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LeadHER

Gender Gap in ICT: Insights and Strategies for Inclusive Education

D2.1 Global Research Report

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1 Introduction

This Global Report is part of the LeadHER – Teaching Framework for Boosting ICT Literacy and Jobs for Girls in Basic and Secondary Education project, co-funded by the European Union. It belongs to Work Package 2 (Needs Assessment and Resource Mapping), which aims to establish a shared evidence base for the project by analyzing gender-related barriers and enablers influencing girls' participation in ICT education and careers.

About the LeadHER Project

The LeadHER project aims to address the persistent gender gap in ICT literacy and careers through gender-responsive education and policymaking. Implemented across Bulgaria, Portugal, and Spain over two school years, the project seeks to dismantle structural, cultural, and pedagogical barriers that limit girls' participation in ICT education and professions.

The project promotes girls' engagement with ICT by developing and implementing the LeadHER ICT Gender Balance Teaching Framework, which includes:

- Mentoring schemes connecting girls with female role models in ICT;
- A Teachers' Toolbox to help educators create inclusive and gender-responsive learning environments; and
- A Family and Community Engagement Program designed to strengthen the ecosystem of support around girls' ICT interests.

The LeadHER consortium comprises eight partners with complementary expertise:

- INOVA+ Innovation Services
- Haaga-Helia University of Applied Sciences
- Know and Can Ltd
- Basque International Research Association
- UMAR
- Centro San Viator
- 93rd school and
- AEJE

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Objectives of the Global Report

This Global Report is part of the Needs Assessment and Resource Mapping and consolidates the evidence gathered through the national desk and field research carried out by project partners under the coordination of HHUAS. It aims to:

- Provide a comprehensive overview of gender-related barriers and enablers affecting girls' participation in ICT studies and careers;
- Identify institutional, socio-economic, and cultural factors shaping ICT gender dynamics in the three intervention countries;
- Map existing policies, initiatives, and good practices at national and EU levels; and
- Offer recommendations to guide the design of the LeadHER Teaching Framework and its three core components: mentoring, teacher support, and family/community engagement.

Methodology and Sources of Evidence

The Global Report builds on two main sources of evidence:

- Desk Research, conducted by national partners in Bulgaria, Portugal, and Spain between April and July 2025, reviewed existing research, policies, statistics, and initiatives addressing female participation in ICT education and employment. This included mapping relevant national and EU-level actions, identifying good practices, and analyzing socio-cultural and institutional barriers.
- Field Research, conducted by national partners in Bulgaria, Portugal, and Spain between July and September 2025, complemented the desk research through direct engagement with stakeholders. The following table 1 details the distribution of participants in the stakeholder consultation, categorized by country and stakeholder group.

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Table 1: Number of participants in stakeholder consultations. Note: BE = Basic Education; SE = Secondary Education.

	Focus Group with students		Surveys/ Interviews with teachers		Interviews with HR managers/ company representatives, including women role models		
Country	**BE**	**SE**	**BE**	**SE**	**HR managers**	**Company representatives**	**Role models**
Bulgaria	13	10	12	16		5	
Portugal	12	14	12	12	5		
Spain	8	12	10	11		4	1

The evidence from these national studies is summarized and synthesized in this Global Report. Each country partner has prepared a national report (Iglesias Arriaran & Santurtun Bugallo, 2025; LeadHER Project, 2025a; Rodrigues et al., 2025; Shalamanova et al., 2025), which serves as a primary reference for this synthesis.

Scope and Limitations

The scope of this Global Report covers the three intervention countries—Portugal, Bulgaria, and Spain—and provides an EU-level overview where relevant data is available. The findings primarily reflect the perceptions and experiences of students, teachers, and industry representatives within these contexts.

However, several limitations should be acknowledged:

- Data availability and comparability across countries vary;
- Field research samples are context-specific and not statistically representative;
- Some qualitative insights may reflect localized experiences rather than general trends.

Despite these limitations, the Global Report offers robust, triangulated evidence that forms the analytical foundation for the next project phase—the design of the LeadHER Teaching Framework.

Triangulation and Validation of Evidence

To ensure analytical consistency and credibility, the Global Report applies a triangulation approach that combines three complementary sources of evidence: desk research, field

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research, and policy analysis. The convergence of these data streams allows for cross-verification of findings between national contexts and stakeholder groups (students, teachers, and industry representatives). Divergent observations were discussed within the LeadHER consortium to ensure interpretive balance and contextual accuracy. This methodological triangulation mitigates the limitations related to sample size and contextual specificity, reinforcing the reliability of the synthesis presented in subsequent chapters.

Structure of the Report

The Global Report is organized into the following chapters:

Chapter 2: EU Guidelines on Gender Equality and Inclusion – an overview of the EU's strategic frameworks and statistics on gender equality in ICT.

Chapter 3: Country Overviews – national analyses for Bulgaria, Portugal, and Spain, including findings from desk and field research as well as policy contexts.

Chapter 4: Identifying Barriers and Enablers – a cross-country synthesis of barriers and enablers shaping girls' ICT aspirations and participation.

Chapter 5: Identified Good Practices and Their Transferability – identified successful approaches and lessons learned, highlighting their potential transferability across contexts.

Chapter 6: This chapter provides recommendations for the design of the teaching framework, including the mentoring scheme, teachers' toolbox, and family and community intervention. It also summarizes the key findings, highlights implications for policy and practice, and suggests directions for future research.

Together, these sections provide an integrated evidence base for advancing gender-responsive ICT education and informing the subsequent design and implementation phases of the LeadHER Teaching Framework.

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2 The European Policy and Strategic Framework for Gender Equality in ICT Education

This chapter provides an overview of the European Union's policy and legal foundations for gender equality, education, and digital competence, as well as their implementation through EU programs and initiatives. It examines areas of thematic convergence across these frameworks and addresses intersectionality and structural challenges that influence equality in the digital and educational spheres. Finally, the chapter links these policy foundations to practical approaches and actions that support gender equality and inclusion in ICT education and practice.

2.1 EU Policy and Legal Foundations for Gender Equality

Gender equality and inclusion are positioned by the European Commission as cross-cutting priorities within the European Union's social, economic, and innovation agenda. The EU pursues these goals through a layered policy architecture that integrates strategic frameworks, legal directives, and program-level instruments (European Commission, 2020). Together, they form the policy foundation for addressing structural inequalities across education, employment, and digital transformation.

The EU Gender Equality Strategy 2020–2025 provides the overarching vision, calling for the integration of gender equality in all EU policies through both mainstreaming and targeted measures. It identifies education and digital participation as key areas where gendered barriers must be dismantled (European Commission, 2020). This strategy is complemented by the Roadmap for Women's Rights 2025, which reaffirms a dual approach to gender equality, embedding gender sensitivity across all sectors while simultaneously addressing persistent inequalities (European Commission, 2025). Two of its long-term priorities, equal access to quality education and equitable employment opportunities, directly address the underrepresentation of women in ICT-related fields.

These commitments are reinforced by legally binding instruments. The Equal Treatment Directive (2006/54/EC) codifies the principle of equal opportunities and prohibits gender-based discrimination in employment, training, and working conditions (European Parliament

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& Council, 2006). The European Pillar of Social Rights establishes gender equality and work-life balance as essential pillars of social justice (European Commission, 2017). Similarly, the Work-Life Balance Directive (EU 2019/1158) provides concrete entitlements for parental leave, carers' rights, and flexible work arrangements, aiming to reduce women's career interruptions and enhance men's participation in caregiving (European Parliament & Council, 2019).

These legislative mechanisms position equality not only as a normative value but also as an economic and social imperative for sustainable digital growth. They ensure that structural rights underpin the EU's strategic goals for gender inclusion in education and employment.

Table 2 presents key EU policy frameworks that guide actions on gender equality, digital inclusion, equal treatment and related areas of education, and competence development.

Table2. EU Policy Frameworks for Gender Equality and Digital Inclusion (Adapted from European Commission, 2020, 2021a, 2021b, 2025).

Policy Instrument	Scope	Relevance to ICT and Education
Gender Equality Strategy 2020–2025	Strategic vision for mainstreaming equality	Identifies education and digital participation as key areas for intervention
Digital Decade Policy Program 2030	Overarching targets for digital skills and participation	Links gender inclusion to digital competitiveness
Digital Education Action Plan 2021–2027	Education sector implementation framework	Promotes digital competence, teacher training, inclusive pedagogy
Equal Treatment Directive 2006/54/EC	Legal basis for non-discrimination in employment	Supports equal access to vocational ICT training and labor market entry
Erasmus+ Inclusion Strategy & EACEA Action Plan	Program-level implementation	Provides mechanisms for outreach and gender mainstreaming in education

2.2 Education, Digital Competence and Program Implementation

Education functions as the EU's most strategic mechanism for achieving both gender equality and digital inclusion. The European Digital Competence Framework (DigComp 2.2) articulates

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a comprehensive understanding of digital literacy that extends beyond technical proficiency to include communication, collaboration, digital safety, and critical engagement (European Commission, 2022). Within this model, equity and inclusion are recognized as essential elements of digital citizenship.

EU education and youth programs operationalize these commitments. The Erasmus+ and European Solidarity Corps Inclusion and Diversity Strategy (European Commission, 2021a) and the EACEA Inclusion & Diversity Action Plan (EACEA, 2023) aim to widen participation and remove structural barriers for underrepresented groups, including girls and women in STEM and ICT. These programs promote gender mainstreaming in curricula, teacher training, and guidance systems, while also improving the collection of gender-disaggregated data to inform interventions (European Commission, 2021a).

The Digital Education Action Plan reinforces this by emphasizing that equitable digital transformation depends on teachers' preparedness to address diversity and bias in the classroom. Gender sensitivity, critical thinking, and creativity are highlighted as core pedagogical competencies (European Commission, 2021a). This approach aligns with UNESCO's Cracking the Code report (2017) and EIGE's (2023) findings, which show that inclusion in digital education requires intentional design that promotes belonging, early exposure, and positive role models.

2.3 Thematic Convergence, Intersectionality and Structural Challenges

Across EU frameworks, a shared narrative emerges achieving gender equality in ICT depends on progress across psychological, social, and institutional dimensions. The EIGE Gender Equality Index (2023) and WiD Scoreboard (2024) confirm that women comprise only around 19–20% of ICT specialists in the EU and remain underrepresented in higher education and leadership roles. These disparities persist despite improvements in access, highlighting the enduring influence of socialization patterns, stereotype reinforcement, and pedagogical capacity gaps.

An increasingly central element in EU policy is intersectionality. The European Commission (2023) notes that women who face multiple forms of discrimination, based on ethnicity, disability, socioeconomic background, or sexual orientation, encounter compounded obstacles in accessing ICT education. For instance, Eurydice (2023) data show that girls from minority backgrounds are less likely to pursue ICT pathways, not solely because of gender

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norms but due to structural disadvantage. Similarly, LGBTIQ+ students and girls with special educational needs experience barriers that require tailored socio-emotional and pedagogical support. Table 3 presents key EU-level gender indicators in ICT education and employment, highlighting current gaps and trends in participation, skills, and representation.

Table 3. Key Gender Indicators in ICT Education and Employment (EU Averages, 2024) (Sources: Eurostat, 2024; EIGE, 2023; Women in Digital Scoreboard, 2024; She Figures, 2021).

Indicator	Female (%)	Male (%)	Source
ICT specialists in the EU labor market	19.5	80.5	Eurostat (2024)
ICT graduates among all tertiary graduates	20	80	She Figures (2021b)
Adults with basic digital skills (ages 16–74)	52	59	WiD Scoreboard (2024)
Adults with advanced digital skills	19	35	WiD Scoreboard (2024)
Women in ICT managerial positions	**18**	**82**	**EIGE (2023)**

2.4 Linking Policy Foundations to Practice

The EU's gender equality architecture represents a coherent synthesis of strategic direction, legal obligation, and programmatic action. The combination of these layers ensures that gender equality is not merely a principle of governance but a structural driver of educational and economic reform. Strategic frameworks such as the Gender Equality Strategy 2020–2025 and the Digital Decade Policy Program 2030 establish the vision and long-term targets, while operational instruments, including the Digital Education Action Plan (2021–2027), Erasmus+ Inclusion Strategy, and the EACEA Diversity Action Plan, translate these commitments into practical measures in education and training. At the same time, legally binding directives —

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notably the Equal Treatment Directive (2006/54/EC) and the Work-Life Balance Directive (EU 2019/1158) — secure individuals' rights to equal treatment, non-discrimination, and balanced participation in family and working life.

Together, these strategic, operational, and legal dimensions create the enabling conditions for systemic change in ICT education and employment. They also highlight a persistent challenge: although the European Union has succeeded in developing a comprehensive and coherent policy framework, implementation across Member States remains uneven. Differences in national education systems, teacher training structures, and socio-cultural environments mean that gender equality objectives are translated and enacted in diverse ways.

From this perspective, policy coherence at the EU level provides both *a benchmark and a catalyst* for national reform. The frameworks reviewed in this chapter establish the normative expectations and measurable targets that shape national digital and education policies. However, the realization of these goals depends on how each Member State interprets and applies them within its institutional and cultural context.

The next chapter explores this dynamic in depth. It examines how Bulgaria, Portugal, and Spain operationalize the EU's gender equality and digital inclusion objectives within their own education and policy systems. By analyzing the interplay between EU policy alignment and national adaptation, Chapter 3 provides the contextual grounding for understanding the varied realities in which the LeadHER project operates. It demonstrates that while the European Union sets the direction, sustainable change ultimately occurs through the local translation of policy into practice

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3 Synthesis Report on Gender and ICT Education: Insights from Bulgaria, Spain and Portugal

This synthesis chapter is based on national reports prepared by project partners in Bulgaria (Shalamanova et al., 2025), Portugal (Rodrigues et al., 2025) and Spain (Iglesias Arriaran & Santurtun Bugallo, 2025). The country reports included both desk and field research conducted during 2025, focusing on gender equality and female participation in ICT education and employment. The chapter summarizes key findings and highlights common trends, challenges, and examples of good practices across the three countries, with particular attention to experiences, attitudes, and perceptions on gender and ICT, as well as policy recommendations derived from the findings.

3.1 Insights from Bulgaria

This section presents the findings from Bulgaria (Shalamanova et al., 2025), combining insights from the desk research and field research phases. Together, these findings provide a comprehensive understanding of the Bulgarian context.

3.1.1 Desk research findings

National Data and Gender Indicators in Bulgarian ICT

Bulgaria stands out in the EU for its high share of women in ICT occupations—about 29% compared to the EU average of 19% (Eurostat, 2024)—reflecting a strong tradition of women's participation in STEM. This progress is supported by a robust policy framework: ICT education is integrated into the national curriculum from primary to upper secondary school, aligned with DigComp 2.2 (Vuorikari, Kluzer, & Punie, 2022), and guided by the National Digital Decade Strategic Roadmap (2022–2027), which emphasizes gender equality and gender-sensitive teacher training in ICT.

Despite these strengths, persistent challenges remain. Societal stereotypes continue to frame ICT as a male domain, affecting girls' confidence and career choices from an early age. Broader issues include low national digital literacy (only 35.5% of the population has basic skills (Digital Skills and Jobs Platform, 2024), uneven implementation of gender-responsive pedagogy, particularly in rural areas, and limited female representation in ICT leadership roles.

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Overall, while Bulgaria's policy framework is ambitious and its participation indicators are strong, gaps in implementation, infrastructure, and digital literacy continue to limit the full realization of gender equality in ICT education and employment.

Academic and Policy Literature on Gender Indicators in ICT in Bulgaria

The desk research identified an extensive body of academic studies, national strategies, and international reports addressing gender indicators in ICT in Bulgaria. Together, these sources highlight the country's high female participation in ICT, its strong policy framework for digital education, and ongoing challenges in pedagogy, stereotypes, and digital literacy.

At the national level, key frameworks include the National Digital Decade Strategic Roadmap (2022–2027) and the Digital Education Framework (2022–2027), both mandating gender-sensitive teacher training and integration of inclusive ICT curricula aligned with DigComp 2.2.

At the European and international level, data from Eurostat, She Figures, and UNESCO confirm Bulgaria's leading participation rates but reveal gaps in digital literacy and women's underrepresentation in research leadership.

The academic literature and project reports—such as those from the American University in Bulgaria, OECD, and UNICEF—demonstrate progress through gender-sensitive curricula, pilot programs, and digital pedagogy innovations, while also identifying a need for more systematic teacher training and curriculum alignment.

Finally, Bulgaria's initiatives are supported by international guidance from UNESCO, UNICEF, UNGEI, and NESET, which provide frameworks for gender-responsive pedagogy and inclusive STEM learning.

Overall, the reviewed literature shows a strong strategic foundation but emphasizes the need for consistent implementation, enhanced teacher capacity, and balanced representation across all educational levels.

Cultural and Educational Influences on Gender Participation in ICT in Bulgaria

Bulgaria's cultural and educational background creates both enabling conditions and persistent barriers for gender participation in ICT. Historically, the country has a strong tradition of women in STEM. This success is supported by mandatory ICT education from primary to upper secondary school and the integration of digital literacy across subjects, ensuring early and equal access to digital learning.

However, cultural stereotypes and uneven pedagogical practices continue to limit girls' confidence and career aspirations. ICT is still often perceived as a "male domain," and by age 12, many girls begin to internalize these biases. Educational materials have historically

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reinforced this imbalance, though new textbook guidelines aim to ensure gender representation from 2025 onward.

The implementation of gender-responsive pedagogy remains inconsistent. Over 40% of ICT teachers report that they feel unprepared to apply gender-aware methods, and unequal access to infrastructure exacerbates disparities, especially in rural areas (European Commission, 2023).

At the same time, community and policy initiatives—such as those led by the Bulgarian Centre for Women in Technology, Telerik Academy School, and the Bulgarian Fund for Women—play a positive role in challenging stereotypes. These programs promote mentorship, family-based ICT learning, and visible female role models, helping to build girls' confidence and participation in technology fields.

Overall, while Bulgaria's educational structure supports equality in access, cultural norms and pedagogical gaps continue to shape gender representation in ICT. Sustained investment in teacher training, inclusive materials, and mentorship networks is key to consolidating these gains.

3.1.2 Field Research Findings

Qualitative Findings from School Communities and Stakeholders in Bulgaria

The qualitative data from students, teachers, and external stakeholders reveal encouraging progress in gender inclusion in ICT education, alongside persistent societal stereotypes and gaps in implementation.

Students reported that ICT classrooms are generally safe, inclusive, and engaging, with teachers treating boys and girls equally. They appreciated interactive, practice-based learning and preferred activities such as coding, digital design, and collaborative projects. However, they noted a lack of female role models in lessons and continued exposure to external stereotypes—for example, the belief that "computers are for boys." Older students expressed limited understanding of ICT career paths and called for more career guidance and examples of women in technology.

Teachers demonstrated commitment to inclusion but emphasized the need for structured training in gender-responsive pedagogy. Many rely on personal experience rather than formal frameworks. They apply strategies like balanced participation, mixed-gender teamwork, and creative projects, which effectively engage girls. Yet, teaching materials remain inconsistently inclusive, often depicting men in technical roles. Teachers identified family engagement and community collaboration as key enablers of sustained interest among girls.

Company representatives reported active diversity initiatives, including gender-neutral recruitment, mentorship programs, and inclusive workplace policies. They stressed the importance of transversal skills—creativity, teamwork, and problem-solving—alongside

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technical competence. Partnerships with schools through hackathons, workshops, and career sessions help bridge the gap between education and the labor market. Still, unconscious bias and underrepresentation in senior roles persist.

Overall, the findings highlight a supportive school environment and proactive private sector, but call for stronger teacher training, visibility of female role models, and curriculum alignment with real-world ICT careers to ensure lasting gender equality in digital education and employment.

Experiences, Attitudes, and Perceptions on Gender and ICT in Bulgaria

The qualitative findings from students, teachers, and company representatives reveal broadly inclusive experiences within schools but continued influence of external gender stereotypes and uneven exposure to female role models.

Students prefer practical, creative, and collaborative learning—such as coding games or designing apps—and value interactive teaching methods over theory. However, external stereotypes still shape perceptions, and female role models are rarely featured in lessons. Family encouragement is strong, but professional examples of women in ICT remain limited. Students also expressed uncertainty about ICT career paths and exposure to advanced topics such as AI and robotics.

Teachers reported moderate to high confidence in inclusive practices, consciously promoting balanced participation and creative, mixed-gender teamwork. Yet many rely on intuition rather than structured frameworks for gender-responsive pedagogy and call for practical training, lesson models, and materials. They recognize that girls' self-confidence often lags performance and that learning materials still overrepresent men in technical roles. Teachers emphasized project-based learning, family involvement, and continuous professional development as key strategies for sustaining girls' engagement in ICT.

Company representatives demonstrated a commitment to gender diversity, using gender-neutral recruitment, visible female mentors, and inclusive workplace policies. They acknowledged that unconscious bias persists, though optimism prevails as more women advance into leadership. Employers highlighted the need for transversal skills alongside technical expertise and called for closer alignment between education and workplace needs. Early exposure and mentoring are viewed as decisive for girls' future confidence and interest in ICT.

Overall, the evidence points to a supportive educational environment and growing institutional awareness, yet calls for systematic teacher training, stronger role modeling, and sustained cooperation between schools and industry to close the gap between equality in access and equality in aspiration.

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3.1.3 Policy Recommendations

The findings highlight that Bulgaria possesses strong policy frameworks for digital inclusion, yet gaps remain in perception, confidence, and long-term participation of women in ICT. To ensure coherence and effective implementation at national, regional, and EU levels, key recommendations are summarized in Table 4.

Table 4. Recommendations for Strengthening Gender Equality and Digital Inclusion in Bulgaria.

Integrate gender-responsive pedagogy into teacher education	Introduce mandatory modules on gender equality in digital learning within teacher training and certification, including practical examples and assessment criteria.
Conduct gender audits of curricula and materials	Ensure balanced representation of women and men in all new ICT and STEM textbooks, avoiding stereotypes and showcasing diverse professional pathways.
Create a national coordination platform for girls in ICT	Establish a cross-sector platform linking ministries, schools, NGOs, and private partners to harmonize existing initiatives and scale up impact.
Expand funding for inclusive extracurricular learning	Prioritize rural and disadvantaged communities through targeted grants supporting access to devices, mentorship, and digital clubs.
Establish measurable indicators and monitoring systems	Collect and analyze gender-disaggregated data on ICT enrolment, performance, and career transitions to align national progress with EU Digital Decade goals.

Overall, these recommendations aim to institutionalize gender equality in ICT education by embedding it into teacher training, curriculum design, and national coordination mechanisms—moving beyond isolated projects toward a sustained, system-level approach.

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3.2 Insights from Portugal

This section presents the findings from Portugal (Rodrigues et al., 2025), combining insights from the desk research and field research phases. Together, these findings provide a comprehensive understanding of the Portuguese context.

3.2.1 Desk Research Findings

National Data on Girls in ICT Education and Professions in Portugal

Portugal demonstrates a strong national commitment to gender equality in ICT, supported by comprehensive strategies such as the National Strategy for Equality and Non-Discrimination (ENIND) 2018–2030, the Gender and Citizenship Education Guidelines, and the INCoDe.2030 program. These frameworks promote gender-sensitive pedagogy, equal access to ICT education, and the integration of digital literacy across all educational levels.

Despite this solid policy foundation, persistent challenges remain. Girls continue to exhibit lower digital self-confidence than boys, even with similar skill levels, which limits engagement in ICT pathways. The curriculum lags behind emerging digital skills needs—particularly in AI, data literacy, and cybersecurity—and gender bias in classroom interactions persists, with teachers sometimes unconsciously assigning different roles or expectations based on gender. Geographical disparities further limit access and inclusion in rural areas.

Portugal has launched several effective national initiatives addressing these barriers. Programs such as "Engineers for a Day", "Technovation Girls", and "Girls in Science" provide hands-on learning and female role models, boosting girls' confidence and visibility in ICT. Projects like "Free Choices: Stereotypes Are Not My Gender" focus on teacher training and bias awareness, while early-intervention measures integrate gender equality into ICT education from preschool age.

Overall, Portugal combines robust policy infrastructure with practical initiatives promoting inclusion, yet continued focus on confidence-building, curriculum modernization, and rural outreach is needed to achieve full gender equality in ICT education and professions.

Relevant Academic and Policy Literature in Portugal

The desk research identified a comprehensive body of academic studies, national policy frameworks, and European strategies addressing gender equality in ICT in Portugal. Collectively, these sources highlight strong policy commitment, solid theoretical foundations, and practical pedagogical tools promoting gender inclusion in digital education.

At the national level, key frameworks include the National Strategy for Equality and Non-Discrimination (ENIND) 2018–2030, the Gender and Citizenship Education Guidelines, and

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INCoDe.2030, all of which integrate gender perspectives into education, support inclusive teaching, and promote digital literacy for girls. Complementary initiatives, such as the National Plan for Gender Equality and EEA-funded project recommendations (2024), further strengthen policy coherence.

The academic and research literature underscores the importance of inclusive digital pedagogy and early intervention. Studies (e.g., Ferreira & Silva, 2016; Marques et al., 2022) confirm ICT's potential to enhance girls' engagement and creativity, while international frameworks such as Social Cognitive Career Theory (SCCT) and Expectancy-Value Theory provide conceptual grounding for addressing stereotypes and boosting motivation. Research from OECD and UNESCO reinforces the need to build girls' digital self-confidence from early childhood.

Portugal's context is also aligned with European and international strategies—including the EU Digital Education Action Plan (2021–2027), European Skills Agenda (2020), EU Gender Equality Strategy (2020–2025), and Women in Digital Strategy—which collectively promote gender-sensitive teaching, equal access to digital training, and increased female participation in STEM.

Finally, several pedagogical resources and best-practice projects—such as "Free Choices: Stereotypes Are Not My Gender", the Gender and Youth Pedagogical Kit, CUIDAdania, and "Girls in Science"—serve as practical tools to help educators challenge bias and showcase female role models in technology.

Overall, Portugal's literature base reveals a well-integrated ecosystem of policies, theory, and practice, though ongoing efforts are needed to translate frameworks into consistent classroom implementation and sustain gender equality in ICT education.

Socio-Cultural Context and Historical Trends in Portugal

Portugal's socio-cultural and educational context reflects a strong institutional commitment to gender equality in ICT, yet deep-seated stereotypes and classroom-level biases continue to shape girls' participation and confidence in the field.

National strategies—such as the National Strategy for Equality and Non-Discrimination (ENIND) 2018–2030, Gender and Citizenship Education Guidelines, and INCoDe.2030—promote gender-responsive pedagogy, digital literacy, and early exposure to ICT. Early interventions led by the Commission for Citizenship and Gender Equality (CIG) aim to prevent the internalization of stereotypes from early childhood, fostering a culture of equality in technology engagement.

However, cultural and societal influences remain persistent barriers. Gender bias is still visible in classroom practices, where teachers may unintentionally assign girls administrative roles and boys' technical tasks. Textbooks and classroom language often lack female representation,

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reinforcing the perception of ICT as a male domain. These dynamics contribute to a digital self-confidence gap, with girls often underestimating their abilities despite performing equally well.

Educationally, Portugal faces a skills and curriculum gap: advanced ICT competencies—such as AI, data literacy, and cybersecurity—are insufficiently embedded in formal education and depend largely on individual teachers' initiatives. Rapid technological change also challenges schools' capacity to provide equitable access to resources, particularly for girls in under-resourced contexts.

To counteract these influences, Portugal has implemented targeted initiatives combining mentorship, inclusive pedagogy, and visibility. Programs like "Engineers for a Day", "Technovation Girls", and "Girls in Science" promote female role models and hands-on learning, while teacher training initiatives such as "Free Choices: Stereotypes Are Not My Gender" strengthen educators' capacity to challenge bias. Efforts to create gender-sensitive materials and language further support a more inclusive representation of ICT careers.

Overall, Portugal demonstrates a progressive and policy-driven approach to gender equality in ICT, but sustained focus on teacher training, curriculum modernization, and cultural change remains essential to ensure that equality in access translates into equality in confidence and participation.

3.2.2 Field research findings from Portugal

Qualitative Findings from School Communities and Stakeholders in Portugal

The qualitative data from students, teachers, and company representatives in Portugal highlight progress toward inclusive ICT education, but also persistent cultural stereotypes, limited training, and gaps between education and workplace expectations.

Students described teachers as generally fair and inclusive, though ICT lessons are often repetitive and disconnected from real-world applications. They expressed enthusiasm for creative, hands-on projects such as game design, video editing, and robotics, but noted that gender stereotypes among peers and traditional roles at home still limit girls' engagement. Many students observed a lack of female role models in learning materials and digital culture, with girls in online spaces facing pressure and sexualization. Positive experiences were linked to collaborative, practical projects and programs like Science Factory in Aveiro and school Hackathons, which fostered confidence and teamwork.

Teachers showed a strong commitment to inclusive, project-based teaching, using gamification and interdisciplinary approaches to make technology accessible. However, they cited a lack of formal training in gender-responsive pedagogy and limited institutional support for collaboration and resource updates. Teachers emphasized the need to engage families to

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challenge cultural stereotypes and proposed activities like "digital families" workshops. Successful initiatives included "Engineers for a Day" and creative media projects, but sustained impact depends on systemic support and professional development.

Company representatives reported steady progress toward gender-balanced recruitment and inclusive workplace cultures. They highlighted mentoring, leadership opportunities, and ethical codes as key enablers of equality. Nonetheless, skills mismatches persist graduates often lack hands-on experience and exposure to emerging technologies such as AI, cybersecurity, and engineering applications. Firms stressed the importance of transversal skills (resilience, creativity, teamwork) and early partnerships between education and industry to bridge this gap.

Overall, the findings point to a supportive educational and corporate environment yet achieving true gender parity in ICT requires curriculum innovation, structured teacher training, stronger family engagement, and closer school–industry collaboration to align learning with future digital careers.

Experiences, Attitudes, and Perceptions on Gender and ICT in Portugal

The findings from students, teachers, and company representatives in Portugal reveal a mixed picture of progress and persistence: schools and workplaces show a strong commitment to equality, yet stereotypes, confidence gaps, and limited training continue to affect girls' participation and perceptions of ICT.

Students described ICT classes as generally inclusive and supportive, with teachers treating boys and girls equally. However, lessons were often seen as repetitive and lacking creativity, and peer stereotypes continue to exclude girls from technology-related activities. Many girls experience pressure and sexualization in digital spaces, while traditional roles at home still assign technical tasks to men. Students emphasized the positive influence of supportive teachers and called for more engaging, hands-on projects and the inclusion of female role models to make ICT feel more relevant and attainable.

Teachers demonstrated strong commitment to equality and inclusive pedagogy, applying active, project-based learning methods and confronting stereotypes in class. They noted gendered differences in interest and confidence—boys often more assertive, girls more detail-oriented—and use collaboration to balance participation. However, teachers expressed moderate confidence in gender-sensitive teaching, citing a lack of specific training and limited institutional support. They highlighted the crucial role of families in dismantling stereotypes and proposed initiatives such as "digital families" and "mother–daughter" workshops to promote shared technology experiences.

HR managers and company representatives reported growing gender balance in the ICT workforce and an emphasis on inclusive recruitment, visible female leadership, and

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psychological safety. Companies have implemented codes of ethics, anonymous reporting, and mental health support, while actively addressing subtle bias. Yet, employers stressed the skills gap between education and labor market needs, particularly in AI, cybersecurity, and practical experience. They also underscored the importance of transversal skills like resilience and teamwork and commended policies that support career continuity for women returning from family-related breaks.

Overall, while Portugal's school and corporate environments show significant progress toward gender inclusion in ICT, persistent cultural stereotypes, limited teacher training, and educational-practice gaps still hinder full equality. Strengthening teacher preparation, family engagement, and school–industry partnerships remain essential to bridge the gap between policy ambition and lived experience.

3.2.3 Policy Recommendations for Portugal

The findings highlight that while Portugal has strong gender equality frameworks, greater implementation, investment, and awareness are needed to close the gap between policy ambition and practice. The recommendations are structured across national, regional, and EU levels, emphasizing teacher training, curriculum reform, and cross-sector collaboration.

National and regional level recommendations focus on integrating gender-responsive approaches into education and promoting inclusive learning environments. The key actions proposed are summarized in Table 5.

Table 5. National and Regional Recommendations for Gender-Responsive and Inclusive Education.

Pedagogy and Teacher Training	Mandate gender-responsive pedagogy in ICT curricula and ensure all teachers receive training on gender equality, inclusive teaching methods, and bias-free classroom practices. Teaching should actively feature diverse role models and learning materials that challenge stereotypes.
Investment and Program Integration	Scale up initiatives such as Technovation Girls and Engineers for a Day, embedding them within the national education system to give girls early and consistent exposure to ICT and STEM careers.
Awareness and Societal Change	Launch nationwide campaigns to challenge gender stereotypes in technology, targeting schools, families, and communities. Local authorities should complement this with

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	region-specific initiatives promoting family involvement and equal participation in ICT.
Local Collaboration and Labour Market Alignment	Encourage partnerships between schools, universities, companies, and municipalities to design ICT programs aligned with regional economic needs, including fields such as AI, digital marketing, and entrepreneurship, ensuring both genders benefit equally.

EU Level Recommendations call for greater coordination and resource sharing:

- **Standard Setting and Frameworks**: The EU should establish union-wide standards for gender-sensitive ICT education and provide implementation frameworks and toolkits to support member states.
- **Funding and Cooperation**: Allocate dedicated EU funding to initiatives that close the gender gap in ICT, and promote cross-border partnerships among schools, higher education institutions, NGOs, and industry to enhance the visibility and participation of women in digital professions.

Overall, these recommendations aim to institutionalize gender equality in ICT education by embedding inclusive pedagogy, expanding targeted programs, fostering regional collaboration, and ensuring EU-level coherence—transforming equality policies from isolated projects into sustained systemic practice.

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3.3 Insights from Spain

This section presents the findings from Spain (Iglesias Arriaran & Santurtun Bugallo, 2025), combining insights from the desk research and field research phases. Together, these findings provide a comprehensive understanding of the Spanish context.

3.3.1 Desk Research Findings

National Data and Gender Indicators in ICT in Spain

Despite significant national efforts to promote gender equality and digital competence within the education system, Spain continues to face a persistent gender gap in ICT and STEM fields.

Although women make up most university students, their representation in technological disciplines remains low—only 14% of Computer Science and 28% of Engineering graduates are women. Interest disparities appear early: just 0.7% of girls, compared to 7% of boys, express an intention to pursue digital technology degrees. This imbalance poses a challenge to Spain's digital economy, which depends on diverse talent in ICT and STEM sectors. Early education data also reveal subtle gender differences in performance—boys tend to excel in math activities, while girls outperform in reading—suggesting that stereotypes and family socialization patterns influence later educational choices.

The desk research identified a lack of systematic data on girls' enrolment and progression in technological fields. To address this, the Ministry of Education and Vocational Training launched the STEAM Alliance for Female Talent: "Girls in Science" (2021). This initiative aims to strengthen data collection and evidence-based policy by:

- Establishing a statistical observatory to monitor girls' and women's participation in STEAM education,
- Using sex-disaggregated data to inform educational planning and decision-making, and
- Increasing the number of girls pursuing scientific and technological studies across secondary, vocational, and higher education.

Overall, while Spain demonstrates strong institutional commitment, systematic data monitoring and early interventions remain essential to closing the gender gap and promoting women's full participation in the ICT and STEM sectors.

National Data and Gender Indicators in ICT in Spain

Spain shows a clear institutional commitment to gender equality and digital education, yet a persistent gender gap remains in ICT and STEM pathways. Despite women forming the

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majority of university students, their participation in technological fields remains limited. The imbalance begins early, posing a long-term challenge to Spain's digital economy and innovation capacity.

The desk research also identified major data gaps concerning girls' participation in ICT education. To address this, the Ministry of Education and Vocational Training launched the STEAM Alliance for Female Talent: "Girls in Science" (2021). The initiative seeks to improve data collection and evidence-based policymaking by creating a national observatory to track girls' and women's progress in STEAM education, using sex-disaggregated data for policy planning, and encouraging more girls to pursue scientific and technological studies at all educational levels.

Overall, while Spain's policies are strong and forward-looking, systematic monitoring and early, gender-sensitive interventions remain crucial to achieving real parity and strengthening women's participation in ICT and STEM careers.

Cultural and Educational Background Influencing Gender Participation in ICT in Spain

Spain's cultural and educational context plays a central role in shaping gender participation in ICT and STEM, combining progressive policy frameworks with persistent societal stereotypes that continue to influence girls' interests, confidence, and career pathways.

Societal and cultural norms remain powerful in determining early educational choices. Although Spanish children begin school with strong math proficiency, gendered family expectations and socialization patterns lead boys to engage more with mathematics and technology, while girls excel in reading and language-based subjects. Few adolescent girls express an interest in digital technology studies compared to boys, reflecting how stereotypes and family roles, including parents' own math anxiety and traditional caregiving expectations—shape perceptions of suitability for STEM. Strengthening parental involvement and awareness is thus considered vital for fostering girls' early confidence in mathematics and digital skills.

Spain's education policy has made notable strides to counter these cultural biases. The national education law LOMLOE (2020) mandates the integration of gender equality and digital competence across all educational stages, explicitly requiring gender-sensitive career guidance. The STEAM Alliance for Female Talent: "Girls in Science" (2021) further promotes women's visibility in STEAM fields, encourages girls' participation, and raises awareness among families, educators, and the broader public about gender equity in science and technology.

However, implementation challenges persist. Despite progressive legislation, women remain underrepresented. Inclusive teaching practices, such as hands-on and interdisciplinary learning, are unevenly applied across regions, and teachers often lack formal training in recognizing and addressing gender bias. Learning materials continue to underrepresent

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female role models, requiring teachers to supplement content with external examples. Schools that highlight visible female ICT teachers and mentors, such as Centro San Viator, show that role models can strongly influence girls' confidence and aspirations.

Overall, while Spain's educational system demonstrates a strong structural commitment to gender equality, societal norms, teacher preparedness, and limited data collection continue to constrain full equity in ICT participation. Strengthening teacher training, family engagement, and consistent implementation of gender-responsive practices will be crucial to transforming policy into long-term cultural change.

3.3.2 Field research findings

Qualitative Findings from School Communities and Stakeholders in Spain

The qualitative data from students, teachers, and company representatives in Spain reveal a consistent pattern of gendered socialization, uneven early exposure to technology, and persistent structural barriers affecting women's engagement and progression in ICT fields.

Students expressed generally positive attitudes toward technology, but highlighted challenges related to learning quality and gendered participation. While both boys and girls value digital tools, many preferred a hybrid learning model combining digital and printed materials for better focus and comprehension. A clear gender divide emerged in academic trajectories: boys gravitate toward technological or scientific studies, while girls tend toward bio sanitary fields, a trend shaped by early exposure and social expectations. Boys more often encountered programming, robotics, and gaming at a young age, while girls reported fewer such opportunities. Female students also described negative experiences in online spaces—such as exclusion, harassment, or discomfort—that discouraged participation in informal digital learning environments.

Teachers confirmed the existence of gendered engagement patterns and subtle biases in classroom dynamics. Boys were described as seeking competitive, game-oriented tasks, while girls showed greater interest in collaborative, structured, and creative projects. Teachers observed that boys sometimes dominated shared digital spaces, and gendered comments occasionally surfaced, reflecting broader cultural norms. Educators are increasingly adopting female role models and relatable platforms, such as TikTok or Instagram, to engage girls in ICT-related learning but noted the need for more training in gender-sensitive pedagogy and professional development to build inclusive digital classrooms.

Company representatives and HR managers highlighted structural inequalities that persist in the workplace despite growing gender diversity. In many small and medium enterprises, authority remains male-dominated, and women often carry a dual burden of technical and administrative work. Interviewees described biases in recognition and promotion, where women's ideas are undervalued until echoed by male colleagues, and noted glass ceiling

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effects that limit women's access to middle management. Family responsibilities, particularly motherhood, remain a key barrier to advancement due to unequal caregiving expectations and rigid work structures. However, inclusive organizations are addressing these issues through flexible work policies, mentorship programs, and equality quotas in training initiatives.

Overall, the findings show that while Spain's educational and corporate sectors are moving toward inclusion, deep-seated cultural patterns, unequal early exposure, and workplace biases continue to constrain women's full participation in ICT. Strengthening gender-responsive teaching, professional development, family engagement, and flexible workplace policies will be essential to closing the gap from education to employment.

Experiences, Attitudes, and Perceptions Regarding Gender and ICT in Spain

The experiences and perceptions of students, teachers, and ICT professionals in Spain reveal enduring gendered patterns shaped by early socialization, classroom dynamics, and workplace structures. While attitudes toward inclusion are generally positive, subtle biases and structural barriers continue to limit women's full participation in ICT.

Students expressed clear awareness of gendered academic pathways and early social influences. Boys typically pursue technological or scientific tracks, while girls more often choose bio sanitary or healthcare studies, a pattern attributed not to ability but to differences in early exposure and encouragement. Boys were more frequently introduced to robotics, gaming, and programming at a young age, while girls reported fewer opportunities and limited family or institutional support for tech-related extracurriculars. Online spaces such as gaming and tech forums remain male-dominated, with girls citing negative experiences and exclusion as deterrents. Despite these barriers, students held positive views of digital tools in learning but preferred a hybrid approach blending digital and traditional materials for better concentration.

Teachers confirmed these gendered engagement trends. Boys often seek competitive and game-based activities, while girls tend to excel in structured and collaborative projects. Some teachers noted that girls showed greater perseverance and attention to detail in programming and teamwork. However, classroom bias persists, with occasional gendered comments undermining girls' confidence. Teachers actively use female role models and relatable platforms like TikTok to challenge stereotypes but emphasized the need for targeted training in gender-sensitive pedagogy. They also shared student concerns about screen fatigue, advocating for a balanced use of digital and printed resources.

HR managers and company representatives described a gendered workplace hierarchy where authority remains male-dominated, even in organizations employing qualified women. Women often bear a "dual role," managing both technical and administrative responsibilities while receiving less recognition. Maternity-related challenges—unequal pay during leave,

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pressure to return early, and uneven caregiving duties—contribute to slower career progression and the persistence of glass ceiling effects. Nonetheless, many companies are implementing inclusive strategies, including equality quotas, flexible work policies, and mentoring programs. The presence of female role models and creative mentors was identified as a powerful factor in making ICT careers more attractive, inclusive, and human-centered.

Overall, the findings illustrate that Spain's progress toward gender equality in ICT is evident in awareness and policy efforts, but unequal access, bias, and social norms still shape experiences from education through employment. Strengthening gender-responsive teaching, early exposure, and workplace inclusivity remains crucial to achieving meaningful parity in the sector.

3.3.3 Policy Recommendations from Spain

The findings lead to multi-level policy recommendations addressing education, data, and awareness at the national, regional, and European levels.

At the national level, Spain should strengthen gender-disaggregated data collection across all education stages, expand teacher training in gender-responsive pedagogy and digital literacy, and launch campaigns highlighting women's contributions in STEM and ICT to promote female role models and counter stereotypes.

At the regional level, policies should ensure consistent implementation of gender-sensitive approaches across Autonomous Communities and support schools in replicating successful local practices.

At the European level, collaboration through programs like Erasmus+ and Horizon Europe should be expanded to share best practices and fund research on gender equality in STEM. EU-wide awareness campaigns should further challenge stereotypes and encourage girls' participation in digital fields.

Overall, these recommendations emphasize a comprehensive, system-wide approach linking education, professional development, and workplace inclusion. Sustained monitoring and evaluation will be key to identifying effective strategies and ensuring long-term progress toward gender equity in ICT.

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4 Identifying Barriers and Enablers: A Cross-Country Synthesis of Key Factors and Actors

This chapter provides a thematic synthesis of the findings from the desk and field research conducted across Bulgaria, Portugal, and Spain, focusing on the key factors and actors that either enable or impede girls' aspirations and participation in Information and Communication Technologies (ICT) studies and careers. The field research encompassed focus groups and surveys involving both primary and secondary school students, as well as teachers and industry representatives, thereby capturing perspectives across different educational stages and age groups. The thematic synthesis identifies three interrelated dimensions that shape girls' participation in ICT: the Confidence Gap, reflecting gendered differences in self-efficacy and motivation; the Socialization Gap, capturing the influence of cultural and familial expectations; and the Pedagogical Gap, referring to the disjunction between policy frameworks and classroom realities that determine how gender equality is enacted in practice. While all three intervention countries demonstrate high-level policy commitment to digital inclusion and gender equality, the evidence reveals a persistent gap between formal access and the psychological, cultural, and pedagogical realities experienced by girls in educational settings.

Table 6. Conceptual framework of the three interrelated "Gaps" influencing girls' participation in ICT.

Analytical Level	Concept / Gap	Core Meaning	Main Evidence
Individual / Psychological	Confidence Gap	Girls' lower digital self-efficacy and underestimation of their technical abilities despite comparable skills.	Field data from classroom observations and student interviews across all three countries (Spain, Portugal, Bulgaria).
Social / Cultural	Socialization Gap	Persistent gender norms in families, peers, and media	Desk and field evidence of family stereotypes, peer

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		that discourage girls from pursuing ICT pathways.	interactions, and digital safety issues.
Institutional / Pedagogical	Pedagogical Gap	The disconnection between teachers' commitment to equality and the lack of systemic support, training, and inclusive content to enact it.	Cross-country data showing uneven teacher preparation, material bias, and absence of structured frameworks.

4.1 Structural and Institutional Context: Formal Access and Policy Commitment

A primary enabling factor across the intervention countries is the strong presence of national policy and curriculum frameworks that mandate digital competence acquisition and promote gender equity. Yet, while these frameworks establish the foundation for inclusion, they do not guarantee its realization. This institutional commitment provides the necessary but insufficient structural basis for achieving equality in ICT education.

The three intervention countries possess comprehensive national policies and strategies that articulate clear commitments to gender equality and digital transformation. Spain's LOMLOE (2020) and the STEAM Alliance for Female Talent (Pastrana et al., 2022), Portugal's National Strategy for Equality and Non-Discrimination (ENIND), Gender and Citizenship Education Guidelines, and INCoDe.2030 Program, as well as Bulgaria's Strategic Roadmap for the Digital Decade (2022–2027), all explicitly aim to reduce the gender gap and integrate digital literacy across the curriculum (Spanish Report, pp. 15–16; Portuguese Report, pp. 8–9; Bulgarian Report, pp. 23–26).

Bulgaria exemplifies structural enablement by making core ICT subjects such as Computer Modelling and Information Technologies (CMIT) and Informatics compulsory from grades 3–4 (ages 8–10) through upper secondary education (Bulgarian Report, pp. 26–27). This guarantees that girls receive formal exposure to algorithmic thinking and digital literacy from an early age, irrespective of initial interest. Despite these institutional enablers, significant challenges remain. There is a persistent gap between the skills taught in schools and the competencies demanded by the digital economy, particularly in artificial intelligence (AI), data literacy, and

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cybersecurity (Portuguese Report, pp. 22–24). Moreover, the effectiveness of structural mandates is undermined by consistently low enrolment rates of women in specialized ICT and engineering fields, defining a shared "paradox of access." In Spain, for example, only 14 percent of Computer Science graduates and 28 percent of Engineering graduates are women, while merely 0.7 percent of adolescent girls express interest in pursuing degrees related to digital technologies, compared with 7 percent of boys (Spanish Report, pp. 27–28; Observatorio Nacional de Tecnología y Sociedad, 2023). This disparity demonstrates that structural frameworks, however comprehensive, are insufficient to dismantle deeply embedded societal barriers.

4.2 Sociocultural and Psychological Barriers: Confidence, Identity, and Belonging

The most persistent barriers to girls' sustained engagement with ICT arise not from formal curricula, but from the sociocultural and psychological contexts that shape self-perception, confidence, and identity. These factors operate largely outside the classroom yet profoundly influence how girls see themselves as potential participants in technology. Two interrelated dimensions emerge across the data: the Confidence Gap and the Socialization Gap, both of which restrict girls' sense of belonging in ICT.

The analysis introduces the terms "Confidence Gap" and "Socialization Gap" as analytical constructs derived from recurring patterns across the national reports. While these concepts do not appear as formal categories in the country studies, they synthesize consistent evidence regarding gendered differences in self-confidence, socialization, and identity formation.

Across all three countries, field research consistently identified a significant gap in digital self-confidence between girls and boys, even when technical abilities were equivalent. Girls frequently underestimated their competence, hesitated to take leadership roles in group projects, and expressed anxiety about making mistakes in technical tasks. This self-efficacy barrier is reinforced by subtle micro-aggressions and gendered expectations within learning environments.

In Spain, teachers described situations where boys made dismissive comments toward girls' ICT performance — for instance, "¿Eres una manta? ¿Por qué eres una chica?" ("Are you useless because you're a girl?") (Spanish Report, pp. 17–18). Such remarks, though often informal,

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reinforce the perception that the technical space is male owned. Portuguese students reported similar dynamics: boys tended to dominate shared digital platforms and classroom devices, monopolizing participation in games and coding activities (Portuguese Report, pp. 23–24). As one teacher observed, "Girls are interested, but they rarely get the keyboard first."

The data indicate that girls' confidence and engagement grow substantially when classrooms cultivate psychological safety—that is, when students feel respected, supported, and encouraged to take intellectual risks without being judged (Spanish Report, pp. 18–19; Portuguese Report, p. 25).

4.3 The Role of Key Actors: Bridging the Gaps

Bridging the gaps identified in the previous sections depends on the collective agency of key actors within the education ecosystem. Teachers, families, communities, and industry representatives each play a distinct but interdependent role in transforming gender equality from policy ambition into lived educational reality.

Teachers and the Pedagogical Gap

Pedagogical Gap refers to the disconnection between teachers' commitment to gender equality and the structural limitations that constrain their practice, including insufficient training, lack of inclusive materials, and the absence of standardized gender-responsive frameworks. Together with the Confidence Gap and Socialization Gap, it helps explain the multi-layered dynamics that hinder girls' sustained participation in ICT.

Teachers are consistently identified as the most decisive agents of change. Across the three countries, many educators demonstrate a strong personal commitment to equality and employ innovative strategies such as project-based learning (PBL). Spain's PinkForce school-level initiative illustrates this potential, showing how linking robotics to social impact enhanced girls' confidence and motivation (Spanish Report, pp. 14–15). Yet the pedagogical gap—the absence of systematic training, relevant content, and inclusive teaching materials—prevents such practices from becoming institutional norms. In Bulgaria and Portugal, teachers frequently rely on intuition rather than structured frameworks for gender-responsive pedagogy, resulting in uneven implementation (Bulgarian Report, p. 34; Portuguese Report, p. 27). In Portugal, students described ICT lessons as repetitive and disconnected from creativity (Portuguese Report, p. 23), while in Spain and Bulgaria teachers noted the persistent lack of

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female role models in textbooks and digital resources (Spanish Report, p. 17; Bulgarian Report, p. 24). These gaps underscore the need for a standardized, evidence-based framework that supports teachers in embedding gender equity into digital education.

Families and Communities

Family involvement often functions as a passive enabler, centered on supervision and safety rather than motivation and exploration. Evidence from Bulgaria and Portugal indicates that teachers actively seek structured programs to engage parents in countering stereotypes and encouraging technical curiosity (Bulgarian Report, pp. 30–31; Portuguese Report, pp. 28–29). Awareness sessions that emphasize the importance of mathematical learning and digital skills can challenge long-standing cultural assumptions. Community-based initiatives such as the Bulgarian Fund for Women (BFW) and BCWT demonstrate how intergenerational learning can normalize girls' participation in technology within family contexts (Bulgarian Report, pp. 30–32). Family engagement, therefore, should be understood not as supplementary, but as foundational to digital inclusion.

Representation and Industry

Beyond schools and families, the visibility of women in ICT professions is essential to overcoming the confidence deficit and shaping aspirations. Spain's Inspiring Girls campaign shows that exposure to female role models significantly enhances girls' self-perception and reduces gender bias (Spanish Report, p. 25). Industry collaboration likewise plays a crucial role in linking education with future opportunities. Across all three countries, company representatives called for more hands-on experiences, internships, and mentoring to bridge the divide between classroom learning and professional reality (Portuguese Report, pp. 31–33; Bulgarian Report, p. 28). Programs such as the STEAM Alliance for Female Talent demonstrate how partnerships between education and industry can demystify technical careers and promote inclusive representation (Spanish Report, p. 25).

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4.4 Key Synthesis: The Paradox of Access and the Call for Systemic Change

The comparative analysis across Bulgaria, Spain, and Portugal reveals a shared paradox of access: while high-level structural commitment to gender equality in ICT has created near parity in formal access, significant disparities persist in perception, confidence, and continuity. In all three contexts, girls now encounter ICT education as a compulsory and ostensibly inclusive field, yet the experience of belonging and progression remains unequally distributed.

The evidence underscores a crucial transition point for policy and practice. Inclusion can no longer depend on individual enthusiasm, whether that of highly motivated teachers, pioneering schools, or isolated NGO projects, but must evolve into a fully institutionalized system of practice. The next phase of the LeadHER initiative therefore requires the consolidation of existing strengths into a coherent, sustainable ecosystem of support that bridges structural, pedagogical, and socio-psychological divides.

Three interdependent domains emerge as priorities for systemic change. First, psychological belonging must be addressed through structured mentoring and role-model schemes, ensuring that girls encounter visible examples of women in ICT and have opportunities to build self-efficacy and confidence (Framework Component 6.1). Second, pedagogical consistency requires the creation of a Teachers' Toolbox, providing evidence-based guidelines, inclusive teaching materials, and practical training to embed gender-responsive methods across disciplines (Component 6.2). Third, the socialization gap must be countered through an integrated Family and Community Engagement Program, aimed at transforming family environments from passive overseers into active motivators of girls' digital learning (Component 6.3).

Together, these components translate the comparative findings of this chapter into actionable strategies for systemic transformation moving from access to agency, from equality of opportunity to equality of participation.

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5 Good Practices for Systemic Change: Evidence-Based Models and Transferability

5.1 From Access to Agency

Building on the analytical framework developed in Chapter 4, this chapter explores evidence-based practices that have successfully addressed the three interrelated barriers constraining girls' participation in ICT: the Confidence Gap, the Socialization Gap, and the Pedagogical Gap. While the pedagogical dimension remains central to the LeadHER project's objectives, the evidence confirms that systemic change can only be achieved when progress occurs simultaneously across all three domains — beginning with individual confidence, expanding through socialization, and institutionalizing through pedagogy.

The practices and lessons discussed in this chapter are derived from the LeadHER field and desk research conducted across Bulgaria, Portugal, and Spain (see Country Reports, 2025). They represent a synthesis of findings already analyzed in Chapter 4 and focus on identifying transferable principles and models of change that can inform the design of the LeadHER Teaching Framework.

Despite strong national policy commitments to digital inclusion — for instance, Bulgaria's introduction of compulsory ICT education from the early grades — the findings show that formal access alone does not guarantee equitable outcomes or sustained engagement. Successful interventions address the microcultures of learning, belonging, and aspiration within classrooms and families, rather than focusing solely on curriculum compliance. The following sections summarize the practices and approaches that have proven most effective in transforming access into agency.

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5.2 Addressing the Confidence Gap: Visibility, Mentorship and Learning Structures

Across all three national contexts, girls' digital self-efficacy remains consistently lower than their demonstrated competence. Successful interventions counter this Confidence Gap by increasing visibility, providing relatable role models, and creating psychologically safe learning environments where experimentation is encouraged and mistakes are treated as part of learning.

Spain's Inspiring Girls initiative (Spanish Report, 2025) exemplifies the impact of mentorship and representation. Through volunteer sessions with women professionals in STEM, girls gained exposure to real-world success stories that demystified technical careers and normalized women's presence in ICT fields. Evaluations of the program indicated a measurable increase in girls' confidence and willingness to consider ICT studies.

Confidence also flourishes where pedagogy promotes collaboration rather than competition. Bulgaria's Telerik Academy School demonstrates this principle at scale: its balanced gender ratio is achieved not through quotas but through a pedagogy based on team coding, problem-solving, and peer-driven projects. These cooperative structures enable girls to assume leadership roles and build competence within psychologically safe spaces. Portuguese teachers reported similar findings when connecting ICT learning to creative or socially relevant projects — for example, through art, environmental issues, or human rights education (Portuguese Report, 2025). These cases underline a shared insight: confidence is cultivated in contexts where participation is valued, relevance is emphasized, and success is collectively defined.

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5.3 Countering the Socialization Gap: Families, Communities and Cultural Narratives

The Socialization Gap reflects how cultural expectations, family roles, and peer norms continue to shape perceptions of who "belongs" in technology. Effective interventions expand the learning ecosystem to include families and communities as active agents of change.

In Bulgaria, the Bulgarian Fund for Women (BFW) supported intergenerational workshops in which teenage girls and their mothers jointly explored web design and online safety (Bulgarian Report, 2025). These activities reframed ICT as a shared family practice rather than a male-coded skill. Similarly, Portuguese teachers advocated "digital family" workshops to engage parents — particularly mothers — as co-learners in technology-related subjects. Such participatory family models disrupt entrenched domestic divisions and create new opportunities for girls to see themselves as capable users and creators of technology.

Beyond the home, large-scale coordination mechanisms reinforce broader cultural change. Spain's STEAM Alliance for Female Talent (Spanish Report, 2025) unites more than 150 organizations across education, research, and industry to promote inclusive curricula and positive media representations of women in technology. This coordinated approach transforms localized good practices into national narratives, embedding gender equality within public discourse and educational culture alike. Together, these models confirm that sustainable transformation requires an ecosystemic approach that links families, schools, and the wider social environment.

5.4 Closing the Pedagogical Gap: Institutionalizing Gender-Responsive Practice

Teachers stand at the intersection of policy ambition and classroom reality. The Pedagogical Gap emerges when personal commitment to gender equality is not supported by institutional frameworks, consistent training, or inclusive teaching materials. Practices that successfully

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close this gap demonstrate how pedagogical reform can function as a catalyst for systemic change.

Spain's PinkForce initiative at Centro San Viator Sopuerta (Spanish Report, 2025) shows how socially relevant project-based learning can inspire girls to engage in robotics and engineering. By designing assistive robots for hospitalized children, students connected technology with empathy and social value, resulting in higher motivation and confidence among girls. In Portugal, teachers reported similar effects when integrating ICT projects into interdisciplinary contexts such as art or environmental studies, showing that contextual relevance enhances participation.

Equally important are efforts to identify and correct bias within learning materials. The Gender-Sensitive Digital and Media Literacy Project in Bulgaria (Bulgarian Report, 2025) conducted audits of ICT textbooks to replace male-dominant examples with gender-balanced narratives. Early outcomes indicated increased interest and participation from female students in technical classroom roles. These practices highlight the importance of systematic, institutionalized approaches to inclusion: gender responsiveness must be professionalized through teacher education, curriculum design, and school governance rather than left to individual initiative.

5.5 Cross-Country Lessons and Transferability

Despite contextual differences, the mechanisms underlying gender inequality in ICT education are strikingly consistent. The Confidence Gap appears universally, manifesting as underestimation of ability despite comparable achievement. The Socialization Gap persists through cultural narratives that link technology with masculinity, limiting the impact of even the most inclusive curricula. The Pedagogical Gap, while shaped by national governance and teacher-training structures, consistently reveals a reliance on individual goodwill rather than systemic capacity.

Successful initiatives across Bulgaria, Portugal, and Spain share three transferable principles. They embed creativity and social relevance within technology education, making ICT meaningful and human-centered. They ensure continuous exposure to credible female role models, enabling girls to visualize themselves in digital futures. And they align actors across the educational ecosystem — teachers, families, communities, and industry — to create coherence and sustainability. These shared principles form the conceptual bridge from analysis to action, providing the foundation for the LeadHER Teaching Framework.

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5.6 Implications for the LeadHER Teaching Framework

Transforming access into meaningful participation requires progress across the psychological, social, and institutional dimensions of learning. The evidence presented here translates into conceptual requirements for the forthcoming LeadHER Teaching Framework.

Addressing the Confidence Gap demands that mentoring and role-modelling schemes become embedded features of school culture (Framework Component 6.1). These initiatives build self-efficacy and make women's presence in ICT visible and attainable. Closing the Pedagogical Gap requires a Teachers' Toolbox (Component 6.2) that operationalizes gender-responsive pedagogy through structured resources, lesson models, and professional training. Overcoming the Socialization Gap calls for a Family and Community Engagement Program (Component 6.3) that empowers parents and caregivers to act as co-educators, reinforcing curiosity, creativity, and confidence in girls' technological learning.

Together, these three interdependent components establish a holistic ecosystem of support. They ensure that equality in ICT education is not limited to policy declarations but becomes a lived reality through collective and sustained action. Chapter 6 will elaborate these evidence-based recommendations, outlining the design and implementation of the LeadHER Teaching Framework.

Summary

This chapter has demonstrated that sustainable inclusion in ICT education requires alignment across confidence, socialization, and pedagogy. The good practices identified in Bulgaria, Portugal, and Spain show that when girls are supported to see themselves as capable, encouraged by inclusive communities, and taught through gender-responsive pedagogy, participation evolves from access to agency. These insights form the empirical and conceptual foundation for the framework design that follows.

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6 Recommendations for Teaching Framework Design

This chapter presents evidence-based recommendations to guide the development of a comprehensive teaching framework that supports gender equality and digital inclusion in education. It focuses on three key components: a mentoring scheme to empower teachers and learners, a teachers' toolbox providing practical resources and pedagogical strategies, and approaches for engaging families and communities to foster inclusive and sustainable learning environments. Together, these elements form a coherent structure for promoting equity and participation across educational contexts.

6.1 Mentoring Scheme

An effective mentoring scheme should be guided by specific design principles aimed at boosting confidence and long-term engagement, and implemented through structured, collaborative approaches involving schools, industry, and policy makers.

The primary goals of mentorship should be centered on addressing non-technical barriers to entry and sustained interest for girls in ICT and STEM fields:

The primary goals of mentorship should focus on addressing non-technical barriers to entry and sustaining girls' long-term interest in ICT and STEM fields. Key objectives and recommended actions are summarized in Table 7.

Table 7. Mentoring Scheme: Objectives and Actions to Support Girls in ICT and STEM.

Inspiring Career Aspirations and Guidance	Mentorship programs should aim to inspire girls' long-term career aspirations and provide guidance throughout their professional journeys.
Boosting Confidence and Self-Efficacy	Mentoring and role-model initiatives are crucial because young women often lack confidence and visibility upon entering ICT professions, tracing this gap back to early educational experiences. Female role models positively influence girls' self-efficacy and interest in technology fields.

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Demystifying the Industry	Mentorship programs should be designed to demystify the world of ICT and provide girls with authentic exposure to professional role models.

Effective implementation requires collaboration between companies, schools, and governmental bodies, focusing on structuring the initiatives and integrating them into the educational ecosystem.

Promoting visibility and connection through mentorship and networking is essential to sustaining girls' engagement in ICT and STEM. The following recommendations highlight ways to strengthen the role of female professionals, structured networks, and peer-led initiatives in supporting girls' learning pathways and career aspirations. These actions are summarized in Table 8.

Table 8. Role Models and Structured Networks for Supporting Girls in ICT and STEM.

Pairing with Female Professionals	Companies should establish mentorship programs that pair girls with women in ICT.
Developing Structured Networks	Companies should develop structured mentorship networks for women in ICT.
Utilizing Role Models	Schools should incorporate female role models into the curriculum and facilitate the direct involvement of women professionals (such as engineers, designers, or alumni) in classrooms, as this has a powerful motivational effect. Families should also expose girls to female role models through various means like media, books, or personal connections.
Peer-Led Initiatives	Schools should facilitate peer-led initiatives alongside mentorship programs to encourage collaborative and creative exploration of technology.

Strengthening collaboration between education and industry is vital for creating meaningful pathways into ICT and STEM careers. The following recommendations outline how companies and schools can work together to promote girls' participation through structured mentorship, outreach, and diverse partnership models. These actions are summarized in Table 9.

Table 9. Industry Collaboration and Outreach to Support Girls in ICT and STEM.

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Policy and Investment	Government and policy authorities should increase investment in programs like Technovation Girls and other mentorship initiatives targeting girls.
Scaling and Integration	Mentorship programs should be scaled and integrated into the national education system to provide more girls with early exposure to ICT and STEM fields.
Harmonization	A national coordination platform could be created to link ministries, schools, NGOs, and private partners, harmonizing ongoing initiatives such as existing mentorship schemes.
Addressing Disparities	Grants for inclusive extracurricular learning should prioritize rural schools and disadvantaged communities where girls have limited access to mentors.

Mentoring for Educators

Mentoring schemes can also be valuable internally within the education system. Research is needed on how mentoring between teachers can sustain progress over time, effectively translating equity principles into classroom practice. Additionally, peer-learning communities or local "teacher labs" could facilitate the exchange of inclusive lesson plans, examples, and materials.

6.2 Teachers' Toolbox

The most effective resources for addressing gender stereotypes and fostering inclusive learning environments span pedagogical approaches, human role models, and systemic curriculum reforms. These resources are designed to challenge biases, boost confidence, and make technology relevant to girls' interests.

Pedagogical Methods and Activity Resources

Gender-inclusive pedagogy involves implementing teaching methods that actively engage girls in digital and STEM learning. Research consistently highlights active, collaborative, and creative methodologies as the most effective "equalizers" for girls' participation. Key approaches are summarized in Table 10.

Table 10. Gender-Inclusive Pedagogical Strategies for Digital and STEM Education.

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Project-Based Learning (PBL)	This could play a more central role in ICT teaching. Adopting active, hands-on learning approaches such as PBL can significantly increase student engagement.
Creative and Interdisciplinary Projects	Combining technical content with storytelling, art, or social themes helps girls see technology as relevant to their interests. Interdisciplinary and creative work, such as practical projects that combine art, film, or environmental themes with ICT, is identified as an effective equalizer for girls' participation.
Gamification and Real-World Applications	Alongside PBL, strategies like gamification and focusing on real-world applications of ICT can increase student engagement. These methods should be tailored to students' interests, making learning more dynamic and meaningful.
Peer-Led Initiatives	Facilitating mentorship programs and peer-led initiatives encourages the collaborative and creative exploration of technology.

Human Resources (Role Models and Mentors)

Role models play a crucial role in challenging stereotypes and strengthening girls' confidence and interest in ICT. The following recommendations highlight ways to integrate female role models into education and mentorship practices at different levels. These approaches are summarized in Table 11.

Table 11. Promoting Female Role Models and Mentorship in ICT Education.

Female Professionals in the Classroom	Inviting female professionals to classrooms (such as engineers, designers, or alumni) has a powerful motivational effect on students.
Role Models in Materials	Schools could incorporate female role models into curricula and learning materials. Furthermore, families should expose girls to female role models in ICT through media, books, or personal connections to inspire technology careers.
Mentorship Programs	Structured guidance from industry is effective in demystifying ICT. Companies should offer mentorship programs that pair girls with women in ICT and develop structured mentorship networks for women in the field.

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Material and Institutional Resources

Systemic resources are essential for sustaining inclusive practices and ensuring their broad implementation across educational and community settings. The following recommendations outline strategies for promoting gender balance through curricula, teacher networks, and societal engagement. These actions are summarized in Table 12.

Table 12. Systemic Resources for Advancing Gender Equality and Inclusion in ICT Education.

Bias-Free Curricula and Textbooks	Systematic gender audits of curricula and learning materials could be conducted. New ICT and STEM textbooks must be used to address stereotypes by including balanced representation of women and men, avoiding stereotypical imagery, and showcasing diverse professional pathways. Learning resources must be ensured to be free from gender bias.
Gender-Sensitive Materials	Schools could integrate gender-sensitive materials and teaching strategies into their ICT curricula, highlighting female figures in technology.
Teacher Exchange Networks	Peer-learning communities or local "teacher labs" can be resources that facilitate the exchange of inclusive lesson plans, examples, and materials among educators.
Societal Awareness Campaigns	National campaigns could be launched to challenge cultural and societal gender stereotypes surrounding technology.
Community Programs	Community organizations have demonstrated how family engagement strengthens girls' digital confidence. These models, such as those run by BCWT and the Bulgarian Fund for Women, could be scaled nationally.

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6.3 Strategies for engaging families and communities

Successfully engaging families and communities in supporting girls in ICT requires a concerted effort to shift societal perceptions, raise awareness, and provide structured opportunities for joint learning and exposure to female role models.

6.3.1 Strategies for Engaging Families

Families play an essential but often underestimated role in shaping girls' views on technology, as family attitudes can either reinforce stereotypes or encourage curiosity.

1. Promoting joint family learning opportunities:

Schools and local authorities should actively create opportunities for joint family learning. These activities can include:

- Open days.
- Parent–child coding workshops.
- Family digital-safety sessions.

2. Challenging gender stereotypes and raising awareness:

A key strategy is raising parental awareness that ICT is a creative, social, and universal skill, not an exclusively technical one.

- Families should encourage both boys and girls to explore technology at home, challenging traditional gender roles.
- Local authorities can implement region-specific awareness campaigns to challenge outdated gender norms and promote family involvement in encouraging girls' tech engagement.

3. Encouraging early engagement and support:

Families should encourage early engagement with technology and STEM activities at home, emphasizing exploration over supervision.

Families must engage in discussions about digital safety, online citizenship, and the responsible use of technology, ensuring girls navigate digital spaces safely and confidently.

Families should support girls in online communities and extracurricular programs, mitigating risks of exclusion and promoting positive digital experiences.

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4. Exposing girls to role models:

Families should expose girls to female role models in ICT, through media, books, or personal connections, which can inspire them to pursue careers in technology.

6.3.2 Strategies for Engaging Communities

Community engagement strategies focus on leveraging local and national platforms to normalize girls' participation in technology and scale effective outreach efforts.

1. **Scaling successful community models:**

Community organizations have already demonstrated how family engagement strengthens girls' digital confidence.

- Models pioneered by organizations such as BCWT and the Bulgarian Fund for Women should be scaled nationally.

2. Launching national and regional campaigns:

Policy makers and local authorities should launch targeted campaigns:

- National campaigns could be launched to challenge cultural and societal gender stereotypes surrounding technology. These campaigns must target schools, families, and communities to raise awareness about the importance of encouraging girls to engage with ICT from an early age, ensuring gender-neutral views on technology.
- National campaigns could also promote campaigns highlighting women's contributions in STEM and ICT.

3. Fostering localized collaborations:

Regional authorities could foster collaborations between schools, universities, companies, and local organizations to create localized initiatives that encourage girls' engagement with ICT.

4. Targeting resources to disadvantaged communities:

Expanding funding for inclusive extracurricular learning is crucial. Grants should prioritize rural schools and disadvantaged communities where girls often have limited access to devices, mentors, and digital clubs.

Overall, active support from families, combined with societal awareness campaigns, is essential to encourage girls' participation in ICT.

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7 Conclusion

This Global Report, developed under Work Package 2 (Needs Assessment and Resource Mapping) of the LeadHER project, establishes a consolidated and triangulated evidence base on gender dynamics in ICT education across Bulgaria, Portugal, and Spain. The synthesis of desk and field research reveals a clear paradox of access: while all three countries demonstrate strong structural and policy commitment to digital inclusion and gender equality, these advances have not yet translated into equal participation, confidence, or continuity for girls. Inclusion policies, however well designed, must be accompanied by psychological, social, and pedagogical transformation within schools, families, and communities.

Three interrelated barriers emerge as central to this needs assessment. The Confidence Gap reflects lower digital self-efficacy among girls and a tendency to underestimate technical ability despite equal competence. The Socialization Gap stems from persistent gender norms within families, peer groups, and media that continue to define technology as a male domain, limiting girls' early exposure to digital tools. The Pedagogical Gap highlights the disconnection between teachers' strong personal commitment to equality and the lack of systemic support, training, and inclusive materials required to embed gender-responsive pedagogy. Together, these gaps explain why formal access has not yet become genuine inclusion.

The evidence also identifies key enabling factors that point toward sustainable solutions: mentorship and visible female role models, project-based learning that links technology to creativity and social relevance, and community-level collaboration that connects schools, families, and industry. These insights form the foundation for the next phase of the project, Work Package 3 (Teaching Framework Design), which will translate the findings of this needs assessment into a coherent pedagogical model, the LeadHER Teaching Framework (LTF). The LTF will operationalize the identified enablers by developing mentoring schemes, teacher support tools, and family engagement strategies aimed at transforming structural commitment into lived equality.

Beyond its immediate project scope, the LeadHER Needs Assessment contributes to the broader European evidence base on gender equality in digital education. By integrating findings from three distinct national contexts, it provides comparative insight into how structural, pedagogical, and socio-cultural factors interact to shape girls' digital participation. This synthesis not only underpins the design of the LeadHER Teaching Framework but also offers transferable lessons for policymakers, teacher-training institutions, and community stakeholders across the European Union seeking to close gender and digital divides.

In conclusion, this report fulfils its role within the LeadHER project by providing a comprehensive, evidence-based needs assessment that maps both barriers and enablers across policy, practice, and perception. It establishes the analytical and conceptual groundwork

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for designing and testing the LeadHER Teaching Framework, ensuring that the next stage of the project moves decisively from understanding the problem to implementing systemic and sustainable changes in gender-responsive ICT education.

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Vuorikari, R., Kluzer, S., & Punie, Y. (2022). *DigComp 2.2: The Digital Competence Framework for Citizens – With new examples of knowledge, skills and attitudes* (Publications Office of the European Union). https://doi.org/10.2760/115376

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Annexes

Relevant research and policy docs

Digital Education Plan: website and pdf

Women in Digital strategy

World Bank, "Education in the EU: Diverging Learning Opportunities?" (2018) — PDF

Center for Policy Studies, CEU Democracy Institute, "Comparative overview of the digital preparedness of education systems in selected CEE countries" (2021) — PDF

Brečko et al., "Mainstreaming ICT-enabled innovation in education and training in Europe" (2014) — PDF

Arqueiro et al., "Literacy in Portugal. Country Report. Children and adolescents" (2016) — PDF

Monnet, "Informatics education at school in Europe" (2022) — PDF

Marques et al., "The use of digital technologies to develop girls' creativity: paths and practices in Greece, Lithuania, Portugal, and Slovenia" (2022) — PDF

Žmuk et al., "Inequality in e-learning in European Union countries: Role of gender, education and urban development" (2023) — PDF

Ferreira & Silva, "Portuguese research on Gender and ICT: The place of education" (2016) — PDF

Prendes-Espinosa & García-Tudela, "Gender equality and ICT in the context of formal education: A systematic review" (2020) — PDF

Report on the state of the Digital Decade, Executive summary for Portugal - PDF

From the Women in Digital website

The Commission will launch several initiatives, including:

Girls go STEM (2025): a program to attract 1 million girls to STEM studies and professions by 2028;

STEM futures (2026): an initiative to identify and share successful STEM education practices, with a focus on girls and women;

European STEM week: an event to promote STEM education and reach out to young people, particularly girls and their families, in synergy with EU-funded projects such as the STEAMbrace (funded under Horizon Europe);

STEM specialists fellowship: a pilot program to attract top international STEM experts to EU higher education and research institutions.

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Digital skills actions focused on women and girls

The annual European Digital Skills Awards (EDSA) include a 'Women in ICT Careers' category. This is dedicated to projects aimed at increasing the number of women ICT professionals and at upskilling women in ICT. Winners include projects like 'Girls code it better', an Italian project bringing girls into tech and STEM

EU Code Week: a European grassroots initiative, organised annually in October to get especially children and teenagers interested in computer programming and coding, computational thinking, robotics and related digital skills. Code Week encourages girls to participate and highlights women role models in digital careers

DigiEduHack is a flagship initiative under the Digital Education Action Plan. It wants to empower digital education enthusiasts to develop creative digital solutions to challenges affecting education systems. While open to everybody, the initiative has a strong focus on attracting youth and girls.

The Commission's Digital Skills & Jobs Platform can help citizens and companies acquire adequate digital skills. It offers resources, articles, training and professional opportunities, such as the Digital Skills Talks series and other initiatives aimed at girls and women.

Women and girls in Digital

WIDCON (Connecting Women in Tech) project provides insight into the reasons for the gender gap in ICT professions. It creates a network of experts to identify best practices to increase girls' and women's participation in ICT studies and professions.

St(R)E(A)M It - Streaming Girls and Women into Steam Education, Innovation and Research is a project to bridge persistent gender gaps in STEM education, research and innovation by implementing the European manifesto for gender-inclusive STE(A)M education and careers.

ESTEAM (Entrepreneurship, Science, Technology, Engineering, Arts and Mathematics) Fests and Communities aims at boosting digital and entrepreneurship competences and confidence building, as well as inspiring girls and women to study and take up careers in ESTEAM.

The European Alliance for Apprenticeships (EAfA) has established a community on social inclusion and gender equality to gather like-minded EAfA members who wish to cooperate in this area. The EAfA Community will showcase and exchange good practices and foster mutual learning on attracting and supporting girls and women in STEM apprenticeships.

EQUALS-EU is a regional partnership originating from the EQUALS Global Partnership for Gender Equality in the Digital Age. EQUALS Global partnership promotes gender balance in

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the technology sector by championing equality of access, skills development and career opportunities for women and men.

Women4IT is an initiative providing fully funded, individually tailored digital skills training reflecting current market needs.

Women4Cyber Network is part of the Digital Skills and Jobs Platform, a collaboration between the European Commission and the Women4Cyber Foundation. It unites skilled women in cybersecurity from various sectors and expertise levels.

Women4Cyber 'Mari Kert – St Aubyn' Foundation is a European cybersecurity organisation with a declaration, awards, mentorship programmes and other projects. It now has national chapters in 30 countries across Europe.

Women TechEU supports deep-tech start-ups led by women, offering coaching and mentoring to female founders, as well as targeted funding to help grow their business.

Women in IT Day is a free online event for women to help shape their careers in IT.

E-women in ICT international conference (2023): this Erasmus+ project, themed 'Enhancing Skills to Bridge Digital Divide, aimed to minimize the gap between men and women related to ICT and entrepreneurial competences and opportunities.

She Figures tracks the progression of women and men in research and innovation (R&I) careers, from education and graduation to professional roles as researchers and inventors. It is the main source of pan-European, comparable statistics on the state of gender equality in R&I and is published every 3 years. She Figures 2024 is the latest version.

The European Network for Gender Balance in Informatics (EUGAIN) is a COST action to improve gender balance in informatics at all levels. It is a European network of people working on gender balance in informatics in their countries and research communities.

The Commission library guide on women in science compiles relevant information resources on women in science

Supporting women entrepreneurs is a media campaign by the European Commission on role models in ESTEAM. It wants to inspire girls and women to study and take up careers in entrepreneurship, science and technology.

Girls Go Circular aims to equip 40.000 schoolgirls aged 14-19 across Europe with digital and entrepreneurial skills by 2027 through an online learning programme about the circular economy. The project has reached its goal, with over 60.000 girls trained, and continues to expand.

Women and Girls in STEM Forum | Girls Go Circular: an annual event involving a student challenge organised annually by Girls Go Circular in cooperation with the European Institute for Innovation & Technology.

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GirlsInSTEM empowers girls to pursue their interests in science, engineering, technology and maths subjects, providing them with positive examples, support and possibilities to experience STEM occupations

STEAMbrace: a project addressing the gender gap by promoting a STEAM educational approach for teachers and students at the secondary level through a digital networking hub, and a pilot EU-level STEAM week (with a roadmap for annual reproducibility).

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