



## Practice Paper

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## **TEACHING WITH A GENDER LENS: INSIGHTS FROM A GUIDE TO INCLUSIVE PRACTICES IN CIVIL ENGINEERING**

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### **ABSTRACT**

Within higher education, integrating gender perspectives into teaching is crucial for inclusivity and addressing gender disparities. This article presents a guideline from the "Xarxa Vives Guides," a resource offering educators strategies for incorporating gender considerations across disciplines. In particular, the civil engineering guideline

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contains general and specific actions aimed at creating a more inclusive learning environment. General recommendations focus on teaching methods, classroom dynamics, assessment, and content. The emphasis is on using diverse methods, promoting respectful dialogue, and employing fair assessments. Additionally, course content should integrate the contributions of underrepresented groups and address gender-related issues within civil engineering. The guideline delves into specific recommendations for various subject areas within civil engineering education. Examples illustrate how to integrate gender perspectives, from considering gendered needs in water access projects to incorporating them into transportation planning. Finally, the chapter presented in this article explores fostering research with a gender lens. This includes supporting students in conducting gender-sensitive research projects and integrating gender considerations throughout the research cycle. By following these recommendations, civil engineering educators can empower students to challenge gender inequalities and contribute to a more equitable and inclusive profession.

## **1 INTRODUCTION**

Teaching with a gender lens in higher education institutions is imperative to promote inclusivity, address gender disparities, and prepare students to navigate diverse professional environments.

Recognising the importance of integrating gender perspectives into teaching methodologies, Xarxa Vives has developed comprehensive guidelines aimed at educators across multiple disciplines. These guidelines serve as a framework for incorporating gender-sensitive approaches into course content, pedagogy, and assessment, fostering critical thinking about gender biases and their implications in various fields of study.

For engineers, competencies acquired by students upon completing their studies should extend beyond technical skills. In the realm of civil engineering, the chapter developed by Xarxa Vives offers practical strategies for educators to integrate gender considerations into the curriculum and final degree dissertations.

By incorporating these guidelines, educators can empower students to recognise and challenge gender inequalities, ultimately contributing to more equitable and inclusive practices within the field of civil engineering and beyond.

## **2 CONTEXT: THE “XARXA VIVES” GUIDES**

### **2.1 The “Xarxa Vives” guides**

The "Guidelines for University Teaching with a Gender Lens" is a collection of guidelines from diverse disciplines and knowledge fields that provide guidance on reviewing courses from a gender perspective. The guidelines present recommendations and indications related to objectives, content, examples, language used, and selected sources, as well as teaching, evaluation, and learning environment management methods and their results.

The resource has become a pioneer in the European Higher Education Area and has received recognition from the European Institute for Gender Equality, which has



included it as an example of good practice in its Guide to Tools for Gender Equality in Academy and Research.

The following are the fields of knowledge and disciplines of the collection:

- Arts and Humanities: Anthropology, Philology and Linguistics, Philosophy, History, Art History, Museology and Museography, Translation and Interpretation.
- Sciences: Physics, Mathematics.
- Social and Legal Sciences: Communication, Law and Criminology, Education and Pedagogy, Sociology, Economics, and Political Science, Geography, Tourism, Business Administration and Management, Social Work.
- Life Sciences: Biology, Nursing, Medicine, Human Nutrition and Dietetics, Psychology, Sports Science and Physical Activity, Podiatry.
- Engineering and Architecture: Architecture, Computer Science, Telecommunications Electronic Engineering, Industrial Engineering, Multimedia Engineering, Agricultural Engineering, Naval, Marine, and Nautical Engineering, Civil Engineering.

Each year, this list grows bigger as guidelines are added to the collection. During year 2023, one of the guidelines developed was the civil engineering one, which is presented here (Josa & Real, 2024). Note that, at the moment of preparing this article, the guideline is only available in Catalan. However, the versions translated to Spanish and English are currently being prepared.

## **2.2 Gender and Civil Engineering**

Over the years, the number of female students and professionals in civil engineering has been increasing. However, differences between men and women are still present. According to the 4th UPC Equality Plan 2022-2026 (Universitat Politècnica de Catalunya, 2022), the percentage of new female students in UPC degrees (mainly engineering and architecture degrees) in the 2021/22 academic year was 31%. This represents an increase from the 2016/17 academic year, when it was 24.4%. The Civil Engineering degree is around the average of all STEAM degrees at the UPC, below degrees related to health and environmental sciences and technology, but above degrees related to Information and Communication Technologies (ICT), where percentages are much lower.

The same pattern is reproduced globally. For example, Imperial College London currently has 29% female students studying Civil Engineering (Imperial College London, 2023), around 31% at École des Ponts (ParisTech) (École des Ponts ParisTech, 2023), between 30% and 40% at the National University of Singapore (National University of Singapore, n.d.) and 30% at the University of Sydney (The University of Sydney, n.d.).

Regarding the differences that exist between men and women who enrol in engineering studies, several studies have found that women are often more attracted to studies that are related to "people", while men tend to choose careers more related to "things" (Su et al., 2009). In addition, other studies have highlighted that women's greater interest in more socially oriented careers is motivated by altruism and a desire to help others and benefit society (Freund et al., 2013).



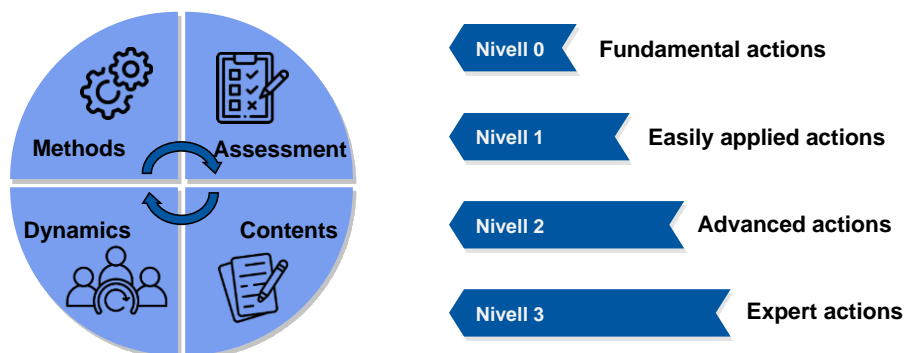
In addition to the differentiated interests between men and women, it is important to consider aspects related to the work environment. Some work environments and cultures can be unwelcoming for women. The lack of diversity and gender equality in organizations and cases of discrimination, harassment, or unequal treatment can create an unfavourable environment for female civil engineers, which can negatively affect their motivation and job satisfaction, and even lead to them leaving the profession. In this context, it is important to note that there are significant salary gaps between men and women in the civil engineering sector (Manesh et al., 2020; Shrestha et al., 2020).

### 3 CONTENTS OF THE GUIDE

The guide delves into this mainstreaming, proposing the inclusion of gender perspective through the implementation of actions in all stages of teaching: teaching methods, teaching dynamics, evaluation, and content. One of the main innovations it brings is the addition of four levels of complexity of the actions to be implemented: fundamental, easily applicable, advanced, and expert.

#### 3.1 General recommendations for teaching with a gender lens

The gender lens may be introduced through actions in four basic pillars: teaching methods, teaching dynamics, assessment, and content. Furthermore, the actions that can be taken may cover four different levels (see Figure 1).



*Fig. 1. Structure of the contents of the guideline*

Below are general teaching recommendations for each of the pillars:

- Teaching methods: that different backgrounds will result in diverse prior experiences and knowledge. Therefore, based on this, the more diverse the classrooms are (including women, for example), the more varied teaching and learning methods must become – otherwise, the majority group will become dominant and privileged. This emphasis on using varied teaching and learning methods is not just a matter of inclusion. Although active and cooperative learning experiences are inclusive, they are also recommended as strategies to improve learning and motivation for all students, regardless of their characteristics (e.g., gender, socio-economic status, cultural background, prior knowledge, etc.).
- Teaching dynamics: when a gender perspective is applied to teaching dynamics, it implies a reflection on the dynamics that occur in the classroom and in the learning environment. It is important to consider these dynamics to ensure that

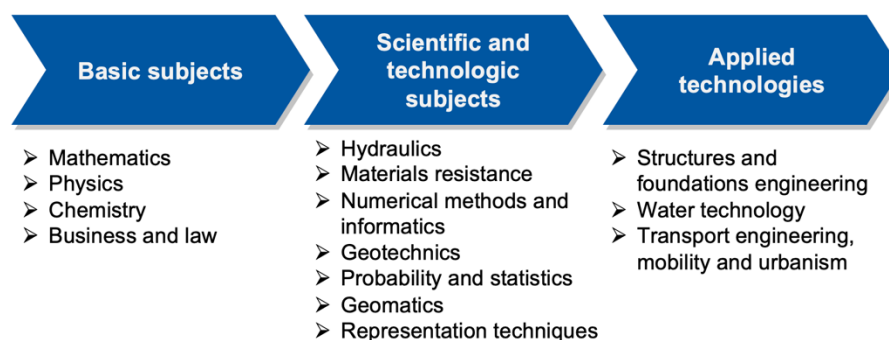


they are equitable and respectful of diversity. This involves being aware of power relations, promoting inclusive participation, encouraging dialogue and collaboration, and fostering a supportive and inclusive atmosphere where all students feel valued and respected. Some strategies to achieve this include: encouraging students to reflect on their own assumptions and biases, promoting inclusive language and communication, providing opportunities for students to share their experiences and perspectives, and creating a safe and supportive learning environment where all students feel comfortable expressing themselves and participating actively in discussions and activities.

- **Assessment:** assessment is a crucial aspect of teaching and learning, as it provides feedback on students' progress and achievements and informs future teaching and learning activities. When applying a gender perspective to assessment, it is important to ensure that assessment tasks are fair, equitable, and inclusive of all students. This involves using a variety of assessment methods that allow students to demonstrate their learning in different ways, considering students' diverse backgrounds and experiences, and avoiding bias and stereotypes in assessment tasks and criteria. Some strategies to achieve this include: using a mix of assessment methods (e.g., essays, presentations, projects, exams, etc.), providing clear and transparent assessment criteria and expectations, offering opportunities for students to receive feedback and improve their work, and being mindful of the language and examples used in assessment tasks to ensure they are inclusive and respectful of diversity.
- **Content:** content refers to the subject matter or material covered in a course or curriculum. When applying a gender perspective to content, it is important to ensure that the content is inclusive, representative, and relevant to all students. This involves integrating gender perspectives into the curriculum and course materials, highlighting the contributions and experiences of women and other underrepresented groups in the field, and addressing gender-related issues and topics in the subject matter. Some strategies to achieve this include: including diverse perspectives and voices in readings and case studies, using examples and illustrations that reflect the diversity of the student body, and exploring gender-related topics and themes in the curriculum. Additionally, it is important to provide opportunities for students to critically reflect on gender-related issues and to engage in discussions and activities that promote awareness and understanding of these issues.

### 3.2 Specific recommendations for teaching with a gender lens

The specific recommendations related to content are given grouped as shown in Figure 2.



*Fig. 2. Organisation of recommendations given for content*



### **3.2.1 Basic subjects**

This group of subjects encompasses competencies and content of basic training subjects, namely mathematics, physics, chemistry, and business and legislation. Mathematics is fundamental for structural analysis, force and motion calculations in structures, and the study of hydraulics. Physics is used to understand the fundamental principles of material and fluid behaviour, while chemistry is important for understanding material reactions, properties of construction materials, or water treatment processes.

Despite these subjects appearing gender-neutral at first glance, it is crucial to recognise that gender inequalities can manifest within these areas, influencing participation, academic performance, and student perceptions. Hence, it is important to introduce such issues from the beginning, gradually raising students' awareness throughout their studies. While topics like differential equations or the first law of thermodynamics are gender-neutral, technical content can be taught in different ways, considering gender, learning environment, types of assessment, teaching methods, etc. Additionally, although the theoretical basis remains unchanged, the examples used to illustrate it and the projects proposed in class can be more inclusive than those traditionally used in engineering classrooms.

### **3.2.2 Scientific and technologic subjects**

The scientific and technological group of subjects focuses on applying scientific principles to engineering problems. Subjects like hydraulics emphasise real-world challenges, such as providing clean water access, particularly in rural areas where women often bear the burden of water retrieval. Implementing water distribution networks could greatly improve quality of life and gender equality by relieving women of this responsibility and allowing them to engage in other activities. In addition to technical considerations, it is crucial to consult affected communities to ensure interventions align with their needs and perspectives.

Furthermore, disciplines like materials resistance and geotechnics address gender-related factors in engineering design and analysis. For instance, considering how gender inequalities may affect terrain or landslide risk perception and responses can lead to more inclusive and effective solutions. The integration of gender perspectives extends to statistical analysis and spatial techniques, aiming to uncover hidden disparities and improve decision-making processes.

### **3.2.3 Applied technologies**

This group of subjects encompasses subjects directly applicable to the profession, focusing on specialised content in various areas such as civil engineering and construction, including structures, water, and transportation/urban planning. For instance, within the realm of structural engineering and foundations, the emphasis lies on designing and calculating structures supporting different types of buildings and infrastructure, with a unique opportunity to delve into techniques ensuring safety, reliability, and sustainability. Incorporating a gender perspective in the conception and construction of structures and foundations is highlighted to ensure projects address diverse population needs, promoting equitable and safe access to buildings and infrastructure. Activities like debates and practical cases, such as the Citicorp Center's structural issues and seismic vulnerability, underscore the importance of



understanding gender implications in engineering and fostering discussions on integrating gender perspectives in design, calculation, and construction processes.

Furthermore, in water technology and transportation, mobility, and urban planning, the significance of considering gender perspectives in addressing water management, transportation infrastructure, and urban planning challenges is emphasized. By analyzing gender dynamics, especially concerning travel patterns and access to resources like water and transportation, engineering education aims to design inclusive solutions responsive to diverse population needs. Practical cases, like designing water supply systems for rural communities with a gender focus, highlight the importance of equitable access to resources and involving communities in the design process. Debates on gender perspectives in public and private transportation usage aim to explore challenges women face in daily mobility and discuss strategies to enhance gender inclusivity in transport planning and policy-making, fostering collaboration among various stakeholders to integrate gender perspectives effectively.

### **3.3 Recommendations for doing research with a gender lens**

To encourage students to conduct gender-sensitive research, it is essential to integrate aspects of research into teaching. Various methods can be employed to introduce research and its connection with gender in the classroom, such as showcasing research projects and practical cases that have considered gender implications in the field of civil engineering. Additionally, fostering critical reflection on gender biases in civil engineering and how they can affect professional and research decisions is crucial. Supporting research with a gender perspective, whether in academic assignments or final projects, is also vital. It is important to identify the level at which gender aspects are being introduced into research projects, with considerations ranging from blindness to transformation. However, while not all research can be transformative, this shouldn't serve as an excuse to limit gender-sensitive analysis.

Incorporating gender perspective throughout all stages of the research cycle, from conceptualization to analysis, report writing, and conclusions, is crucial and should not be left until the end of the research process, as is often the case. Various conceptual frameworks have been developed to integrate gender considerations into projects, including the Harvard Analytical Framework, Moser's Framework, Gender Analysis Matrix, and others. Integrating gender perspective into research design from the outset is emphasized to fully realize its potential, considering gender as an analytical category or variable rather than the sole focus of research.

Considerations at different stages of a research project include identifying research areas and generating ideas, defining research objectives, conducting research, drawing conclusions, and dissemination. Strategies such as using gender-sensitive methodologies, participatory approaches, and considering gender-specific risks are recommended. Additionally, it is crucial to report data sensitively, analyze gender implications, propose recommendations to address gender biases, and use inclusive language in reporting and dissemination.

Moreover, in various types of final degree projects, such as construction projects, laboratory experiments, simulations, and literature reviews, specific recommendations are provided to integrate gender perspectives effectively. For example, in construction projects, factors like accessibility, lighting, comfort, and



signage should be designed considering the needs of all users, while in laboratory experiments, attention should be paid to ensuring equal participation of all students to enrich their learning experiences. Overall, integrating gender into research projects not only benefits the research outcomes but also inspires students and contributes to a more inclusive academic environment.

#### **4 SUMMARY AND ACKNOWLEDGEMENTS**

This article presented a guideline from the Xarxa Vives guides that promotes integrating gender perspectives into civil engineering education. This approach aims to create a more inclusive learning environment and address gender disparities in the field.

The guideline suggests incorporating gender considerations throughout the curriculum, from teaching methods and classroom dynamics to assessment and course content. It emphasizes using diverse teaching methods, fostering respectful dialogue, and employing fair assessments.

The content itself should integrate the contributions of underrepresented groups and address gender-related issues within civil engineering. Specific examples are provided on how to consider gender in various subjects, like water access projects and transportation planning.

Finally, the guideline encourages research with a gender lens. This includes supporting students in conducting gender-sensitive research projects and integrating gender considerations throughout the research cycle.

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