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From Plans to Practice: Transformative Gender-in-Teaching Training Programs Through GEPs in Higher Education

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Abstract

Universities play a crucial role in advancing gender equality by implementing gender equality plans (GEPs). A key element of these plans is gender-in-teaching training for educators, which equips them to integrate gender dimensions into their subjects. This initiative benefits students by challenging entrenched gender norms and stereotypes and fostering more inclusive and humanized learning experiences. Particularly in STEM disciplines (science, technology, engineering, and mathematics), such training is essential in promoting equal opportunities and dismantling biases. To determine effective approaches for designing these transformative programs, action research was conducted across seven online training programs involving over 140 educators from seven Spanish universities. The research identified best practices and challenges educators face when integrating gender perspectives into teaching, along with strategies to overcome these barriers. Effective solutions included defining gender-related activities tailored to individual subjects and providing ongoing, personalized support to educators. The findings emphasize that sustained support through well-structured, online gender-in-teaching programs is vital for authentic curriculum transformation. Personalized content and collaborative approaches enable educators to critically reflect on their teaching practices and implement meaningful changes. These initiatives not only enhance gender sensitivity in education but also contribute to broader societal transformation towards gender equality. This research offers practical insights for institutions looking to bridge policy and practice through GEPs, ensuring lasting impact in higher education and fostering equitable, inclusive learning environments.

Keywords
curricula; gender; GEP; higher education; STEM

1. Introduction

Gender equality plans (GEPs) have emerged as one of the key pillars for achieving equity in educational institutions. The introduction of GEPs in universities and research institutions aims to systematically address gender disparities by implementing specific policies, actions, and commitments (Clavero & Galligan, 2021; Guthridge et al., 2022; Tomlinson, 2011). This is especially relevant in fields where gender imbalances and hegemonic masculinity are most pronounced, such as STEM disciplines (science, technology, engineering, and mathematics; see Barros et al., 2018; Costa et al., 2024; Schiebinger, 2021; Zabaniotou et al., 2021). Hegemonic masculinity refers to the dominant social norms and practices that reinforce male privilege and maintain gender hierarchies, particularly in male-dominated fields like the STEM disciplines (Cech & Waidzunas, 2021; Connell & Messerschmidt, 2005). In these disciplines, the prevalence of hegemonic masculinity manifests in various ways, including the undervaluation of women's contributions, gendered stereotypes about technical competence, and exclusionary workplace cultures (Faulkner, 2009; Hatmaker, 2013). These dynamics contribute to the persistent underrepresentation of women and marginalized gender groups in STEM education and careers, reinforcing structural barriers that limit participation and retention (Sagebiel & Dahmen, 2006; van den Brink & Benschop, 2012). Although biased gender norms and stereotypes are often unconsciously perpetuated in everyday life, including in academic settings, universities hold significant potential as agents of change, advancing gender equality through education, research, and organizational structures. Addressing these issues through GEPs requires targeted interventions such as gender-inclusive teaching methodologies, mentorship programs, and institutional policies that challenge implicit biases and create more equitable learning and working environments (Reka & Memeti, 2024; Yu et al., 2024). GEPs play a pivotal role in challenging and changing entrenched gender biases that have traditionally excluded women and other minority groups in these fields. Through structural changes and strategic interventions, GEPs offer a comprehensive approach to transforming institutional cultures and promoting inclusive environments (Barros et al., 2018; Costa et al., 2024; Podreka et al., 2020; Schiebinger, 2021; Zabaniotou et al., 2021).

A key component of GEPs is the integration of gender perspectives into the syllabus and curriculum of university subjects offered by the institution (Eschenbach et al., 2005; Knight et al., 2012). This involves a critical review of teaching materials, case studies, and examples to ensure the representation of diverse perspectives and avoid stereotyping. To do so, educators should highlight the contributions of women and marginalized genders in their fields, ensuring visibility and inclusion. In male-dominated disciplines, this could mean including research by women scientists or addressing the gendered impact of technology (Rogošić & Baranović, 2024; Rosenthal, 2021).

Furthermore, by embedding gender equity into their curricula, universities can educate students about gender equality, highlight the contributions of women across disciplines, and provide equitable opportunities for female students (Ellie Bothwell et al., 2022; Mills & Gill, 2009).

In recent years, a growing number of educational institutions have integrated gender-sensitive training into their programs. For instance, in Spain, 85% of public universities have implemented such initiatives (Unidad de Mujeres y Ciencia, 2021).

However, integrating a gender perspective into curricula requires specific methodologies that actively engage academic staff and professors in critically analyzing and restructuring course content. Often, these initiatives are driven by management or specialized teams within the institution, such as the university's equality unit, which can make it challenging to motivate and ensure the active participation of faculty members who may perceive them as external or even imposed (Ruiz-Cantero et al., 2019; Verge et al., 2017). To address this challenge, it is essential to create spaces for reflection and collaboration, such as interactive workshops, discussion groups, and practical activities that foster dialogue about gender biases in educational materials and classroom dynamics. These initiatives should actively involve teachers and encourage them to reflect on the importance of addressing gender in their curricula.

This study critically examines the effectiveness of various activities designed to engage educators in integrating a gender perspective into university curricula. By detailing a range of interactive and reflective strategies, it evaluates their capacity to inspire faculty members to critically examine and revise course content, ensuring inclusivity and representation. The analysis delves into the outcomes of these initiatives, shedding light on their impact in fostering equitable teaching practices and challenging entrenched biases. Beyond identifying successes, the study also uncovers key challenges and resistances in implementing these strategies, offering actionable recommendations to address resistance and enhance engagement. By sharing these findings, the study seeks to identify and promote best practices for building effective strategies that support the implementation of transformative GEPs, ensuring their long-term impact and sustainability in educational institutions.

1.1. Theoretical Framework

GEPs are transformative tools aimed at systematically addressing institutional gender disparities and fostering inclusive environments. By embedding structural and cultural changes, GEPs have the potential to dismantle long-standing biases and promote equitable practices in educational institutions (Podreka et al., 2020). Their implementation has moved beyond policy mandates, focusing on creating actionable strategies that impact daily academic and organizational practices.

Recognizing the critical importance of addressing these systemic inequities, the European Union has mandated the implementation of GEPs in research performing organisations across its member states (European Commission, 2021a). This obligation underscores the urgent need for transformative approaches to gender inclusion and equity, particularly in traditionally male-dominated contexts. These measures aim to accelerate the integration of gender-sensitive practices and foster meaningful change in organizational and academic cultures.

To bridge the gap between policy mandates and tangible outcomes, it is crucial to translate the requirements of GEPs into actionable strategies that directly impact academic and organizational practices. While implementing GEPs establishes a foundation for addressing systemic inequities, their success depends on the commitment of institutions to actively integrate these principles into their daily operations, particularly

in teaching and research. This transition from policy to practice needs a focus on creating environments where gender-sensitive approaches are encouraged and normalized. A critical area for this transformation is the curriculum, which conveys knowledge and shapes the values and norms students internalize (Mills & Gill, 2009). Gender-sensitive curricula are pivotal in advancing educational equity and creating lasting cultural change within institutions by fostering inclusive learning environments and challenging entrenched biases.

Incorporating gender-sensitive practices into teaching and research in STEM disciplines is essential for creating a more inclusive academic environment (Ruiz-Cantero et al., 2019). Such practices involve revising teaching materials, methodologies, and evaluation systems to eliminate biases, incorporating examples of women and marginalized groups' contributions to STEM, and using inclusive language. These changes are not merely symbolic but have the potential to reshape classroom dynamics, foster greater engagement among diverse student groups, and challenge entrenched stereotypes.

Ultimately, by cultivating gender-sensitive curricula and practices, universities can become agents of transformation, addressing the educational system's structural inequities and paving the way for more diverse and inclusive learning and professional environments.

1.1.1. Gender Dimension in Curricula

Several comprehensive guides have been developed to support the integration of the gender dimension in teaching, with the toolkit developed in the framework of the European project GARCIA (Trbovc & Hofman, 2015) being a referential one. This guide emphasizes the educator's role as a model, integrating gender-sensitive content and raising awareness about gender stereotypes, inequalities, and biases. It also addresses teaching methodologies and outcomes. The guide concludes with a checklist for applying a gender-sensitive approach to curricula.

An interesting initiative to further promote the integration of a gender dimension in teaching has been developed by the Agència per a la Qualitat del Sistema Universitari de Catalunya (Spain), which established a normative framework (AQU Catalunya, 2018). This framework mandates the inclusion of a gender dimension in the accreditation, follow-up, verification, and modification processes of all bachelor's and master's degrees. It demonstrates how gender considerations can be integrated across the four pillars of teaching (AQU Catalunya, 2018): course content, teaching methodology, classroom management, and assessment processes.

Numerous examples in the literature illustrate how to facilitate this transformation (Mas de les Valls & Peña, 2022; Heijden et al., 2017). Two of the most common strategies for integrating a gender dimension into curricula are the inclusion of female role models (Calvo Iglesias, 2020; Epifanio et al., 2021) and the use of non-sexist language and imagery (García-Holgado et al., 2021). Reflections on the learning environment, often incorporating perspectives from both educators and students, are also frequently included (Aguillon et al., 2020; Mas de les Valls et al., 2020). In a male-dominated context, the social relevance of subjects is emphasized as a critical factor in engaging female students (Bixler et al., 2014; Merayo & Ayuso, 2023; Sáinz et al., 2020).

Despite the wealth of available information and legal mandates, the effective inclusion of a gender dimension in curricula still largely depends on the voluntary efforts of individual educators (López Belloso

et al., 2021). To address this, universities must provide educators with clear, field-specific guidelines and practical suggestions. For instance, in engineering, the so-called FTM classification categorizes subjects into three groups: fundamentals, technology, and management (Mas de les Valls & Peña, 2022). The classification assumes that the difficulty of implementing a gender dimension varies by subject type, with "fundamentals" being the most challenging and "management" the easiest. For fundamental subjects, the integration of gender-sensitive activities often involves introducing female role models and promoting the use of inclusive language. In technology subjects, incorporating projects or laboratory experiments that emphasize teamwork can effectively challenge and transform students' stereotypes and roles. Meanwhile, in management subjects, which are frequently associated with interpersonal skills, gender-sensitive teaching can be explicitly integrated through activities such as debates and role-plays.

Professional development for educators, particularly regarding the integration of a gender dimension into teaching, requires unlearning assumptions and biases (Bali & Caines, 2018). This need is especially critical in engineering, where an ostensibly gender-neutral framework often conceals gender-blind practices and overlooks feminist perspectives in the field (Calvo-Iglesias et al., 2022). Designing transformative gender-in-teaching training programs should encourage educators to critically reassess their gender-biased assumptions, educator-student relationships, and learning outcomes. Reflection on one's teaching practices is essential for achieving meaningful change. An illustrative example is provided by Carreiro-Otero et al. (2021), where case studies and discussions formed the core of a training program. Moreover, adopting a sustained approach that fosters a community of educators can enhance opportunities for collective reflection and dialogue, increasing awareness and improving learning outcomes (Bali & Caines, 2018).

1.1.2. Syllabus Transformation

The university syllabus is a public document outlining the subject's objectives, intended learning outcomes, content, and assessment strategies, among other components. It represents the university's formal commitment to its students.

Ideally, the syllabus should include a statement addressing diversity, equity, and inclusion in the classroom (Wagner et al., 2023). However, to ensure consistency in integrating the gender dimension throughout the document, more comprehensive measures are necessary. In this regard, the Agència per a la Qualitat del Sistema Universitari de Catalunya mandates that universities incorporate gender-specific learning outcomes where applicable (AQU Catalunya, 2018). Consequently, any substantial transformation of a subject must be reflected in corresponding modifications to its syllabus (Royce et al., 2023; Wagh, 2023).

Furthermore, the syllabus can serve as a tool to analyze the extent to which the gender dimension has been integrated (Arias-Rodríguez et al., 2021; Ross et al., 2023). As such, it becomes a valuable instrument for assessing the progress of gender-sensitive practices within university programs.

1.2. Present Research

The primary aim of this study is to explore and evaluate the implementation of various activities designed to promote gender inclusion within university curricula. Specifically, the study examines the effectiveness, outcomes, and limitations of applying these activities in educator training sessions. The analysis is based on

seven online trainings and seminars (with one-session trainings referred to as seminars) conducted at four public and three private Spanish universities during the 2020–2021 academic year, involving over 140 educators from diverse academic disciplines. Course syllabi were adapted following a participatory action research methodology to tailor the interventions to institutional contexts and needs (MacDonald, 2012). The data gathered during these trainings were subjected to quantitative and qualitative analysis, employing conventional, direct, and summative content analysis approaches as outlined by Hsieh and Shannon (Hsieh & Shannon, 2005).

The study aims to advance the integration of gender perspectives in higher education by offering evidence-based insights into the outcomes of transformative online gender-in-teaching training. Focused on designing effective training models to foster meaningful change in university teaching, the research addresses the following key questions:

> RQ1: What are the best practices for creating a reflective and participatory learning environment in online gender-in-teaching training programs?
>
> RQ2: What are the main challenges and resistances faced by educators?

The present study will assist academic gender policy design bodies and educators in incorporating the gender dimension into university teaching to benefit the student body. By aligning with the objectives of institutional GEP, the study provides actionable insights to support their implementation in teaching practices. Specifically, it contributes to:

1. Enhancing the implementation of GEPs by bridging policy and practice, offering practical tools and evidence-based strategies that help institutions translate GEP commitments into measurable changes in teaching, research, and organizational culture.
2. Identifying key aspects for designing transformative online gender-in-teaching training programs, including effective training structures, durations, and activities.
3. Proposing innovative uses of technology to create participatory, equitable, and transformative online learning environments for educators.
4. Encouraging self-reflection among university educators by addressing resistances and challenges in integrating the gender dimension into their subjects
5. Offering practical guidelines for university educators to transform their courses and syllabi and incorporate a gender perspective.

2. Methodology

Training programs and seminars were designed with a student-centered approach (Wright, 2011), emphasizing participants' intrinsic motivation and tailoring the sessions to their specific needs. The facilitator, who had extensive experience in gender-in-teaching training within the fields of engineering and architecture, adapted the activities to align with the unique context of each session. This adaptation process followed a participatory action research approach (MacDonald, 2012), which involved a three-step cyclical process: (a) designing the training structure, (b) implementing the design while fostering collaboration among participants to co-construct knowledge and gather insights, and (c) analyzing the results and reflecting on them to refine and improve the design for transformative gender-in-teaching training.

All four pillars of teaching activity (AQU Catalunya, 2018)—course content, teaching methodology, classroom management, and assessment processes—were thoroughly analyzed and discussed, drawing on participants' experiences to ensure a comprehensive and context-sensitive exploration of gender-sensitive practices.

2.1. Target Group

The study engaged over 140 university educators from diverse academic disciplines, participating in seven online gender-in-teaching trainings and seminars conducted across four public and three private Spanish universities during the 2020–2021 academic year. These educators represented a mix of STEM and non-STEM fields, with courses explicitly targeting subjects in engineering, architecture, social sciences, arts, and humanities.

Participants were primarily drawn from university teaching staff, with a significant portion involved in teaching innovation projects to embed a gender dimension in curricula. These participants not only contributed to discussions but also actively engaged in collaborative activities such as syllabus transformation, content wall exercises, and assessment wall reviews. Their varied expertise provided valuable insights into the challenges and opportunities of integrating gender-sensitive approaches in higher education teaching.

2.2. Training Programs

The study included seven online gender-in-teaching trainings and seminars conducted at Spanish universities during the 2020–2021 academic year. These sessions aimed to equip educators with tools and strategies to incorporate a gender dimension into university curricula. Table 1 summarizes the main characteristics of the different training programs, including their focus, duration, and areas of knowledge addressed. Two of them (no. 1 and no. 5) were focused on the development of teaching guides with gender dimensions. Both courses are part of a long project; indeed, no. 1 was a 5-week training while no. 5 was a seminar focused on the gender dimension in physics and engineering included in a teaching innovation project (the participants had already received similar seminars in other areas of knowledge). Training no. 6 was organized to prepare a team of volunteering educators to reproduce the pilot project experiences held at UPC (Mas de les Valls & Peña, 2022). Also, training no. 2 was organized within a HORIZON 2020 project devoted to supporting the promotion of equality in research and academia. The goal of the course was to prepare the node network, i.e.,

Table 1. Summary of gender-in-teaching training programs: Course type, framework, participant composition, female participation, and areas of knowledge.

ID	Course	Framework	$N(N_{STEM})$	Female (%)	Area of Knowledge
1	Training	Independent course	*22*(13)	86%	Mixed
2	Training	HORIZON 2020 project	22*(7)	100%	Mixed
3	Seminar	Teaching innovation day	*17*(17)	18%	Eng. + Arch.
4	Training	Independent course	20*(20)	5%	Engineering
5	Seminar	Teaching innovation project	24	92%	Mixed
6	Training	Teaching innovation project	*29*(4)	76%	Mixed
7	Seminar	Teaching innovation day	*56*(56)	30%	Eng. + Phys.

Notes: $N(N_{STEM})$ = Number of participants (number of participants belonging to a STEM field); * estimated number of participants according to the number of answers obtained within the Kahoot! activity.

a group of referent educators with the mission to train their mates in gender in teaching, distributed by area of knowledge.

2.3. Activities

In all courses, both trainings and seminars, spaces for debate and exchange of ideas were actively encouraged. This approach facilitated the identification of resistance patterns and enabled the facilitator to optimize strategies for raising participants' awareness of gender issues. Hands-on activities, focused on integrating a gender perspective into teaching practices and curriculum design, were incorporated exclusively in the training sessions, as these provided sufficient time for their implementation. What these activities entailed will be explored in the following.

2.3.1. Ice-Breaking

The objective of the ice-breaking activity—carried out in training programs no. 1, no. 2, no. 4, and no. 6—was to facilitate the sharing of classroom perceptions and personal teaching experiences. To encourage this exchange, a questionnaire was designed with direct and thought-provoking statements, offering limited flexibility in responses. The Kahoot! platform was selected to implement the questions due to its high accessibility, user-friendly interface, and the ability to analyze answers immediately after each question. Each response was treated as correct, ensuring the activity remained non-competitive. Additionally, after every question, participants discussed the reasoning behind their answers, providing an opportunity to reconsider and revise their opinions. These two measures were essential to mitigate potential risks associated with using Kahoot!

2.3.2. Stereotypes

During training no. 2, participants engaged in an activity addressing gender-biased stereotypes. They were divided into four groups according to their areas of expertise: (a) arts and humanities, (b) social sciences, (c) health sciences, and (d) natural and experimental sciences. A shared Google presentation was used, with one slide allocated to each area, enabling all teams to view and compare one another's results. Each slide displayed the percentage of female students enrolled in two bachelor's degree programs relevant to the respective field. Participants were tasked with identifying common stereotypes associated with their area of knowledge and proposing initial ideas—or "seed ideas"—to address and reduce these stereotypes.

2.3.3. Contents Wall

The Contents Wall activity helps educators integrate gender-related content into their courses. Participants are prompted with guiding questions about the gender relevance of their subject and are encouraged to define gender-focused activities, such as highlighting female contributors, designing inclusive projects, or using case studies. Educators collaborate using a digital platform, where they document and refine their ideas collectively.

It is often observed that when educators are asked to incorporate gender-related content into their subjects, they may feel uncertain or overwhelmed, unsure of how to approach the task. However, when prompted with targeted questions—such as the social or gender relevance of their subject, the intended users or target groups

of the knowledge being taught, or the subjectivity inherent in the chosen technologies or methodologies—educators often begin to identify potential opportunities for integrating gender content within their subjects. Furthermore, providing educators with specific guidance based on the FTM classification can make defining gender-focused activities more manageable. This was the primary goal of the Contents Wall activity.

In the Contents Wall included in training programs no. 1 and no. 2, participants were organized into heterogeneous teams according to the FTM classification of their subjects, and they were given access to a digital wall platform (e.g., Padlet or similar alternatives). Each team worked on a distinct section of the shared wall, allowing all participants to view and learn from the contributions of their peers. The sequence of actions was structured as follows:

1. Individual work: Participants wrote a short description of their subject and its context, identified a gender-related activity (e.g., highlighting the contribution of a female figure, designing a teamwork project, preparing a case study, or organizing a role-play), and provided a brief description of the activity.
2. Teamwork in parallel virtual rooms: Participants introduced their subject to their team, responded to team members' questions regarding the social or gender relevance, target groups, and chosen methodology, described the proposed gender activity, and explicitly discussed its gender relevance and potential utility.
3. Group discussion in the main virtual room: Teams reconvened to share their work, discuss insights, and reflect collectively on the proposed activities.

2.3.4. Assessment Wall

The Assessment Wall activity builds upon the Contents Wall by focusing on how to assess gender-related activities effectively. Educators collaboratively review and refine assessment methods for previously identified gender-focused activities. Like the Contents Wall, this process is conducted on a shared digital platform, allowing participants to exchange feedback and improve their evaluation strategies.

Conducted in training no. 1, the Assessment Wall utilized the same technical framework as the Contents Wall. Teams were tasked with identifying appropriate assessment methods for a selected set of gender-focused activities.

2.3.5. Syllabus Transformation

Integral to training programs no. 1 and no. 6, this activity guided participants through revising their course syllabi to explicitly incorporate gender dimensions. A general syllabus template was developed and provided to participants. During each session, the facilitator progressively completed and reviewed the syllabus. Individualized feedback was delivered through the Moodle platform, while team feedback and key points from individual evaluations were shared at the beginning of each session to encourage collaborative learning.

A three-step methodology was developed to guide educators through the process and emphasize the key issues, as illustrated in Figure 1. In the first step, general aspects of the syllabus were addressed, covering three of the four teaching pillars without yet incorporating any gender-focused activities. Once this foundational

step was successfully completed, participants undertook more detailed work: designing and identifying at least one activity that explicitly integrated a gender dimension. This step was closely tied to the outcomes of the Contents Wall activity.

In the third and final step, participants incorporated the designed gender activity into the syllabus, explicitly highlighting its gender-related aspects and specifying its expected learning outcomes. Additionally, the description of the subject at the beginning of the syllabus was revised to reflect its incorporation of a gender dimension.

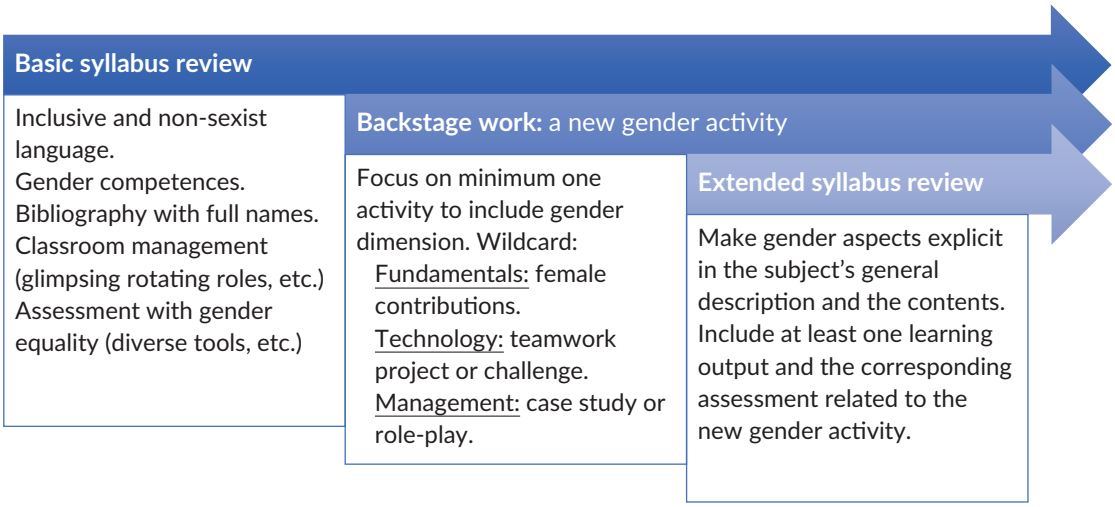

Figure 1. Three-step process for integrating gender dimension into university syllabi.

2.4. Evidence and Indicators

The relationship between the evidence collected and the corresponding indicators is shown in Table 2.

To describe the qualitative analysis, the three distinct approaches described in Hsieh and Shannon (2005) are used: (a) the conventional content analysis, (b) the direct content analysis, and (c) the summative content analysis. Conventional content analysis is an inductive approach that derives categories directly from data, suited for exploring phenomena with limited prior research. Directed content analysis starts with existing theories to guide initial coding, validating, or extending frameworks but with a risk of bias. Summative content analysis combines counting specific words (quantitative) with analyzing their context (qualitative), uncovering patterns in language use but potentially missing broader insights.

The qualitative analysis for both the ice-breaking activity and the stereotypes activity was conducted using the conventional content analysis approach. This was particularly emphasized in the stereotypes activity, where the authors meticulously reviewed the text outcomes multiple times to construct and identify common categories across different areas of knowledge, trying to minimize the effect of any preconceived categories.

For the Contents Wall, the Assessment Wall, and the syllabus activities, qualitative analysis followed a direct content analysis approach. This approach is feasible because, in each of the three activities, participants are required to create a specific output (a teaching activity, an assessment tool, or the syllabus for a course)

Table 2. Evidence and indicators for assessing gender integration in syllabi.

Evidence	Quantitative indicator	Qualitative indicator
Training definition	Number of sessions Number of STEM/non-STEM participants Embodied in a project (Y/N)	Type of training (seminar/training)
Ice-breaking	Answers to the questionnaire	Participants' comments
Stereotypes	—	Quality of the entries Participants' comments
Contents Wall	Number of entries Type of entry (female referents, project, teamwork, role-play, etc.)	Quality of the entries Participants' comments
Assessment Wall	Number of entries	Quality of the entries Participants' comments
Syllabus Transformation	Number of assignments done Number of used gender-related terms Type of subject (fundamental, technology, management)	Quality of the changes according to the subject's gender potential Coherence
Assessment by participants	Number of participants Score (1–10) of expertise before and after the training	Participants' comments

following a structured framework and predefined expectations. Thus, the output can be compared against an ideal solution, which is not fixed but rather adapted to the specific context or course. This ideal solution is built according to the facilitator's background, so some bias is unavoidable.

In contrast, the quantitative analysis of the syllabus required a more extensive summative content analysis. This analysis employed a methodology similar to that used for evaluating students' teaching feedback (Okoye et al., 2020) and included the following components:

1. Identification of gender-related terms (GRTs): After carefully reviewing the syllabi, the most frequently used GRTs were identified, along with their frequency of occurrence in each assignment. A helpful starting point for this analysis was the list of GRT proposed by Arias-Rodríguez et al. (2021). To streamline the analysis, clustering of similar words was employed, as detailed in Section 3.5.
2. Coherence analysis: The coherence of the syllabus's final version was examined qualitatively and quantitatively. The qualitative analysis evaluated the alignment between the syllabus contents and the ideas or proposals discussed individually with participants during the Contents Wall activity. A quantitative analysis of the appearances of GRTs complemented this qualitative assessment. The combined results were used to assess each participant's overall performance.
3. Feasibility analysis: The feasibility of incorporating gender-related content into the subject's curriculum was assessed based on the authors' experience in university teaching and educator training activities.

3. Results

The participant group varied across the trainings regarding gender composition and academic backgrounds. For example, long-term training programs (no. 1, no. 2, no. 5, and no. 6) exhibited higher participation of female educators (up to 100% in some cases), reflecting a broader interest in gender inclusion in mixed academic areas. Conversely, shorter seminars had a more limited percentage of female participants, particularly in highly masculinized fields like engineering.

3.1. Ice-Breaking

The ice-breaking activity was conducted in training programs no. 1, no. 2, no. 4, and no. 6, with participation rates of 77%, 100%, 100%, and 62%, respectively. Women comprised 56% of the participants, and 59% of the total participants were from the STEM field. Within the STEM participants, 59% were men. This aligns with literature (European Commission, 2021b) indicating that STEM remains a male-dominated field. Notably, all the male participants in the courses came from the STEM field, whereas only 36% of the female participants belonged to STEM disciplines.

3.2. Stereotypes

The stereotypes activity is summarized in Table 3, highlighting participants' contributions, which predominantly emphasized skills attributed to women and interests over those attributed to men. Additionally, possibly because all participants were women, the proposed transformative actions heavily focused on re-evaluating and elevating the value of care-related duties. The identified stereotypes align with

Table 3. Overview of participants' contributions on gendered perceptions and proposed actions from the stereotypes activity.

Stereotypes and influencing factors	Transformative seed ideas and actions
Skills: Attributed to women: collaborative, communicative, organized, detail work, emotional intelligence, high academic performance Attributed to men: competitive, powerful	To promote teamwork within a less hierarchical structure To enhance fellowship instead of competition To build confidence in girl's abilities Emotional intelligence can be learned (and included in curricula)
Assumed interests (due to gender-specific socialization and social role expectations): Attributed to women: care-duties Attributed to men: object-oriented (machines)	To put in value care duties and to professionalize them. To remind that family-life balance is a shared responsibility To empower emotional skills in boys
Family culture & historical factors	To enhance gender commitment by the universities and professional bodies To review salaries in feminized professions
Lack of female referents	To increase female visibility and voice To create new female referents
Safer atmosphere in feminized studies	To further include a gender-inclusive language

those documented by Bixler et al. (2014) and Calvo-Iglesias et al. (2022) in the fields of engineering, physics, and mathematics.

3.3. Contents Wall

Seventy percent of enrolled educators actively participated in the Contents Wall activity. The types of gender-related activities selected varied significantly among participants. The most frequently chosen methodology was teamwork projects (39%), which enabled participants to address gendered roles and incorporate gender-specific needs and preferences into their designs. The service-learning project methodology (6%) also emphasized teamwork but was treated separately due to its focus on enhancing care-related duties or addressing the needs of third parties.

Female role models were another commonly chosen approach (29%), especially in subjects where projects or team activities were traditionally avoided. In health sciences, new gender-related content (13%), such as the differentiation of diseases by sex, was included as part of the extended theory. The importance of considering sex as a variable in health sciences has been relatively evident in the last few years. However, when it comes to gender, all disciplines are at a more delayed stage. Despite its significance, gender is rarely included in curricula, as doing so requires not only awareness and willingness but also effort and time to conduct a thorough review of the existing literature to identify whether relevant gender-specific research results are available and can be integrated into the content.

Other popular activities included case studies (26%) and debates (16%). Role-playing was the least selected activity (3%), likely due to participants' limited prior experience with this methodology. It is important to note that a single participant could select more than one gender-related activity.

The Contents Wall activity fostered self-reflection and exposed participants to a wide range of strategies that could be implemented in their classrooms. Overall, the activity was highly productive, although participants expressed a need for additional time to refine their chosen activities more thoroughly.

3.4. Assessment Wall

The Assessment Wall involved reviewing five activities in teams, with each activity receiving an average of 2.6 assessment improvements. Peer suggestions included creating specific reports for the activity, conducting written qualitative analyses, and incorporating gender-related aspects into oral presentations, among other recommendations.

By the fourth week of training, it was notable that participants demonstrated a high level of awareness regarding gender issues and how to integrate them seamlessly into their teaching practices. As a result, they proposed straightforward and effective assessment strategies.

3.5. Syllabus Transformation

Four assignments were required as part of the syllabus transformation activity. Seventy-three percent of the enrolled educators submitted the first assignment. Among these participants, 88%, 53%, and 59% completed

the second, third, and final assignments, respectively. The decline in submission rates is likely attributable to time constraints, as the course was conducted during the first semester.

Following submitting the first assignment and reviewing the subject descriptions, the facilitator categorized the subjects according to their feasibility for integrating gender-related content (low, medium, or high) based on her expertise. Six of the 16 subjects involved in this activity were classified as having high feasibility, three as medium, and seven as low. According to the FTM classification, eight of these subjects fell under the fundamentals category, seven under technology, and one under management.

A detailed review of all the deliverables allowed for the identification of GRTs used in the quantitative analysis. These terms were grouped into six clusters, aligning with the proposal by Arias-Rodríguez et al. (2021). The gender cluster includes the term "gender," while the sex cluster encompasses "sex" and "sexual." The person cluster includes terms such as "person" and "personal," and the user cluster refers specifically to "female user/s." The equality cluster incorporates terms like "equality," "equalitarian," and "equity," and the woman cluster includes "woman," "women," "female researcher/s," and "female scientist/s." Lastly, the citizenship cluster includes terms such as "citizenship" and "female citizen/s." The presence of these terms was only considered relevant when they appeared within the context of gender or sex.

The occurrence of GRTs was calculated across the four deliverables (I, II, III, IV). Figure 2 presents various GRTs, specifically "gender," "sex," "person," "user," "equality," "woman," and "citizenship," along with the frequency of their appearance in each deliverable. As illustrated in the figure, there is a clear trend indicating an increase in the use of GRT throughout the training. This is particularly evident in deliverables III and IV, where terms such as "gender," "sex," and "woman" appear more frequently than in deliverables I and II. There was also a noticeable shift from more general terms (e.g., "person" and "user") in the earlier deliverables to more specific ones (e.g., "gender") in the later deliverables. Although participants were not informed that this quantitative analysis would be conducted, the frequency of GRTs usage appears to have been strongly influenced by the facilitator's emphasis on shifting the teaching focus—from content-centric to

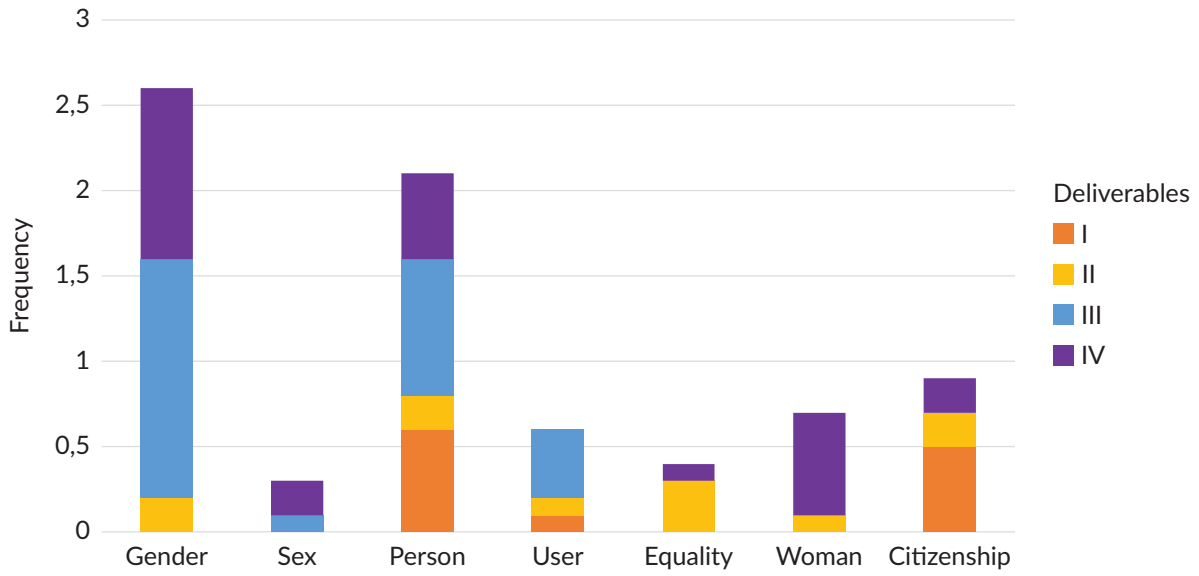

Figure 2. Increase in the frequency of gender-related keywords across syllabus deliverables (I–IV).

people-centric, whether referring to target groups or students. This focus likely accounts for the high occurrence of terms within the "person" cluster. Additionally, the final deliverable (IV) saw the explicit inclusion of female contributions or case studies in the syllabi, which explains the significant appearance of terms in the "woman" cluster.

From a qualitative perspective, the overall performance of each participant was classified into three categories: high, incipient, or stagnant. The results are summarized in Table 4. The term Stagnant refers to cases where participants either discontinued their involvement after the first two deliverables or showed no significant progress in their work. Thirty-one percent of participants were classified as demonstrating a High performance. While this does not imply that the results were exceptional, it reflects a notable improvement, successfully incorporating gender-related elements into their teaching design. Additionally, 31% of participants were categorized as having an Incipient performance, indicating they had introduced a gender-related activity but had not yet consistently modified their syllabus or explicitly integrated a gender dimension. Nonetheless, educators in this group made some progress by adopting inclusive language and/or including female authors in their bibliographies.

Table 4. Summary of participants' performance in the syllabus analysis activity.

ID	FTM	Feasibility	Contents Wall	Performance
1	T	High	Yes	High
2	T	Low	Yes	Stagnant
3	F	Low	Yes	Stagnant
4	F	Low	Yes	Stagnant
5	F	Low	No	Stagnant
6	T	Medium	Yes	High
7	F	High	No	Incipient
8	M	High	No	Incipient
9	F	Low	Yes	High
10	F	Low	Yes	Incipient
11	F	Low	Yes	High
12	T	Medium	Yes	Incipient
13	T	High	No	Incipient
14	T	High	Yes	Stagnant
15	T	High	Yes	High
16	F	Medium	Yes	Stagnant

It might be expected that subjects with high feasibility would correspond to better performance and thus be classified as high. However, as illustrated in Table 4, the reality is quite different. In fact, 50% of participants working on subjects classified as highly feasible only achieved a Stagnant performance. Generally, active participation in the Contents Wall significantly increases the likelihood of successfully transforming the syllabus.

3.6. Assessment by Participants

After training programs no. 1 and no. 2, participants were asked to rate their gender-in-teaching expertise on a scale from 0 to 10. The participation rates were 81% and 88%, respectively. The average score obtained was 8.22, indicating significant success. In training no. 1, the initial average score was 3.6/10, which increased to 8.1/10 by the end (no initial data was available for training no. 2).

Additionally, when participants were asked if they planned to incorporate new gender-related activities in the near future, all responded affirmatively, demonstrating increased self-confidence following the training.

Feedback from the post-training questionnaire revealed that participants appreciated the progressive approach to revising their syllabi and expressed gratitude for the seamless integration of gender aspects into everyday teaching practices. They valued the flexible and comprehensive treatment of the gender-in-teaching topic and enjoyed the collaborative activities and debates. Participants also highlighted the value of suggested activities between sessions and the feedback provided by both the facilitator and their peers. Many noted that the training had alleviated their initial apprehensions about incorporating gender dimensions into their teaching.

On the other hand, some participants identified limitations. There was a shared concern about the limited time available to attend sessions and work on activities. Several participants suggested that more time was needed to refine activities and develop new ideas. One participant expressed dissatisfaction with the online format of the training, noting that greater progress might have been achieved in an in-person setting.

4. Discussion

This section addresses the RQs posed at the study's outset, analyzing the key findings and insights gained from the training sessions. The discussion reflects on best practices for fostering a reflective and participatory learning environment in online gender-in-teaching training (RQ1) and identifies educators' main challenges and resistances (RQ2). These findings provide essential insights for turning GEPs into effective teaching practices. By identifying strategies that successfully engage educators in integrating gender perspectives, the results highlight practical ways to address gender disparities in higher education. Connecting these practices to the implementation of GEPs supports the creation of more inclusive academic environments and ensures that gender equity becomes embedded in everyday teaching and learning processes.

4.1. RQ1: Best Practices for Creating a Reflective and Participatory Learning Environment in Online Gender-in-Teaching Training Programs

Overall, the proposed activities demonstrated high levels of participation, fostering meaningful exchanges of ideas and experiences while producing significant outputs. The online framework contributed to this success by providing equal accessibility to shared documents and facilitating seamless team communication through parallel virtual rooms. The flexibility of the online environment also allowed the facilitator to move between rooms and provide personalized feedback. Nevertheless, as per the action research methodology, there remain opportunities for improvement.

The ice-breaking activity effectively established a reflective, respectful, and participatory environment. However, aligning with the recommendations of Carreiro-Otero et al. (2021), the formulated questions could be adapted to better match participants' levels of gender awareness, thereby enhancing their engagement and understanding.

The stereotypes activity successfully facilitated the sharing of ideas among participants within the same area of knowledge. Its primary aim was to boost participants' self-confidence in identifying and addressing gender-related needs, empowering them to incorporate a gender perspective into their teaching practices.

The Contents Wall activity was instrumental in generating gender-related activities tailored to each subject. Even experienced participants benefited from refining existing gender activities. Two critical factors contributed to the success of this activity: (a) the open sharing of information among all participants, which supported those facing challenges, and (b) continuous feedback and suggestions for improvement from the facilitator, helping create engaging and transformative gender activities. The online strategy employed—utilizing a shared digital wall while teams worked in separate rooms—proved optimal. For future iterations, allocating more time for this activity would be beneficial. For example, introducing the activity at the end of one session and completing it in the following session could allow participants more time for thoughtful consideration.

The syllabus transformation process outlined in this study also demonstrated success, achieving significant levels of transformation. However, fostering greater exchange among participants would enhance the learning experience. Encouraging participants to share their draft syllabi with peers could create valuable opportunities for collaborative learning. For this activity, additional resources could provide recommendations about how to make the STEM syllabus more inclusive for women (see, e.g., such as Parson, 2016). Additionally, after the training, alongside the final assessment questionnaire, it would be beneficial to provide participants with co-produced materials (e.g., the Contents Wall) and encourage personal reflections.

While this research primarily discusses online training, its findings can be extended to blended learning and face-to-face teaching. The methodologies used—such as interactive workshops, collaborative digital exercises, and syllabus transformation activities—are adaptable to in-person settings. In fact, some participants expressed that in-person formats might even enhance engagement. The key takeaway is that structured, participatory approaches are crucial for integrating gender perspectives, whether online, blended, or fully in-person. Institutions implementing GEPs could benefit from incorporating similar activities in faculty development for all teaching formats.

4.2. RQ2: Main Challenges and Resistances Faced by Educators

Table 5 summarizes the resistances, barriers, and challenges participants encountered during the training sessions. Based on the experiences observed throughout the study, corresponding actions have been proposed to address these challenges.

Table 5. Identified resistances, challenges, and barriers during the training sessions and seminars and proposed actions.

ID	Description	Action
1	Resentment against men (due to personal experiences or cultural heritage). It appears at the very beginning of the training.	Ask participants to focus on building a better future rather than remaining stuck in the past. Therefore, during the course, polite efforts will be made to avoid any references unrelated to teaching. While it is important to identify classroom situations where gender-related issues have arisen, dwelling excessively on these situations should be avoided. Participants will be encouraged to maintain their attention on identifying strategies to implement in their teaching practices, gradually reducing gender biases over time. If done properly, no extra incidents appear.
2	Gender-blinded (unexperienced) participants	Promote discussion on statistical data and examples to raise awareness (Carreiro-Otero et al., 2021). Indicators from the institution's own students and staff can be used, official databases relevant to the field of study can be employed, and existing literature on the state of the art in the area of study can also be utilized.
3	Lack of consensus on how to reach equity in students' participation	Present and discuss different strategies to promote equal participation. Some educators prefer to direct questions more explicitly to female students, but if this approach is perceived as targeting, it can have the opposite effect. Other educators opt to distribute questions among the class and allow students some time to think before responding. This strategy gives students with lower self-efficacy (often female students) the opportunity to prepare their answers and overcome barriers. Another approach involves posing questions to small groups of two or three students. This allows less confident students to discuss and build confidence before presenting their responses to the entire class. Each educator and student is different, the "one size fits all" cannot be applied.
4	"How can I include gender contents in my gender-neutral subject?" (STEM participants)	In STEM disciplines, it is essential to address the concept of the "cult of objectivity," which refers to the tendency to present these fields as entirely objective, neutral, and free from bias. However, critical epistemology and gender studies have highlighted that this apparent objectivity can be influenced by underlying values, social norms, and power structures. Therefore, it is important to incorporate a critical perspective into these trainings, encouraging reflection on how knowledge is constructed and the potential biases embedded in scientific and technical fields. Indicate that STEM subjects are not gender-neutral and behind any technology or strategy one can find users, beneficiaries, or conceptualists (among others), what represents a source of gender-biased concepts and an opportunity to promote gender equality. To support this effort, resources that highlight gender diversity in STEM, such as those by Kube et al. (2024) and Guo et al. (2024), can be provided.

Table 5. (Cont.) Identified resistances, challenges, and barriers during the training sessions and seminars and proposed actions.

ID	Description	Action
5	Fear against students' and mates' resistance when they are unaccustomed to discussing gender-related topics and, in some cases, are even opposed to them	Promote a gradual and natural introduction of gender dimension, while realizing that the subject benefits from it. Sometimes it is easier when the word "gender" is changed to "human" in order to gain acceptance within the non-gender-awareness teaching staff. Indeed, it is much easier to accept the need to consider people in general than to acknowledge the importance of focusing specifically on gender equity. However, when thinking about people, aspects such as how students are treated, the impact of solutions designed within the subject's field of study on the population, or the influence of personal preferences when proposing one solution over another come into play. Once work has begun in this direction, it becomes possible to analyze how gender affects the evaluation of all individuals involved. Studies such as those by Khokhlova and Lamba (2023) and LaPaglia et al. (2022) could be useful for providing examples of gender bias.
6	Difficulties in making gender explicit in the syllabus, despite the subject, include a gender dimension in all four pillars	Provide sustained support on the transformation of the syllabus. It is often easier to start by including an activity where the gender perspective is very evident and explicitly referencing it in the syllabus. It can also be straightforward to incorporate guidelines emphasizing respect in the classroom, making it clear that behaviors disrespecting diversity will not be tolerated. Gradually, the gender perspective can be integrated into learning outcomes and assessments, ultimately leading to a transformation of the course description and objectives. This transformation should not be rushed but approached progressively and thoughtfully.
7	Lack of time	Define minimum participation to reach the training certificate as a pressure measure for the lack of self-regulation scenario (Barak et al., 2016). The university and the administration should define some incentives for educators by putting in value teaching activities in their professional assessment.

A particularly notable observation was the prevalence of gender-blindness among participants from fields such as engineering and ICT. In these disciplines, gender inclusion remains absent in most subjects, reflecting an ongoing gap in understanding how gender perspectives intersect with these fields. STEM educators, in particular, often require additional guidance and support to make the conceptual shift necessary for incorporating a gender dimension into what are often perceived as gender-neutral subjects. For example, Gilbert (2009) provides useful insights into gendering practices in mechanical engineering and materials science. Addressing these challenges will require continued efforts to engage educators in reflective practices, provide targeted resources, and offer ongoing support to build confidence and competence in integrating gender into their teaching practices.

The gender gap in higher education remains a critical issue, shaped by stereotypes (Makarova et al., 2019), systemic and family structures (LaCosse et al., 2016; Shin et al., 2015; Sinnes & Løken, 2014), and socioeconomic and demographic factors (Giaconi et al., 2024). Mentorship has emerged as a powerful strategy for addressing this gap, as demonstrated by Stout et al. (2011), who highlight its positive effects in

fostering women's STEM identity and commitment. By adopting a multifaceted approach, educators, policymakers, and society at large can promote a more inclusive and equitable landscape.

This research underscores the vital role of integrating gender perspectives into curricula and teaching to advance gender equality within higher education. By identifying effective strategies and addressing key challenges, the study provides practical tools for educators and institutions to address gender mainstreaming in educational practices as an action of the GEP. Embedding gender in curricula not only fosters inclusive learning environments but also challenges entrenched biases, particularly in STEM fields, as shown by Parson (2016). Sharing these findings is essential for promoting the widespread adoption of these practices, encouraging cross-disciplinary collaboration, and ensuring that gender equity becomes a core component of academic culture. Disseminating these insights supports sustainable, actionable change, contributing to more equitable and transformative educational systems.

5. Limitations of the Study

The fact that the same facilitator led all seven training sessions and seminars can be viewed as both an advantage and a limitation. On the positive side, consistency in the facilitation approach enabled comparisons across the different courses, allowing for a deeper understanding of the training's impact and facilitating the identification of trends and patterns. However, it is important to recognize that the facilitator's characteristics and style could have influenced participants' performance. Different facilitators might employ varied approaches and techniques, potentially leading to different outcomes.

Another limitation is that all seven courses were conducted within Spanish universities. Consequently, the findings can only be extrapolated to similar contexts. The cultural and institutional characteristics of Spanish universities may differ from those in other educational systems, potentially affecting the generalizability of the results. To validate these findings in broader contexts, similar studies should be conducted in diverse cultural and educational settings.

In addition, the participants who contributed the most to the study were likely those already interested in or supportive of gender equality initiatives. This self-selection bias may mean the findings do not fully reflect the challenges and resistances faced by educators who are less engaged or resistant to integrating gender perspectives. Future research could explore strategies to specifically engage these less interested educators to better understand and address varying levels of commitment and resistance.

6. Conclusions

A research-action approach was utilized to design, implement, and analyze online synchronous gender-in-teaching courses. The outcomes of this approach led to the development of an improved training structure that leverages technology to facilitate the natural and collaborative integration of the gender dimension into teaching practices, contributing to a gradual transformation in higher education and supporting the implementation of GEPs.

The analysis included four training sessions and three seminars involving over 140 educators. The digital nature of the courses enabled the collection of substantial data gathered both during collaborative

in-session activities and through digital platforms that supported assignments between sessions. Throughout the process, key challenges and resistances were identified, and corresponding actions were proposed to address them. These findings offer actionable insights that help bridge the gap between GEP policy mandates and practical teaching interventions.

The Contents Wall activity emerged as the pivotal synchronous element of the training. When combined with active exchanges among participants and feedback from the facilitator, this activity resulted in the most impactful experiences and the establishment of a connected network of educators committed to integrating gender perspectives.

The analysis revealed that sustained support for educators is essential to achieve genuine subject transformation through coherently incorporating the gender dimension, aligning with the structural changes envisioned by GEPs. This support can be effectively delivered through online gender-in-teaching training courses consisting of weekly sessions, allowing participants time for individual reflection between sessions. As a result of this transformation, students benefit from a more personalized and human-centered learning experience, contributing to the broader goals of gender equality and inclusivity in higher education.

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Conflict of Interests

The authors declare no conflict of interests.

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