours. An episode reported in the dataset tells of a shy girl who became a group leader during a lab.

Alongside the practical method, some teachers experimented with multimedia projects. A note describes them as: "Multimedia projects make STEAM skills visible." Podcasts and videos made girls' work visible to their families, increasing their self-esteem and strengthening social recognition.

Finally, blended courses had a positive role. A note states: "Blended extracurricular courses foster motivation." The combination of online and in-person activities motivated particularly interested students, although the limitation of non-universal accessibility remains.

Female Role Models

The dataset strongly insists on the issue of female models. Two notes clearly highlight this: "Authentic role models reinforce STEAM ambitions" and "Scarcity of role models at crucial stages of choice."

The meeting with Samantha Cristoforetti, cited by multiple teachers, showed how powerful a role model can be: girls felt that a woman can hold very high-level roles. However, media coverage reduced the educational effectiveness by focusing on irrelevant details.

Teachers insist on the need for authentic and local role models. Girls need everyday examples, women from their area who tell realistic experiences. The lack of reference figures at crucial moments of school and university choice is an evident barrier that must be addressed.

Internal Resistance and Organizational Challenges

The dataset also points out the presence of internal resistance. A note states: "Internal resistance to innovative methodologies." Some teachers fear that labs waste time compared to the curriculum. Others feel technically unprepared. These resistances risk slowing down innovation. Teachers suggest practical solutions: starting small pilots, providing targeted training, fostering exchange among colleagues, and recognizing planning time as an integral part of a teacher's work.

Operational Recommendations

The recommendations that emerged from the interviews are precise and concrete:

- Narrative robotics labs – integrate storytelling and technical construction, making girls the protagonists.
- Co-teaching – ensure the presence of two adults in the lab, with clear roles of support and facilitation.
- Bank of local female stories – collect testimonials from local female professionals who are relatable and credible.
- Visibility spaces – give public prominence to projects created by girls, both physically and online.
- Multimedia projects – use podcasts and videos to give a voice to students and show their skills.
- Blended courses – integrate online activities and post-lab reflections to increase motivation.

Monitoring Indicators

Teachers proposed several indicators to measure the impact of the actions:

- Number of labs activated.
- Hours of co-teaching effectively guaranteed.
- Number of role models girls have met.
- Multimedia products created and disseminated.
- Percentage of girls who have taken on leadership roles.
- Satisfaction of students, families, and teachers, collected through questionnaires and feedback.

Conclusions

The Italian case study, developed by Scuola di Robotica, highlights three main axes:

- Hands-on as the preferred method to maintain attention and value girls' skills.
- Co-teaching as an indispensable tool for making labs inclusive and managing large classes.
- Authentic and local role models as levers to guide school and career choices.

Alongside these, the dataset points to the need to address cultural stereotypes, resource shortages, and internal resistance. The evidence collected provides a solid basis for building the WP2 methodological guide, transforming Italian experiences into recommendations applicable at a European level.

Chapter 1.2 – CTEN (Romania)

Introduction

The case study of Colegiul Tehnic "Edmond Nicolau" (CTEN) is based on a cross-analysis of teacher interviews and the testimony of a female role model, as documented in the Interview data teachers, Interview data Role Model, and Interview tracker sheets. The goal is to provide a narrative and well-argued account of what emerges from the materials: female students' genuine interest in scientific subjects, the fragility of their confidence in mathematics, the joint role of school and family, the impact of exposure to professionals/role models, and the material barriers that interfere with the regularity of practical activities. All statements reported here are derived from the CTEN data and are accompanied by specific citations to the original worksheets. [CTEN – Interview data teachers, Key Insights; CTEN – Interview data Role Model, Participant Response; CTEN – Interview tracker].

Girls' Interest in STEM

Teachers describe a concrete and early interest of female students in mathematics, computer science, and applied activities, an interest that manifests strongly when lessons take a practical form and when learning is tied to real-world tasks. In lab settings, girls show precision, attention to detail, and the ability to coordinate small work phases—qualities that become visible precisely during the execution of experimental or programming activities. Participation increases where it is possible to "see" the meaning of concepts and link them to tangible results, while it declines when the proposal remains abstract. This dynamic is repeatedly noted in the teachers' Key Insights and confirmed in their Participant Responses. [CTEN – Interview data teachers, Key Insights; CTEN – Interview data teachers, Participant Response]

Some accounts emphasize the gap between behavior in a frontal lesson and behavior in a lab: initially quiet female students become active and speak up when they can manipulate materials or structure procedures, even leading the group through critical steps. At multiple points, the summary notes report that the increase in involvement is linked to the hands-on nature of the proposals, to "tasks with a practical component," and to a framing of error as a natural part of the process. [CTEN – Interview data teachers, Key Insights ("practical component", hands-on); CTEN – Interview data teachers, Participant Response].

Fear of Mathematics

Almost all interviews converge on one issue: the fear of mathematics. This is a perceived rather than a real fear—the ability is there, but it is obscured by the belief that the subject is "too difficult" or "not for them." Teachers note a reluctance to speak in public, especially during board exercises and oral assessments, with a tendency to stay silent to avoid making a mistake. The Key Insights explicitly cite barriers such as "fear of mathematics" and indicate that this fear diminishes when error is normalized and discussed as a useful step, not as a failure. [CTEN – Interview data teachers, Key Insights ("fear of mathematics"; error normalization)].

In multiple teacher responses, the observation recurs that the perception of mathematics as a "male" domain acts as a self-fulfilling prophecy: "Mathematics is seen as something for boys." Girls internalize the stereotype and self-limit, despite having comparable results to their male peers. It is in this context that the classroom management style becomes decisive: where feedback values the process and effort, anxiety is reduced and participation increases; where a punitive culture of error prevails, participation shrinks. [CTEN – Interview data teachers, Participant Response; CTEN – Interview data teachers, Key Insights].

The Role of Family and School

Teachers highlight the need for consistency between school and family. At multiple points, notes and responses emphasize that school encouragement can be nullified by contrary family messages; conversely, when the family supports a technical choice, girls persist and grow in confidence. The Key Insights insist on the importance of a school-home alignment to keep interest alive and transform it into consistent educational decisions [CTEN – Interview data teachers, Key Insights ("school–family coherence"); CTEN – Interview data teachers, Participant Response].

The examples narrated by teachers, with phrases like "they give up if at home they hear that engineering is not for girls," immediately convey the impact of the home environment on career choices. At the same time, the same sheets show opposite descriptions: the satisfaction of families who see their daughters succeed in technical activities, with a positive reinforcement effect ("parents notice when their daughters are proud") [CTEN – Interview data teachers, Participant Response].

Material and Infrastructural Barriers

Alongside cultural factors, teachers report material barriers: insufficient kits and equipment, not always adequate labs, and the need to share resources among multiple classes. The phrases are recurring: "We do not have enough kits," "sometimes we must share them between classes." Added to this is improvisation ("we improvise with what we have") as a solution of necessity, which, while demonstrating dedication, also confirms the difficulty of maintaining regularity and quality in hands-on experiences [CTEN – Interview data teachers, Participant Response; CTEN – Interview data teachers, Key Insights].

The notes directly link material availability and female student involvement: where kits circulate with clear protocols and sensible rotations, the probability of proposing frequent practical activities increases; where tools or spaces are lacking, experiences become rare and interest weakens. These aspects emerge in the operational tracking reported by the tracker, which documents the times and phases of data collection, confirming the systematic nature of the investigation [CTEN – Interview data teachers, Key Insights; CTEN – Interview tracker].

The Importance of Role Models and External Professionals

All voices converge on the value of direct exposure to female and male STEM professionals. Teachers observe that meeting real figures produces a perceptual shift: "When girls meet real engineers, they realize this is possible also for them." The role model confirms that teachers and professionals who believed in her abilities were decisive for her, insisting on the difference between a single event and continuous mentoring: "One meeting inspires you, but continuous mentoring builds your path." [CTEN – Interview data teachers, Participant Response; CTEN – Interview data Role Model, Participant Response].

The Key Insights repeatedly mention the idea that the effectiveness of exposure increases with continuity: repeated cycles of meetings with the same person allow for building familiarity, asking progressive questions, and obtaining increasingly targeted advice. This repetition transforms inspiration into guidance and makes the transition from interest to choice of major credible [CTEN – Interview data Role Model, Key Insights; CTEN – Interview data teachers, Key Insights].

Effective Practices Observed

The CTEN corpus documents practices that have already worked in the classroom. Applied math and computer science activities linked to real problems reduce the perception of distance ("when mathematics is linked to real life, students – especially girls – understand its value"), while competitions and events offer recognition and motivation ("competitions create enthusiasm and recognition") [CTEN – Interview data teachers, Participant Response; CTEN – Interview data teachers, Key Insights].

The shared management of kits, with borrowing and maintenance rules, emerges as an organizational strategy capable of extending access to hands-on experiences even under conditions of scarcity ("If we organize a protocol for sharing kits, more classes can benefit"). The combination of these practices does not eliminate structural obstacles but shifts the balance towards more inclusive contexts, making situations where female students feel like protagonists more frequent [CTEN – Interview data teachers, Participant Response; CTEN – Interview data teachers, Key Insights].

Methodological Recommendations

The recommendations derived from the interviews are consistent with what has been observed. Teachers suggest short, applied math modules, designed to “dismantle” anxiety and accumulate small, close-together successes; they suggest regular cycles of meetings with the same professionals, to build trust and not lose the effect of inspiration; they indicate the need to formalize the circulation of kits at the institutional level (inventory, rotations, usage rules), to ensure continuity of practical experiences; finally, they report the usefulness of internal mini-competitions as a device for rhythm, visibility, and pride. All these elements are mentioned in the Key Insights and are reiterated in the teachers’ narrative responses [CTEN – Interview data teachers, Key Insights; CTEN – Interview data teachers, Participant Response].

Monitoring Indicators

Evaluation, according to the CTEN materials, must capture how often the practices occur and how female students’ behaviors change. In terms of frequency, teachers suggest observing the number of practical activities actually carried out, the regularity of meetings with professionals/mentors, the extent of shared kit usage, and girls’ participation in visible roles (presentations, coordination of micro-phases) [CTEN – Interview data teachers, Key Insights; CTEN – Interview tracker].

On a qualitative level, the interviews insist on signs of confidence: more questions asked in public, greater willingness to accept and discuss error, and family stories that record pride and satisfaction for the activities performed (“Parents notice when their daughters are proud of what they do”). The idea that change is captured first in attitudes and then in grades is a constant in the Key Insights and Participant Responses [CTEN – Interview data teachers, Participant Response; CTEN – Interview data teachers, Key Insights].

Conclusions

The CTEN case study outlines a clear perimeter: girls have interest and potential, but they face three main challenges—the fear of mathematics (of a perceptual and cultural nature), the lack of resources (kits/labs), and the discontinuity of exposure to role models. The solutions suggested by teachers and confirmed by the role model focus on what the data indicates as effective levers for change: applied teaching, continuous mentoring, and resource organization to multiply hands-on experiences. The school-family alignment is the cross-cutting element that determines long-term persistence: without consistent messages, initial interest risks fading; with consistent messages, interest matures into a choice.

Chapter 1.3 – Fundación Cibervoluntarios (Spain)

Introduction: A Context of Innovation with Limited Resources

Interviews conducted at Fundación Cibervoluntarios reveal a contradictory landscape: on one hand, there is a strong desire to experiment with innovative practices—gamification, applied projects, social and communicative activities; on the other, structural constraints emerge related to the scarcity of resources and the limited time allocated to STEM disciplines in the curriculum. As one teacher synthesizes: “Gamification, practical projects, integrating real-world applications, but we lack resources and attention” [CIB – Interview data Teacher, Participant Response].

This initial finding already provides two coordinates: a focus on creative teaching as a lever for engagement and the need to transform such experiences from isolated events into consolidated routines. The interview tracker notes the variety of profiles involved (mathematics and technology teachers, a STEM role model), ensuring the validity of the emerging framework [CIB – Interview tracker].

Innovative Teaching: Gamification and Creativity as Access Levers

A first core of responses insists on the effectiveness of playful and creative practices. Cited activities include “gamified quizzes, robotics projects, competitions” [CIB – Interview data Teacher, Participant Response] and the use of social media as a vehicle for representation: “Projects like Instagram profiles of female scientists, debates, challenge days” [CIB – Interview data Teacher, Participant Response].

Teachers observe that when girls can use familiar languages—games, digital platforms, group activities—motivation grows and participation becomes more spontaneous. The Key Insights confirm that attention to detail, precision, and collaboration emerge strongly in these practical contexts, while remaining hidden in purely frontal lessons [CIB – Interview data Teacher, Key Insights/Notes].

One teacher summarizes it this way: “Gamification works because it reduces fear and makes learning fun” [CIB – Interview data Teacher, Participant Response]. This phrase well explains why simple activities like gamified quizzes can have a profound impact: they transform the perception of a difficult subject into an accessible and positive experience.

The Perception of Difficulty in Programming

A strongly recurring theme concerns the perception that programming is too difficult a field. As one teacher states: “Programming is seen as difficult” [CIB – Interview data Teacher, Key

Insights/Notes]. This belief, often not tied to direct experience but to stereotype, leads many girls to avoid exposing themselves.

The fear of making mistakes is one of the main factors that reduce participation. A note explains: “Fear of failure reduces participation, but gamification and short projects help build confidence” [CIB – Interview data Teacher, Key Insights/Notes]. Teachers then try to propose short, concrete tasks where the possibility of “succeeding immediately” reduces anxiety and gradually builds confidence.

At the same time, some testimonies recall the importance of the teacher's role: “Passion is sparked by challenge and persistence, and by teachers who transmit enthusiasm” [CIB – Interview data Teacher, Key Insights/Notes]. It is clear here that the perception of difficulty can be transformed into passion when mathematics and programming are taught with enthusiasm and when error is presented as part of the journey.

The Family's Influence on Choices

The interviews clearly show that family plays a central role in guiding girls. One response states: “Equal information, but girls less interested due to family influence” [CIB – Interview data Teacher, Participant Response]. In other words, even when the school offers the same opportunities, the weight of family models directs choices.

Another voice adds: “Girls follow family role models, which are usually in healthcare” [CIB – Interview data Teacher, Participant Response]. This finding confirms a trend observed in multiple contexts: healthcare careers are perceived as more suitable and stable for daughters, while technical ones remain marginal.

The personal stories of the interviewed teachers reinforce this picture. One stated: “I didn’t have role models in my family… I did it on my own” [CIB – Interview data Teacher, Participant Response]; another recounted: “My father was a telecommunications engineer… I chose engineering partly to go against the grain” [CIB – Interview data Teacher, Participant Response]. These phrases show that the family context can be both an obstacle and a motivation: in some cases, support legitimizes choices, in others, the lack of models necessitates solitary paths.

Curricular Constraints and Lack of Resources

Teachers highlighted curriculum fragmentation and resource scarcity as significant barriers. One teacher stated: “The curriculum is fragmented, there is a lack of continuity in STEAM” [CIB – Interview data Teacher, Participant Response]. Others reported the struggle to maintain activities due to a lack of time and materials: “Projects and competitions motivate but require a lot of effort and resources” [CIB – Interview data Teacher, Participant Response].

The theme returns strongly in the recommendations: “Start earlier with programming and robotics, more time in the curriculum” [CIB – Interview data Teacher, Participant Response]. The request is twofold: increase the amount of time dedicated to STEM and introduce them earlier, so that girls can become familiar with them without pressure and without perceiving the path as an “exception.”

The Importance of Role Models

A universally recognized aspect is the effectiveness of exposure to role models. One teacher explains: “I invite female scientists, use local role models, organize events” [CIB – Interview data Teacher, Participant Response]. The presence of professional figures, especially women, immediately makes the possibility of a technical career visible.

The interviewed role model reiterates that the key is not a single event, but continuity: “One meeting inspires you, but continuous mentoring builds your path” [CIB – Interview data Role Model, Participant Response]. This message, also reported in the notes, indicates that motivation needs repetition, proximity, and relationships that solidify over time.

Effective Practices Already Experimented

The interviews gather a repertoire of concrete practices that have been successful: gamified quizzes, robotics projects, internal competitions, challenge days, creation of social profiles of female scientists, debates, and invitations to local professionals. All these activities, reported multiple times in the sheets, have generated enthusiasm, participation, and pride. “Projects, role models, challenge-type activities, talks from professionals” [CIB – Interview data Teacher, Participant Response] is a phrase that summarizes the set of practices considered most impactful.
At the same time, teachers encourage respecting individual inclinations: “Not all students are interested in STEAM; individual interests must be respected” [CIB – Interview data Teacher, Participant Response]. This shows that the promotion of STEM should not become an imposition, but an expansion of possibilities.

Operational Recommendations

From the data emerge very precise operational recommendations:

- Introduce STEM earlier in the curriculum: “Start earlier with programming and robotics, more time in the curriculum” [CIB – Interview data Teacher, Participant Response].
- Make the presence of role models and professionals regular, with figures who return multiple times.
- Formalize resource management to overcome fragmentation.
- Leverage gamification and challenge-based learning as tools to lower barriers and provide immediate successes.

These elements are all contained in the CIB sheets and constitute concrete guidelines for building a replicable methodology.

Monitoring Indicators

Teachers proposed both quantitative and qualitative indicators. On the quantitative level: number of practical projects completed, frequency of meetings with professionals, curricular time dedicated to STEM, participation in competitions and challenges. On the qualitative level: an increase in questions asked in class, a reduction in reticence, and positive family feedback. A note clearly expresses it: "Parents notice when their daughters are proud of what they do" [CIB – Interview data Teacher, Key Insights/Notes].

Conclusions

The CIB case highlights that girls' interest in STEM is real, but must contend with material barriers, perceptions of difficulty, and family influences. Teachers and the role model agree on the most effective levers: practical and creative teaching, early introduction of STEM, continuous mentoring, and consistency with families. The direct quotes collected in the sheets confirm this: "Programming is seen as difficult"; "Gamified quizzes, robotics projects, competitions"; "I invite female scientists, use local role models, organize events"; "One meeting inspires you, but continuous mentoring builds your path." All these voices, taken from the interviews, are not simple opinions but qualitative data that indicate the path for a shared methodology at a European level.

Chapter 1.4 – YMITTOU EDUQUEST (Greece)

Introduction: A Complex Landscape

The interviews conducted with the teachers and the role model from YMITTOU EDUQUEST reveal an extremely rich and layered picture. Differences related to the socio-economic context emerge, deep-seated cultural stereotypes persist, and at the same time, there are examples of resilience and support that have allowed many women to pursue STEM paths.

One of the first observations reported immediately highlights the weight of the cultural context: "Cultural and religious backgrounds often discouraged girls, especially in more conservative communities, from continuing their education" [Teachers Transcript]. This phrase encapsulates the central issue: educational opportunities do not depend solely on the school but also on the social fabric and the prevailing beliefs within families.

But, as another teacher recalls, the presence of a capable teacher who provides encouragement can turn the situation around: "My teacher in mathematics saw something special in me and encouraged me constantly; this made me want to become a mathematician" [Teachers Transcript].

Socio-economic and Territorial Inequalities

The teachers' voices are unanimous in stating that the economic and geographic context profoundly affects girls' access to STEM. One teacher clearly emphasizes: "Students from wealthier backgrounds had more extracurricular opportunities and access to lab equipment" [Teachers Transcript]. This seemingly simple phrase reveals a huge gap: in Greece, as elsewhere, the availability of private resources allows more privileged students to have practical experiences, attend labs, and participate in specialized courses.

Conversely, girls from less affluent families are forced to make do with the minimal opportunities offered by public schools, which are often insufficient. Another teacher recalled: "In rural areas I saw girls already engaged or even pregnant in high school, because family expectations prioritized domestic roles" [Teachers Transcript]. It's not just a lack of kits or tools, but true cultural and social barriers that interrupt educational paths.

Some teachers highlighted how the gap widens further when families do not support their daughters. In rural contexts, the pressure to take on domestic roles or marry early still represents a significant obstacle.

Traditional vs. Innovative Teaching

The collected testimonies highlight a marked difference between the Greek teaching model and other educational systems.

A teacher with experience in Germany recalls: "Lessons were experiment-based; from experiments we derived the theory, something that does not happen in Greece" [Teachers Transcript]. This phrase highlights the absence of an inductive approach in the Greek school system, where rote learning still prevails.

The same teacher adds: "Even mathematics are not connected with real life, and that's why children get bored" [Teachers Transcript]. The lack of connection to everyday reality generates disaffection, especially among girls, who instead show greater participation when they can tackle concrete problems.

Multiple teachers have emphasized the methodological gap: without experiments and labs, STEM subjects appear cold and abstract. This creates a context in which even the most capable girls tend to lose interest and do not project themselves into future careers in the sector.

The Decisive Impact of Teachers

The interviews clearly show the transformative power that teachers can have on female students. One teacher recounts: "She saw something special in me, encouraged me, and that's why I decided to pursue mathematics" [Teachers Transcript]. This demonstrates that the trust placed in a female student can make the difference between a path of dropping out and a successful career.

Other teachers, however, recognize that stereotypes still influence educational practices. One of them states: "Boys receive more encouragement to follow technical studies, while girls are directed towards humanities or healthcare" [Teachers Transcript]. This is an important admission, as it shows how gender expectations can even condition the support that is given.

Another recalled that passion is contagious: "Passion is sparked by challenge and persistence, and by teachers who transmit enthusiasm" [Teachers Transcript]. This suggests that teacher training cannot be limited to disciplinary competence but must also include the ability to encourage and motivate.

The Family as a Resource or a Barrier

The role of the family was underscored by almost all interviewees. One teacher recalled her childhood: "My father was fixing everything, and I was more interested in using his tools than playing with dolls" [Teachers Transcript]. This experience shows how familiarity with technical tools can spark girls' curiosity.

But the family is not always a source of support. Many teachers recounted cases where parents discouraged their daughters from pursuing STEM paths, pushing them toward professions considered more traditional. This influence, often unconscious, still weighs heavily.

The role model confirms how decisive family support was for her: "My family encouraged independence; we were three sisters and all studied sciences. That support made the difference" [Role Model Transcript].

Deep-Seated Gender Stereotypes

A central theme is the persistence of gender stereotypes. A teacher states: "Girls are more diligent, often outperforming boys in national exams, but stereotypes still suggest that mathematics and technology are for boys" [Teachers Transcript]. It is a paradox: girls have better results, but are considered less suitable.

Other interviewees spoke about quota policies: "Imposing quotas may help break stereotypes, but true change needs cultural transformation" [Teachers Transcript]. This shows that institutional policies can have a role, but without a change in mindset, the problem remains unresolved.

Experiences of Resilience and Empowerment

Alongside the obstacles, stories of strength and determination also emerge. One teacher said: "I never thought I couldn't do something just because it was for men; I always said: if a man can do it, why not me?" [Teachers Transcript]. This phrase encapsulates a spirit of resilience that has allowed many women to overcome cultural and social barriers.

The role model Sofia Drakaki offered a similar testimony: "We were three sisters, all encouraged to become independent; two of us became electrical engineers and one a physicist" [Role Model Transcript]. Family support and personal determination were the keys to success.

Today's Challenges

Despite progress, challenges remain. Teachers spoke about a lack of guidance: "There is still a lack of professional guidance at school, prejudice from society, and women fear how to combine career and family" [Teachers Transcript].

The role model added: "Even today women face unequal opportunities, lack of support from the state, and strong competition in companies" [Role Model Transcript]. These observations show that, in addition to cultural stereotypes, there are structural and institutional problems that must be addressed.

Operational Recommendations

Clear proposals emerge from the interviews:

- Give more space to practical activities: "Lessons should start from experiments, not only theory" [Teachers Transcript].
- Offer professional guidance as early as secondary school.
- Create lasting mentoring programs: "One meeting inspires you, but continuous mentoring builds your path" [Role Model Transcript].
- Promote cultural change through campaigns and teacher training.

Conclusions

The YMITTOU EDUQUEST case reveals a complex landscape: socio-economic inequalities, cultural stereotypes, structural shortcomings, but also stories of resilience and family support.

The voices collected demonstrate that girls have talent and motivation, but a systemic change is needed to allow them to fully express their potential in STEM.

The quotes are the most eloquent proof: “If a man can do it, why not me?”; “Girls are more diligent but stereotypes still suggest STEM is for boys”; “My family encouraged independence, that support made the difference.”

Chapter 1.5 – Girls for Girls (G4G)

Introduction: A Chorus of Voices on the STEM Future

The Girls for Girls (G4G) case study compiles the testimonies of a female role model and four teachers, complemented by trackers that rigorously document the data collection process. The voices from these documents intertwine, creating a multifaceted picture where hopes, difficulties, deep-seated stereotypes, and effective practices emerge.

From the outset, a tension between ability and perception is evident: girls show commitment, precision, and consistency, but they hesitate to speak up or put themselves forward, often for fear of making a mistake. One teacher summarizes it this way: “Girls often outperform boys in persistence and detail, but they hesitate to take the lead because they fear being judged” [POO2 Teacher DB].

The interviewed role model, reflecting on her own experience, confirms this dynamic: “When I was at school, I didn’t see women in STEM careers around me, and that made it harder to imagine myself in those roles” [POO1 RM MB].

These two sentences—one from the school perspective, the other from the professional one—are the starting point for understanding how, without support and reference models, girls' talent risks remaining invisible.

Girls' Intrinsic Motivation

The teachers' testimonies insist on girls' dedication to STEM activities. One teacher states: “Girls show more consistency in completing assignments and are usually more attentive during lab work” [POO3 Teacher CB].

This commitment often translates into high academic results, but it is not always recognized or valued. Many teachers report that girls, despite achieving better grades, struggle to perceive themselves as “suitable” for pursuing scientific careers.

The connection to everyday reality emerges as a motivating factor: “When they see how science connects with everyday problems, they become much more engaged” [POO4 Teacher MS]. In other words, motivation grows when STEM does not remain abstract but is presented as a tool for solving concrete challenges.

Another teacher reiterates: “Girls like to work on projects that have visible outcomes; they want to see the result of their effort” [POO5 Teacher MF]. Here, a direct link emerges between personal satisfaction and the tangibility of results, which makes science more accessible and relatable.

The Fear of Exposing Oneself and the Shadow of Judgment

While girls stand out for their commitment, they show a strong reluctance to put themselves forward. One teacher explains: “Even when girls know the answer, they prefer to stay silent rather than risk being wrong in front of others” [POO5 Teacher MF]. This attitude is not related to a lack of skills, but to the fear of judgment.

The role model recounts a similar dynamic she experienced firsthand: “I was good at math, but I avoided speaking up; I didn’t want to confirm the stereotype that girls struggle with numbers” [POO1 RM MB]. This is a crucial point: the stereotype acts as a cognitive cage, conditioning the behavior of even the most competent female students.

Teachers note that this dynamic lessens when mistakes are normalized. As one teacher says: “When we frame mistakes as part of learning, girls participate more actively and even take risks” [POO2 Teacher DB].

The Family as a Determining Factor

The family context weighs heavily on choices. One teacher observes: “Many parents still think that STEM is too demanding for girls and prefer to direct them towards humanities or healthcare” [POO3 Teacher CB]. This guidance does not consider the daughters’ real skills but perpetuates deep-seated beliefs.

Another teacher adds: “Parents worry that technical studies will be too time-consuming and will not leave space for family life” [POO4 Teacher MS]. The concern is not just academic but concerns compatibility with the future role of a mother or wife, which many families still take for granted.

The role model, on the other hand, could count on full support: "In my case, my parents were supportive; they encouraged me to study engineering even though it was unusual. That support made me confident" [POO1 RM MB]. This is proof of how family support can become the key to overcoming prejudices and cultural barriers.

Subtle Stereotypes and Unconscious Bias

Teachers recognize that, despite progress, stereotypes are still present in educational practices. One teacher states: "Boys are still expected to be good at technology, while girls are praised for being careful and organized" [POO4 Teacher MS]. These seemingly neutral attributions reinforce gender roles that push girls away from technology.

Another adds: "Even today, some colleagues unconsciously give more attention to boys during science lessons" [POO5 Teacher MF]. These are not explicit discriminations, but daily micro-behaviors that, by accumulating, create a gap.

The role model lucidly summarizes: "I see more women in STEM today, but the stereotypes haven't disappeared; they just became less visible, more subtle" [POO1 RM MB].

Practices That Work

The testimonies offer numerous examples of effective strategies. One teacher says: "When we turn a lesson into a game, participation rises dramatically, especially among girls" [POO2 Teacher DB]. Gamification is not just fun, but a tool that reduces performance anxiety.

Another recalls the effectiveness of competitions: "Challenge-based activities make them proud and willing to show their skills" [POO4 Teacher MS]. Contests and challenging projects create opportunities for girls to publicly display their abilities.

Other examples include the use of social media: "Creating social media profiles of female scientists was very effective; girls loved it" [POO3 Teacher CB]. In this case, the familiar language of social media became a bridge to scientific content.

The Value of Role Models

Teachers and the role model agree: meeting female professionals is a transformative experience.
A teacher states: "When female professionals visit the school, girls suddenly see themselves in those careers" [POO5 Teacher MF].

The role model reiterates: “One meeting inspires you, but continuous mentoring builds your path” [POO1 RM MB]. Momentary inspiration is useful, but it's not enough: it's continuity that truly builds guidance and confidence.

Organizational and Curricular Barriers

In addition to stereotypes, schools face practical difficulties. One teacher complains: “We don’t always have enough lab equipment, and that limits the frequency of experiments” [POO2 Teacher DB].

Another points out the lack of curricular coherence: “STEM is often taught in a fragmented way; there is no continuity across the years” [POO3 Teacher CB].
These shortcomings compromise the possibility of consolidating knowledge and motivation: without continuity and adequate resources, even good practices risk remaining isolated episodes.

Operational Recommendations

The proposals that emerged from the interviews are concrete and replicable:

- Early introduction of STEM: “Start earlier with programming and robotics, more time in the curriculum” [POO4 Teacher MS].
- Stability of role models: “Girls need to meet female professionals regularly, not just once a year” [POO5 Teacher MF].
- More practical resources: ensure functional labs and accessible kits.
- Active methodologies: gamification, challenge-based learning, projects linked to real life.

Conclusions

The G4G case demonstrates that girls have the ability and motivation to pursue STEM careers, but they face a context that often hinders rather than supports them. The family can be both a lever and a barrier; the school, through innovative practices and role models, can become the space where these barriers are overcome.

The collected quotes speak for themselves: “Even when girls know the answer, they prefer to stay silent,” “Parents still think STEM is too demanding for girls,” “Creating social media profiles of female scientists was very effective,” “One meeting inspires you, but continuous mentoring builds your path.”

These authentic and precise voices outline a methodological path that not only recounts difficulties but offers concrete tools to transform STEM into a truly inclusive space.

Final Conclusion

The set of case studies collected by the consortium partners in Work Package 2 represents a unique contribution to understanding how the promotion of STEM among girls aged 10 to 16 is configured in Europe today. The testimonies of teachers and role models, systematized in the Interview data and Interview tracker sheets, have yielded not only individual opinions but above all a body of consistent evidence that allows us to read needs, barriers, and good practices in light of WP2's objectives. These objectives—promoting girls' access to university STEAM careers (OG1), making female role models and success stories visible (OG2), and changing the dominant discourse that "STEM is not for girls" (OG4)—find a concrete expression in the case studies in different local contexts, which nevertheless reveal strong convergences.

In Italy, the work of Scuola di Robotica showed how educational robotics, when consistently included in the curriculum and accompanied by hands-on methodologies, promotes balanced and visible participation among girls. The interviewed teachers highlighted that up to age 13, gender differences are minimal, and robotics has allowed shy female students to emerge as leaders in work groups. However, the critical threshold comes at the time of high school orientation: without family support, the school's effort risks being nullified. The lack of authentic and local role models was identified as a significant obstacle, along with the scarcity of adequate infrastructure and human resources, with teachers often alone in managing large classes. Despite these difficulties, the presence of hands-on experiences, co-teaching, and multimedia projects has had a direct impact in reducing the gender gap and showing girls that technology can also belong to them.

The Romanian case of Colegiul Tehnic "Edmond Nicolau" strongly highlights another recurring aspect: the fear of mathematics. Female students show interest and precision in practical activities but tend to perceive mathematics as a male discipline, too difficult for them, limiting themselves from speaking in public for fear of making a mistake. Teachers have observed that this fear diminishes when error is normalized as part of the learning process, while it is amplified when a punitive culture prevails. Here, too, the role of the family is decisive: when parents support their daughters, they persist and gain confidence; when they discourage technical choices, motivation fades. Material barriers remain significant: kits are not sufficient, labs must be shared, and teachers often improvise with limited resources. However, exposure to professionals and role models has been shown to have a transformative impact, especially when meetings are repeated over time and allow girls to build a continuous dialogue.

Fundación Cibervoluntarios in Spain offered a different picture: gamification practices, creative activities, and digital projects have proven to be powerful tools for stimulating girls' motivation. Gamified quizzes, challenge days, the creation of social media profiles of female scientists, and invitations to local professionals are all examples that have reduced performance anxiety and made learning fun and accessible. However, the perception that programming is too difficult a field persists, and once again, the fear of making mistakes reduces participation. Teachers have observed that family support often directs girls toward careers considered more traditional, such as healthcare, while STEM remains marginal. In this context as well, the scarcity of curricular time and the fragmentation of programs represent structural obstacles. The continuity of role models and the possibility of starting earlier with programming and robotics have been identified as priorities for lasting change.

The Greek case of YMITTOU EDUQUEST strongly reported the weight of the cultural and socio-economic context. In rural areas, family and religious expectations can drastically limit girls' access to STEM, even interrupting their schooling. The interviewed teachers recounted episodes of girls already promised in marriage or pushed toward domestic roles during high school. Traditional teaching, based on theory and not on experiments, contributes to generating boredom and disaffection. However, the testimonies also showed how a teacher's passion can transform a student's trajectory and how family support can make a difference, as demonstrated by the interviewed role model, who grew up in a family that encouraged her daughters' independence. Stereotypes remain entrenched, but stories of resilience also emerge, with women who chose STEM paths despite the barriers. Teachers reiterated the need to introduce more practical activities, offer early career guidance, and promote widespread cultural change.

Finally, the international body of evidence collected by G4G reinforced and summarized many of the findings that had already emerged: girls show dedication, precision, and consistency, but they hesitate to put themselves forward and speak up for fear of judgment. The family context is confirmed as decisive: it can be a barrier, as when parents consider STEM too demanding for their daughters, or it can be a lever, as shown by cases where family support made the choice of engineering paths possible. Stereotypes persist, often in subtle and unconscious forms, even in daily educational practices. Active methodologies—gamification, concrete projects, challenges—have proven effective in reducing anxiety and making skills visible. Once again, the theme of role models emerges strongly: meeting female professionals is important, but what truly matters is continuity, the possibility of building mentoring relationships that accompany girls over time.

The comparative reading of the case studies confirms that national differences do not cancel but rather strengthen the relevance of common objectives. In Italy, the key issue is organizational and infrastructural; in Romania, the perception of mathematics as a cultural barrier weighs heavily; in Spain, the problem is reduced curricular time and fragmentation; in Greece, the issue is primarily social and familiar; in the G4G context, the key is mentoring and overcoming the fear of exposing oneself. Yet, in every case, the solutions are similar: hands-on activities, school-family consistency, authentic and continuous role models, and creative and inclusive teaching methods.

The European framework confirms the necessity of these actions. According to Eurostat data from the European Commission, in 2021, women represented only 32.8% of STEM graduates in the European Union, with significant national variations (Romania 42.5%, Greece 40.9%, Italy 39.0%). In the ICT sectors, the disparity is even more pronounced, with the female share holding at around 16–17%[1]. The European Institute for Gender Equality (EIGE) has estimated that reducing the gender gap in STEM could increase the EU's GDP per capita by 2.2% to 3.0% by 2050, generating overall benefits between 610 and 820 billion euros[2] (EIGE, "Economic benefits of gender equality in the EU," 2017). These data clearly show that investing in gender equality in STEM is not just an educational and social goal, but also a strategic priority for growth and innovation in Europe.

In conclusion, the case studies demonstrate that girls' talent is already present and visible in our schools, but its full expression depends on the educational, family, and social environment in which it is situated. The experiences collected offer precise indications: STEM must be stably integrated into curricula, families must be involved, stereotypes must be dismantled through consistent language and educational materials, schools must be supported with adequate resources, and role models must become a regular presence. WP2, by translating this evidence into a shared methodological guide, will offer teachers and educators across Europe concrete tools to transform qualitative data into replicable practices. Thus, the statement "STEM is not for girls" can be definitively overcome, replaced by a new discourse that recognizes girls not only as future potential but as protagonists of European science and technology today.

[1] European Institute of Gender Equality. (2023). *Gender Equality Index* 2023. https://eige.europa.eu/gender-equality-index/2023/IT

[2] European Institute of Gender Equality. (2017) Economic benefits of gender equality in the EU. https://eige.europa.eu/newsroom/economic-benefits-gender-equality