



SEFI ANNUAL CONFERENCE
19-22 September 2022
BARCELONA



Gender mainstreaming in Engineering Education

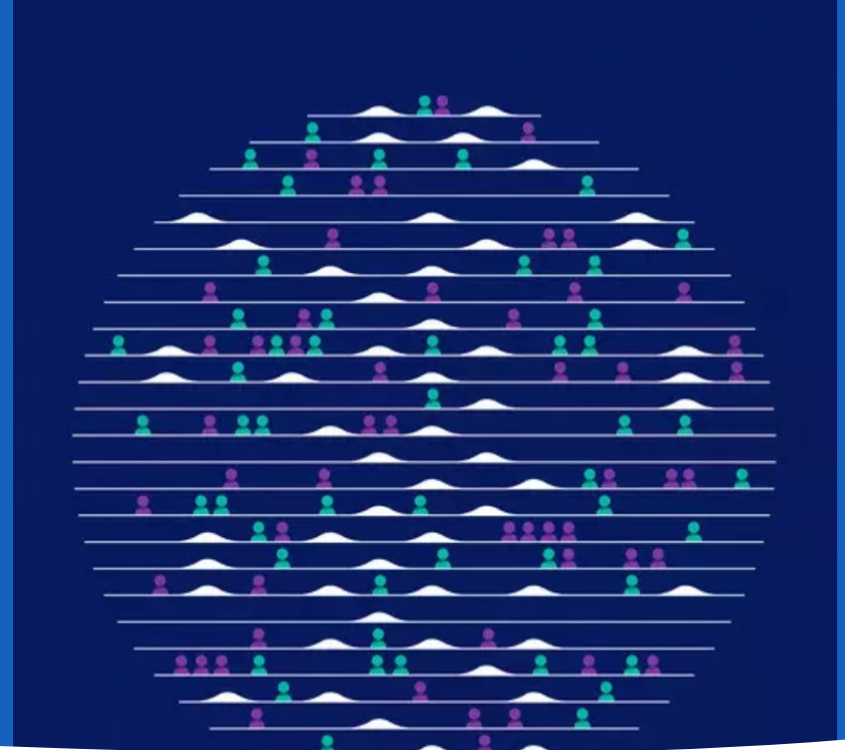
Dr. Alicia García-Holgado
GRIAL Research Group
Computer Science and Automation
Department
Universidad de Salamanca
aliciagh@usal.es [@aliciagh_](https://www.instagram.com/aliciagh_)



Global Gender Gap Report 2022

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Gender parity is not recovering, according to the *Global Gender Gap Report 2022*. It will take another 132 years to close the global gender gap. As crises are compounding, women's workforce outcomes are suffering and the risk of global gender parity backsliding further intensifies.

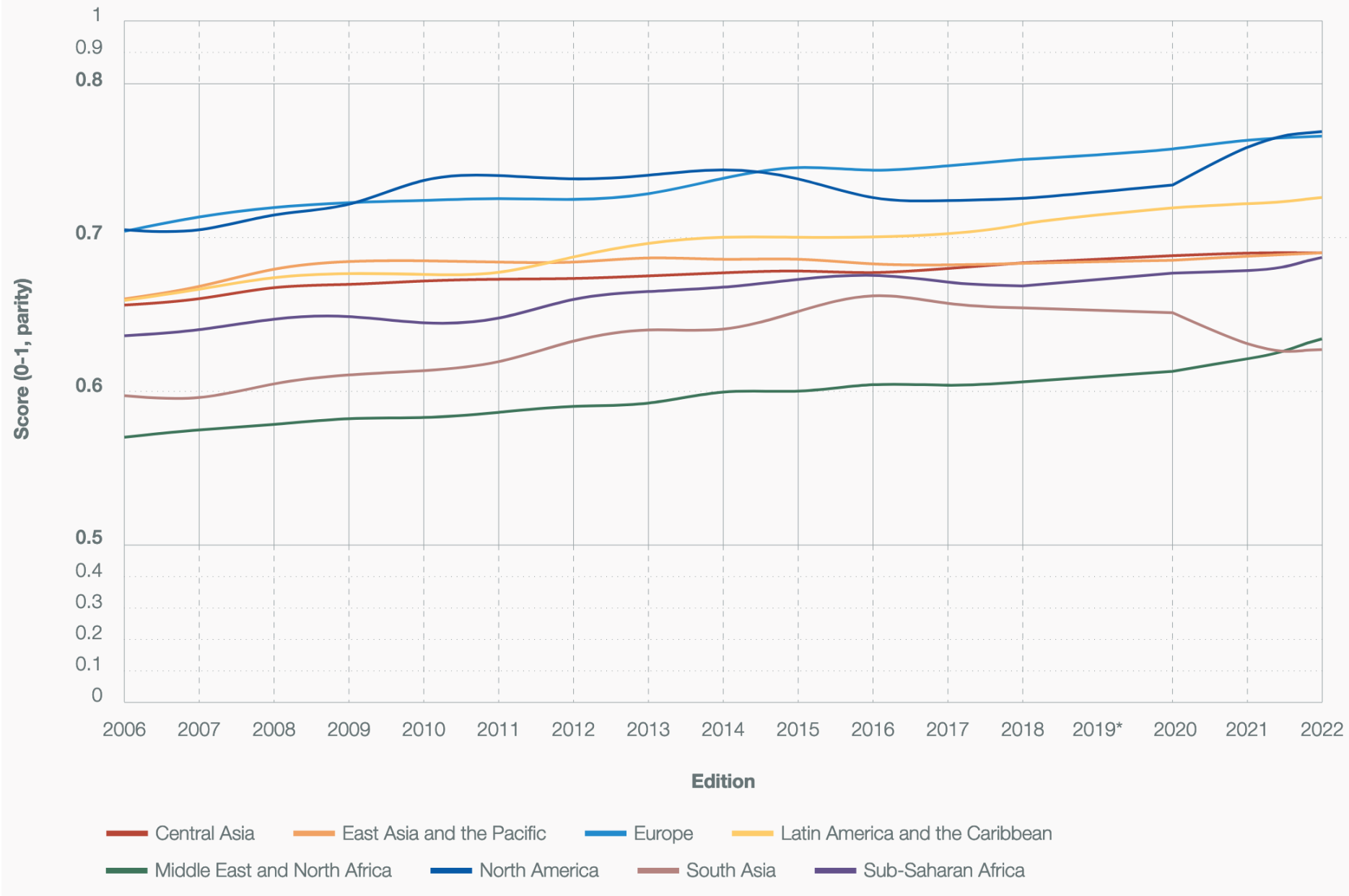


The gender gap in the world (I)

- The Global Gender Gap report 2022 includes 146 countries, however, no country has yet achieved full gender parity
- Europe has the second-highest level of gender parity (76.6%)
- Based on the constant set of 102 countries covered since 2006, the region has a 60-year wait to close the gap

Regional gender gaps

Evolution in scores, 2006–2022




Europe

Country	Rank		Score
	Regional	Global	
Iceland	1	1	0.908
Finland	2	2	0.860
Norway	3	3	0.845
Sweden	4	5	0.822
Ireland	5	9	0.804
Germany	6	10	0.801
Lithuania	7	11	0.799
Switzerland	8	13	0.795
Belgium	9	14	0.793
France	10	15	0.791
Spain	11	17	0.788
Albania	12	18	0.787
Austria	13	21	0.781
United Kingdom	14	22	0.780
Serbia	15	23	0.779
Latvia	16	26	0.771

Netherlands	17	28	0.767
Portugal	18	29	0.766
Denmark	19	32	0.764
Slovenia	20	39	0.744
Bulgaria	21	42	0.740
Luxembourg	22	46	0.736
Estonia	23	52	0.733
Montenegro	24	54	0.732
Italy	25	63	0.720
Slovak Republic	26	67	0.717
North Macedonia	27	69	0.716
Bosnia and Herzegovina	28	73	0.710
Czech Republic	29	76	0.710
Poland	30	77	0.709
Malta	31	85	0.703
Hungary	32	88	0.699
Romania	33	90	0.698
Cyprus	34	93	0.696
Greece	35	100	0.689

The gender gap in the world (IV)

	Subindexes				
	Overall Index	Economic Participation and Opportunity	Educational Attainment	Health and Survival	Political Empowerment
Central Asia	69.1%	68.2%	98.8%	97.4%	11.8%
East Asia and the Pacific	69.0%	72.2%	95.4%	95.2%	13.3%
Europe	76.6%	70.2%	99.5%	97.0%	39.8%
Latin America and the Caribbean	72.6%	64.5%	99.5%	97.6%	28.7%
Middle East and North Africa	63.4%	46.0%	96.2%	96.4%	15.1%
North America	76.9%	77.4%	99.7%	96.9%	33.7%
South Asia	62.3%	35.7%	93.2%	94.2%	26.2%
Sub-Saharan Africa	67.9%	67.7%	85.3%	97.2%	21.3%
Global average	68.1%	60.3%	94.4%	95.8%	22.0%

imparity (0%)  parity (100%)

World Economic Forum, Global Gender Gap Index, 2022

The gender gap in STEM (I)

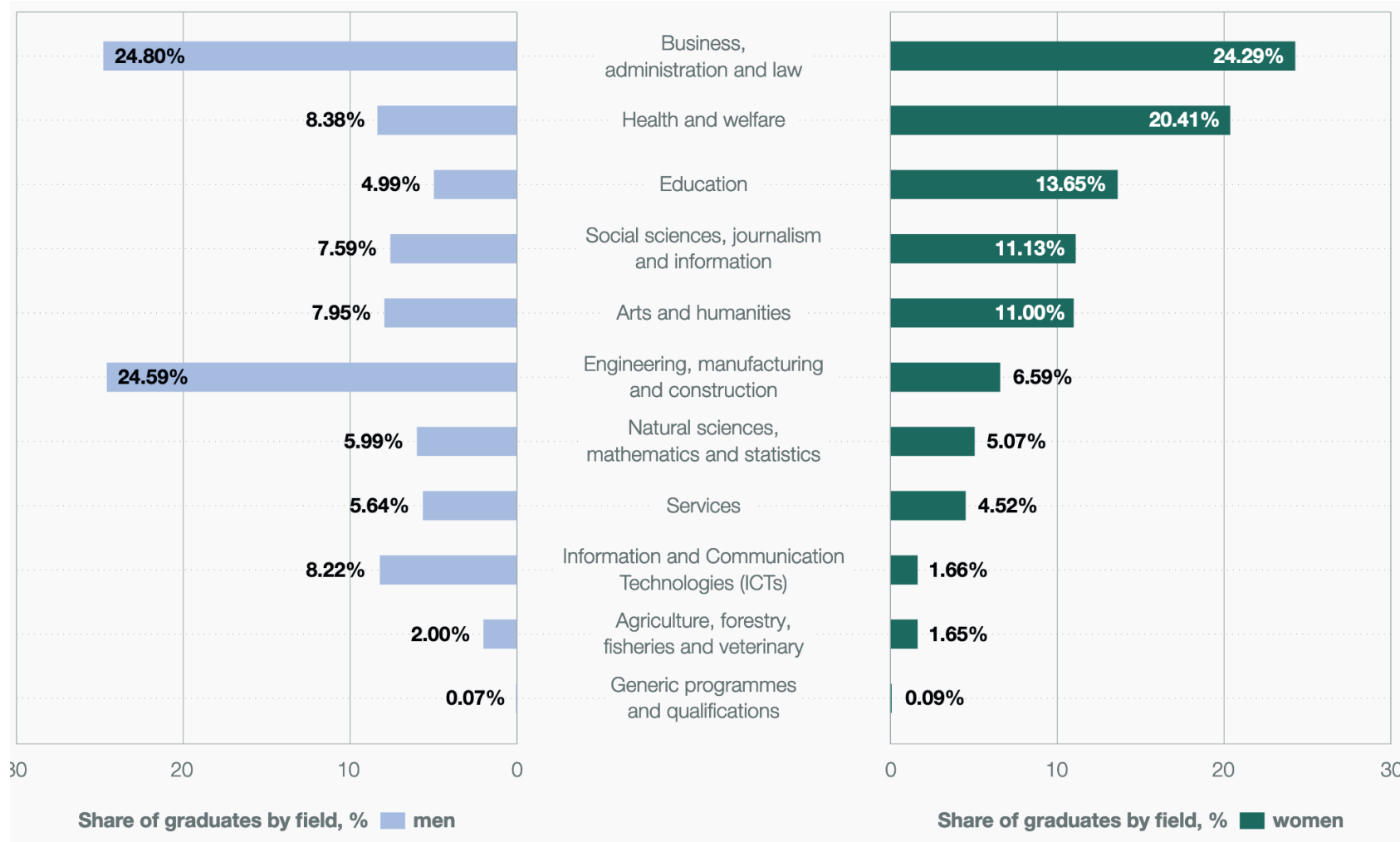
- There is parity in tertiary education enrolment but a significant gap in STEM áreas (UNESCO, UIS.Stat education statistics data portal)
- The percentage of women graduates in ICT is 1.7%, compared to 8.2% of men graduates (World Economic Forum, 2022)
- In Engineering and Manufacturing the same figures are 24.6% for men and 6.6% for women (World Economic Forum, 2022)



The gender gap in STEM (II)

- According to data from the LinkedIn platform, it is estimated that women represent 15% of workers in the engineering sector, despite the fact that engineering has one of the highest employment growth rates in the world (World Economic Forum, 2020)

The gender gap in STEM (III)





What can we do?



SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



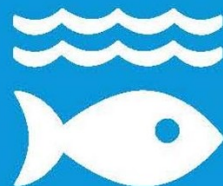
12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS

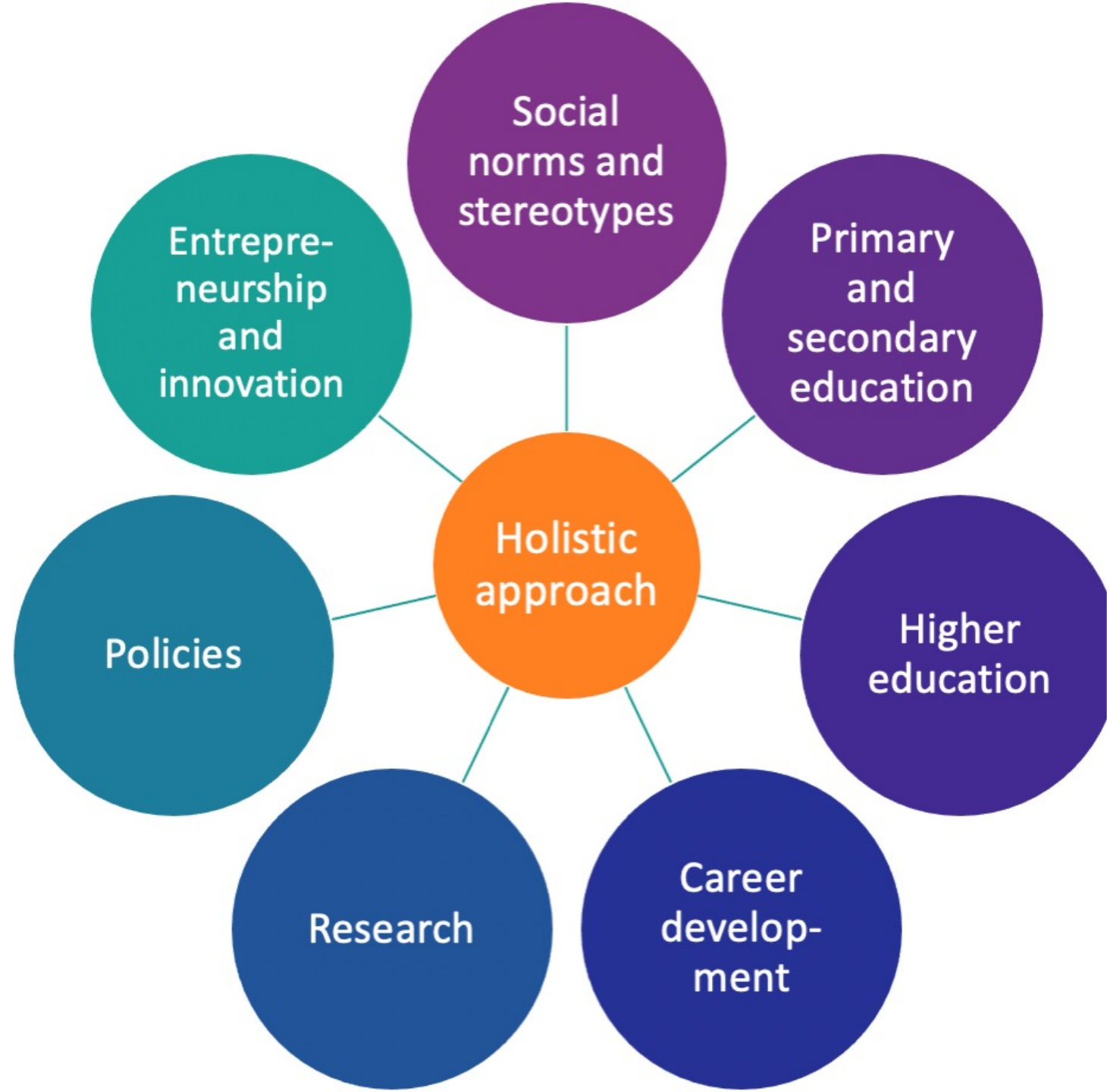


17 PARTNERSHIPS FOR THE GOALS



SUSTAINABLE DEVELOPMENT GOALS

University role



Motivation

An international problem that needs to be addressed at all levels of education

University education

- Methodological initiatives and proposals are still few and far between
- Although it is compulsory for university students to receive equality training, there is little or no practical guidance on how to do this in teaching guides and examples of educational activities

Education for equality

- Methodological proposal for approaching teaching-learning processes with a gender perspective in educational centers
- Students and teachers must be trained in values such as equality, tolerance, dialogue and practical conflict resolution and introduce this knowledge and skills into the educational curriculum





Different ways of gender mainstreaming

- Specific degrees focusing on gender studies
- Degrees that have specific equality subjects
- Gender mainstreaming, in which equality content is integrated into any subject of the curriculum

Co-education

- “It is a current pedagogical proposal to respond to the claim of equality made by feminist theory, which proposes a reformulation of the model of transmission of knowledge and ideas from a gender perspective in socialization spaces for training and education” (Spanish Institute of Woman, 2017)

Main characteristics of co-educational practices

Project/Problem Based Learning (knowledge and observation of the environment)

Crash of traditional educational dynamics and practices

Active Methodologies, participatory and motivating

Non-sexist language

Sensitization of students, teachers and the immediate environment

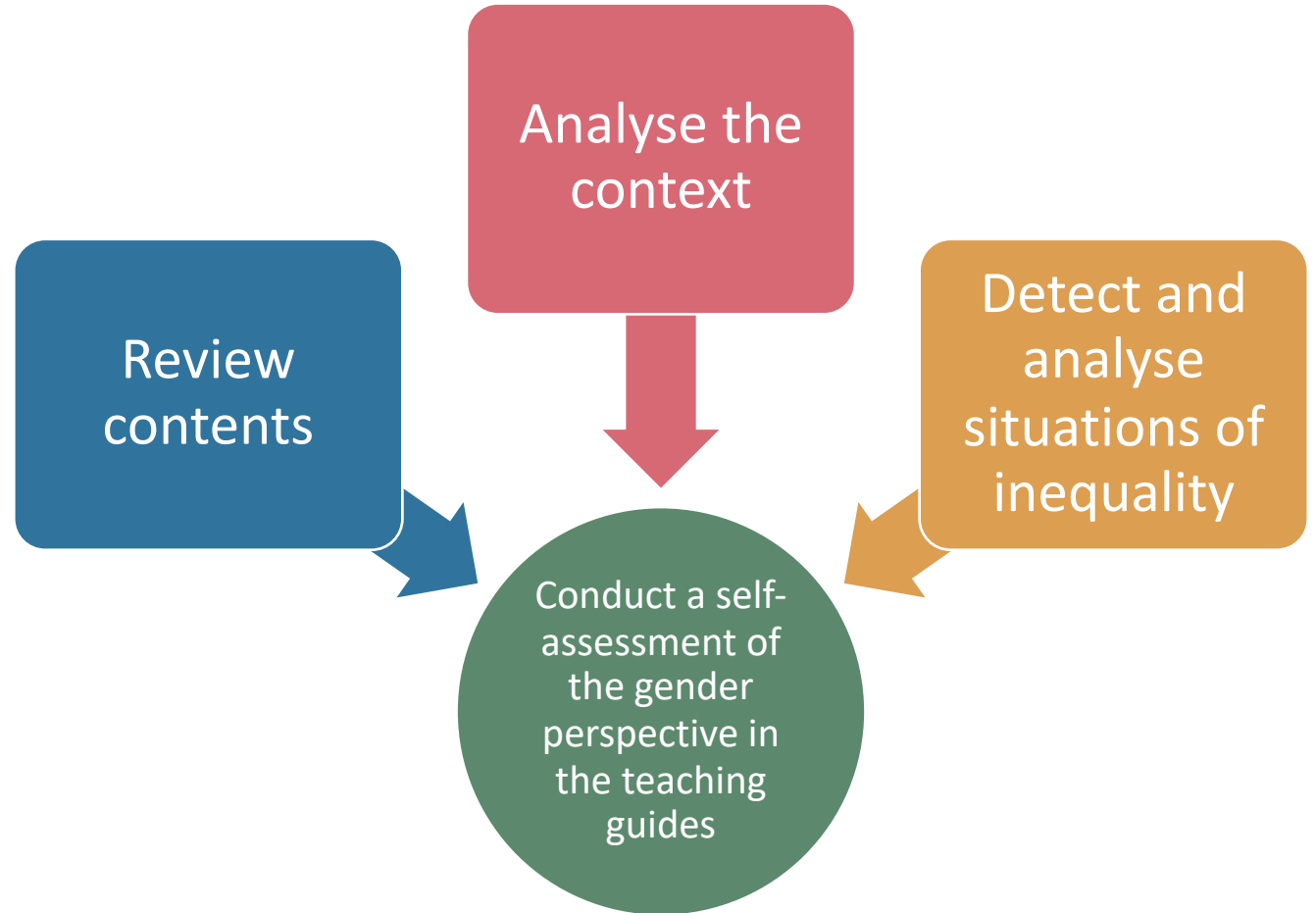
Participation and cooperation

Discovery, critical thinking and debate



How can we incorporate
co-education in
engineering education?

Self- assessment



Rubric for co-educational practices



	Indicators	Yes	No
Classroom	Consideration of the gender perspective in the class approach		
	Consideration of expectations about students		
	Assignment of responsibilities according to sex		
	Consideration about treatment based on sex		
	Spatial arrangement in the classroom to promote the relationship between different sexes		
	Construction of inter-sex and balanced groups		
Language	Defense and use of non-exclusive language		
	The language considers the participation of female students		

	Indicators	Yes	No
Contents	Inclusion of female names and protagonists		
	Non-sexist content		
	Critical review of the bibliography including relevant female authors		
Spaces	Balanced sharing		
	Equal access		
Leadership	Differentiation of leadership capacities based on sex		
	Female presence in leadership roles		



Carina S. González-González & Alicia García-Holgado

Finding out students' perspective on the gender gap: the GENCE 2.0 questionnaire

*Indicate the degree of agreement/disagreement with the following statements (Likert: 1-Strongly Disagree, 2-Disagree, 3-Neither Agree nor Disagree, 4-Agree, 5-Strongly Agree)

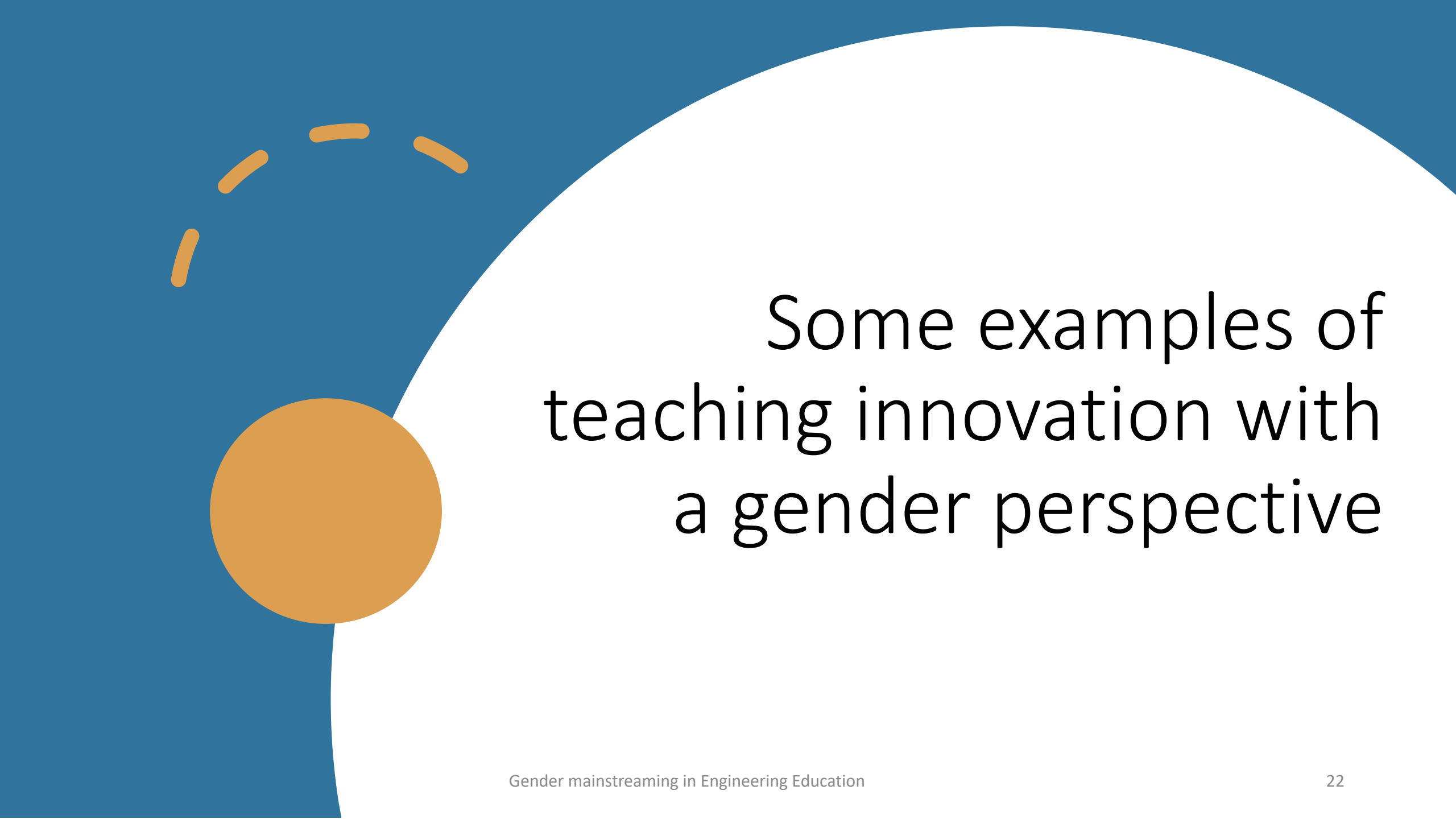
	1	2	3	4	5
Engineering students are treated differently by their teachers according to their gender	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People who enrol in Engineering studies receive the same institutional support regardless of gender	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All people must have the same rights regardless of gender	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gender equality is an important issue that must be addressed from all spheres (family, education, social, and work)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gender equality must be part of the University's curricula	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The women who make studies in Engineering are not feminine enough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People who study Engineering are considered "freaks" (rare)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

García-Holgado, A., González-González, C. S., & García-Peñalvo, F. J. (2020). Gender gap perceptions of computing students: a case study in two Spanish universities. In C. S. González González, A. Infante Moro, & J. C. Infante Moro (Eds.), *2020 X International Conference on Virtual Campus (JICV)* (pp. 10-14). IEEE. <https://doi.org/10.1109/JICV51605.2020.9375768>

García-Holgado, A., González-González, C. S., & Peixoto, A. (2020). A comparative study on the support in engineering courses: a case study in Brazil and Spain. *IEEE Access*, 8, 125179-125190. <https://doi.org/10.1109/ACCESS.2020.3007711>

Design,
develop and
evaluate the
experience



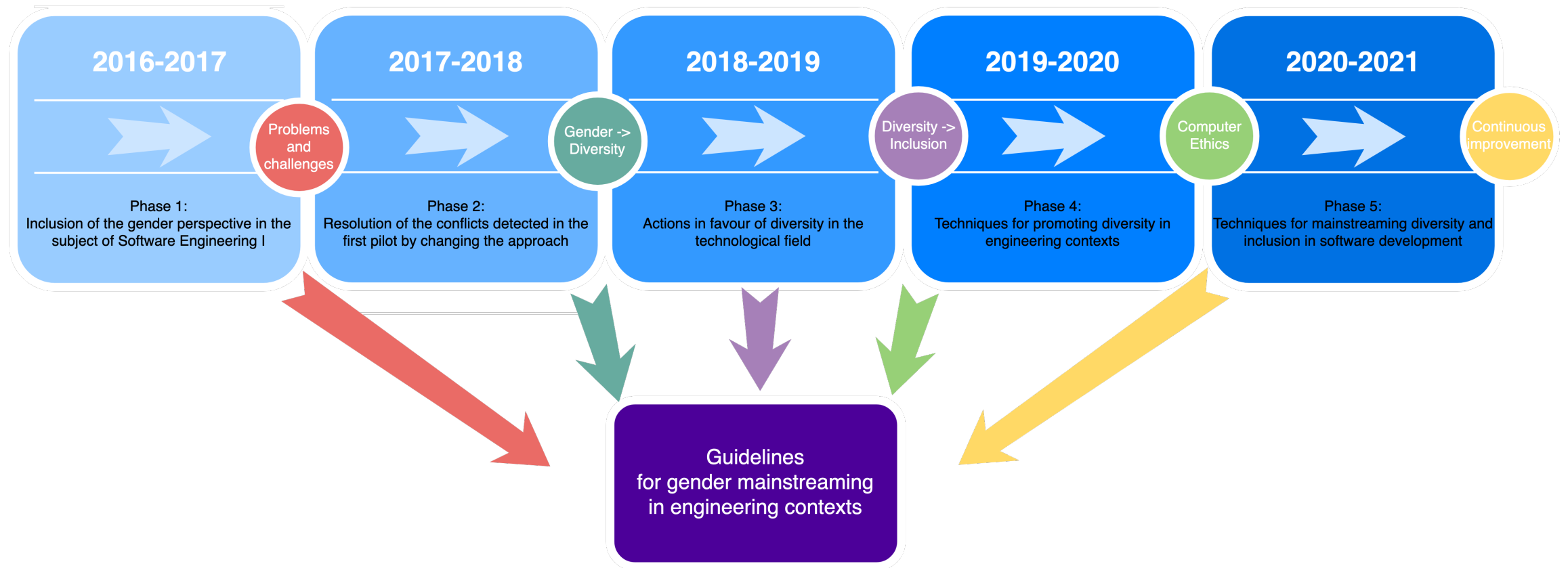


Some examples of teaching innovation with a gender perspective

Gender Mainstreaming in Software Engineering course

Degree in Computer Science, University of
Salamanca, Spain

Gender -> Diversity & inclusion -> Ethics

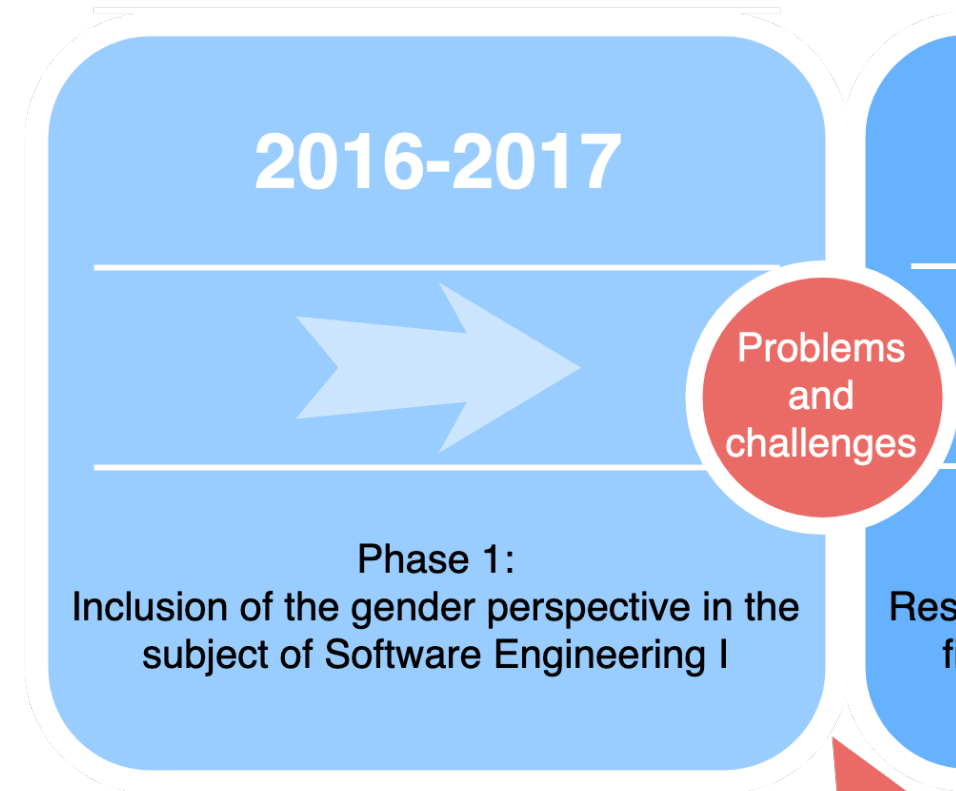


García-Peñalvo, F. J., García-Holgado, A., Vázquez-Ingelmo, A., & Sánchez Prieto, J. C. (2021). Planning, communication and active methodologies: Online assessment of the software engineering subject during the COVID-19 crisis. *RIED. Revista iberoamericana de educación a distancia*, 24(2), 41-66. <https://doi.org/10.5944/ried.24.2.27689>

García-Holgado, A., Vázquez-Ingelmo, A., Verdugo-Castro, S., González, C. S., Sánchez-Gómez, M. C., & García-Peñalvo, F. J. (2019). Actions to promote diversity in engineering studies: a case study in a Computer Science Degree. In *2019 IEEE Global Engineering Education Conference (EDUCON)*, (9-11 April 2019, Dubai, UAE) (pp. 793-800). IEEE. <https://doi.org/10.1109/EDUCON.2019.8725134>

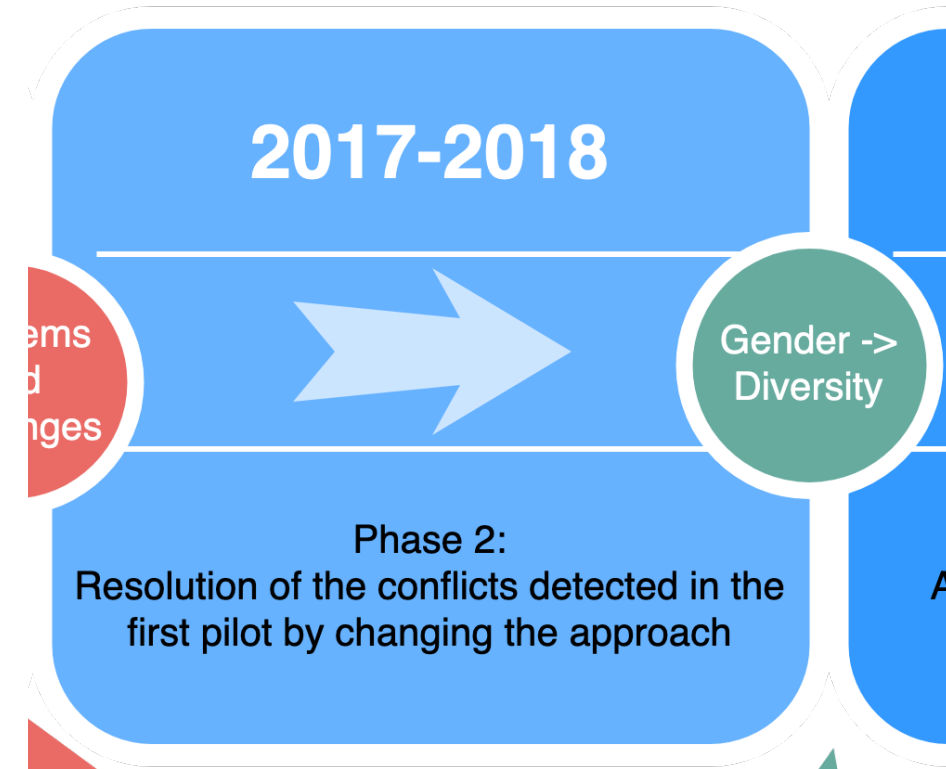
Phase 1

- Review and update educational materials
- Diversity in teams
- Twitter for sharing news
- Gender issues as problems to solve in the workshops
- Final Project developed across the course focused on solving society problems related to women



Phase 2

- Improve and solve issues detected in phase 1
- Remove the introduction talk about gender in technology



Phase 3

- Coach. Focus on diversity and ethics.
- Talks on topics related to software engineering and the professional sector
- Gamification through a set of badges associated with diversity and inclusion



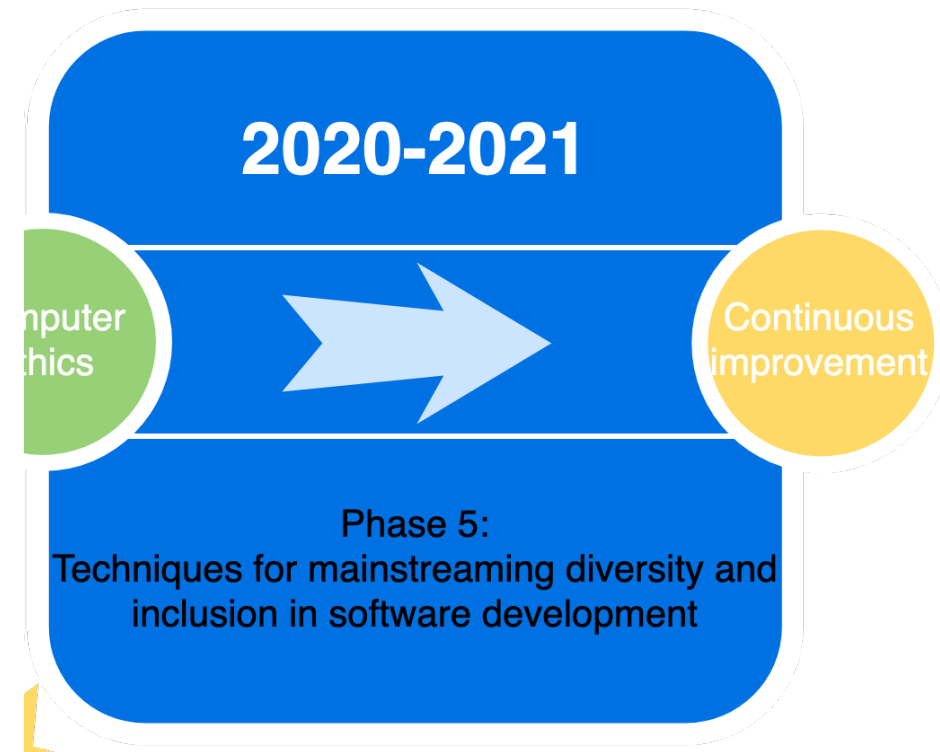
Phase 4

- Selection and adaptation of techniques used in agile methodologies to establish group dynamics that promote internal and external inclusion
- Design thinking techniques



Phase 4

- The last phase focused on incorporating ethical aspects related to software development in the Bachelor's Degree in Computer Engineering through a SPOC
- Lectures on computer ethics: introduction to computer ethics, ethics and HCI, ethics and universal design, and ethics and AI



Gender-sensitive mentoring

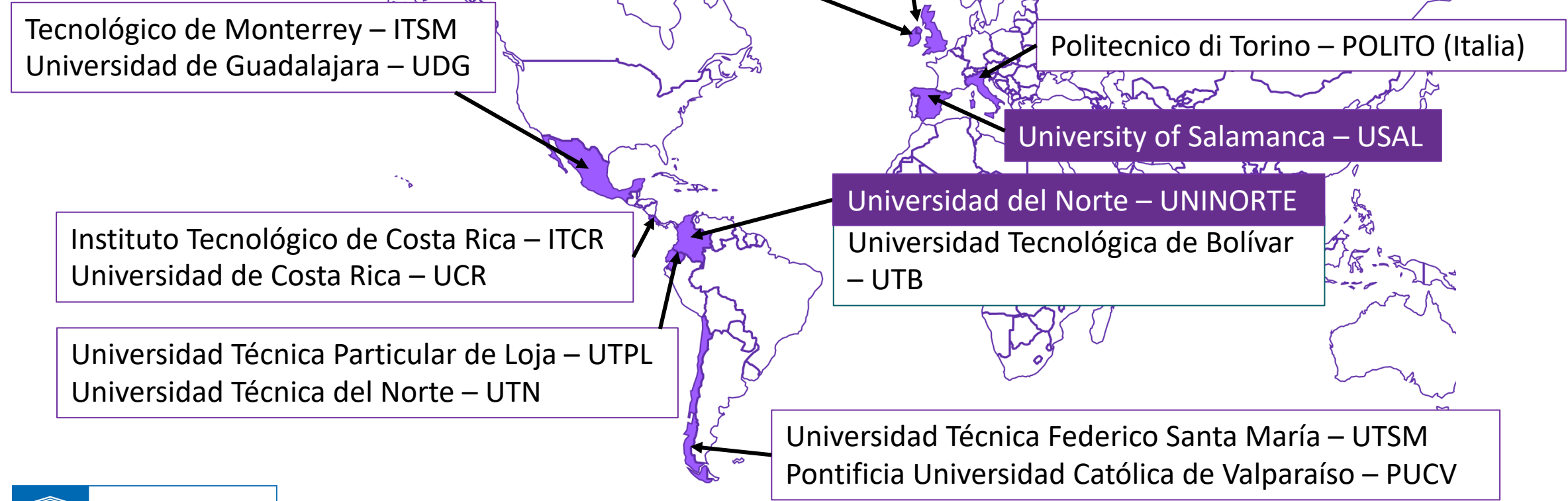


Gender-sensitive mentorship network

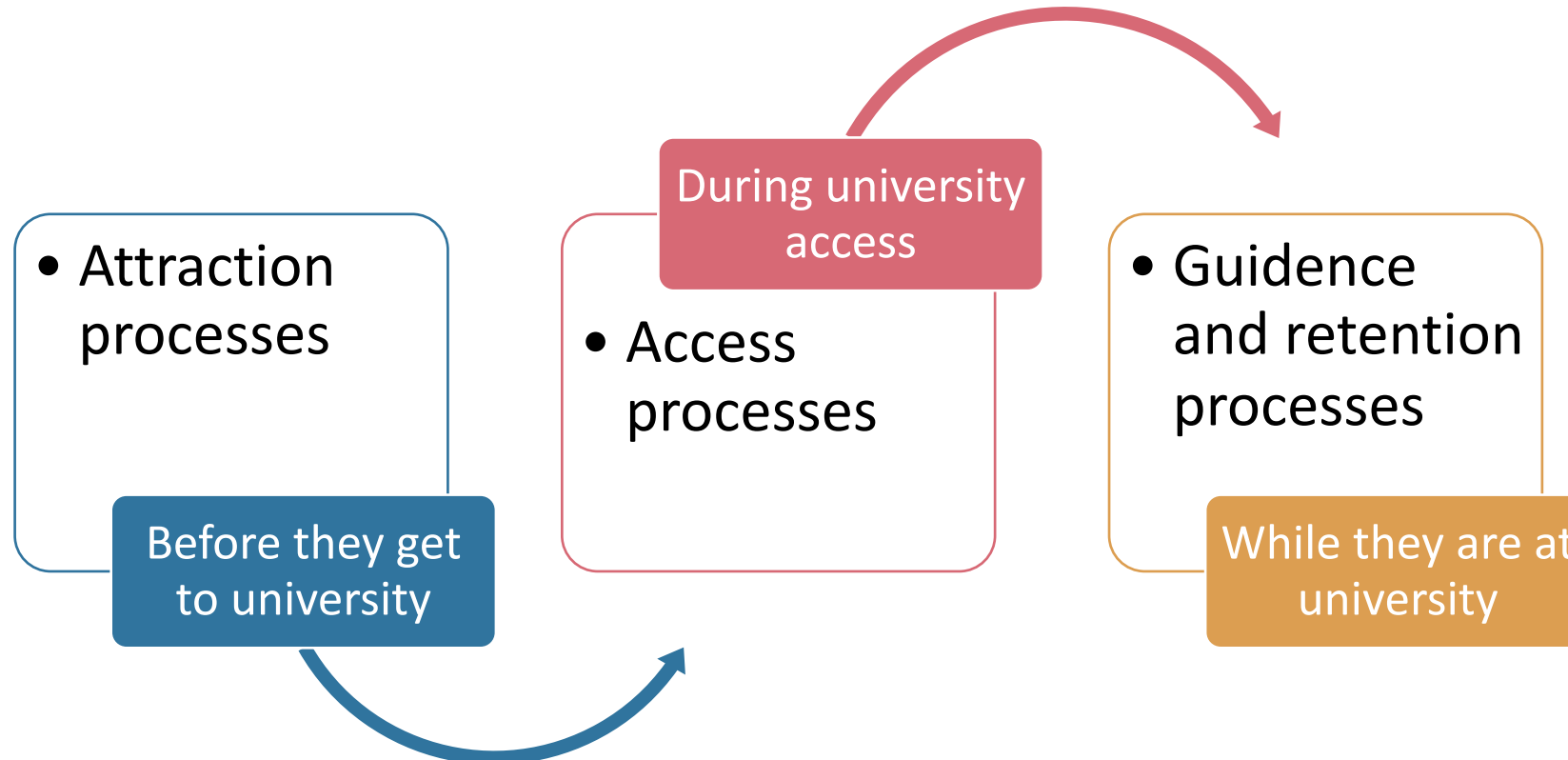
- Co-education approach outside the classroom
- Gender-sensitive mentorship network across countries from Latin America and Europe
- Main action of the W-STEM network

González Rogado, A. B., García-Holgado, A., & García-Peñalvo, F. J. (2021). Mentoring for future female engineers: pilot at the Higher Polytechnic School of Zamora In A. García-Holgado, F. J. García-Peñalvo, C. S. González González, A. Infante Moro, & J. C. Infante Moro (Eds.), *2021 XI International Conference on Virtual Campus (JICV)*. IEEE. doi:10.1109/JICV53222.2021.9600410

W-STEM Network



W-STEM model (I)



García-Holgado, A., & García-Peñalvo, F. J. (2022). A *Model* for Bridging the Gender Gap in STEM in Higher Education Institutions. In F. J. García-Peñalvo, A. García-Holgado, A. Dominguez, & J. Pascual (Eds.), *Women in STEM in Higher Education: Good Practices of Attraction, Access and Retainment in Higher Education* (pp. 1-19). Springer. https://doi.org/10.1007/978-981-19-1552-9_1

Gender-sensitive mentorship for guidance and retention



The goal of the Mentoring Network is to empower women and encourage their active participation in STEM careers

- Training of MENTORs (teachers + students) at centralised level
- Accompanying first-year STEM students and enhancing their student participation
- Generate indicators to characterise young women choosing STEM careers

Cross-cutting training in leadership, women's empowerment, inclusive language, creating inclusive environments

Roadmap to implement the gender-sensitive mentorship

García-Holgado, A., Segarra-Morales, S., González-Rogado, A. B., & García-Peñalvo, F. J. (2022). Definición e implementación de la Red de Mentorías W-STEM. In M. E. García D. & M. Holanda (Eds.), Proceedings of the XIV Congress of Latin American Women in Computing 2022 (LAWCC 2022) co-located with XLVIII Latin American Computer Conference (CLEI 2022), Armenia, Colombia, October 21, 2022. CEUR-WS.org.

Preparation

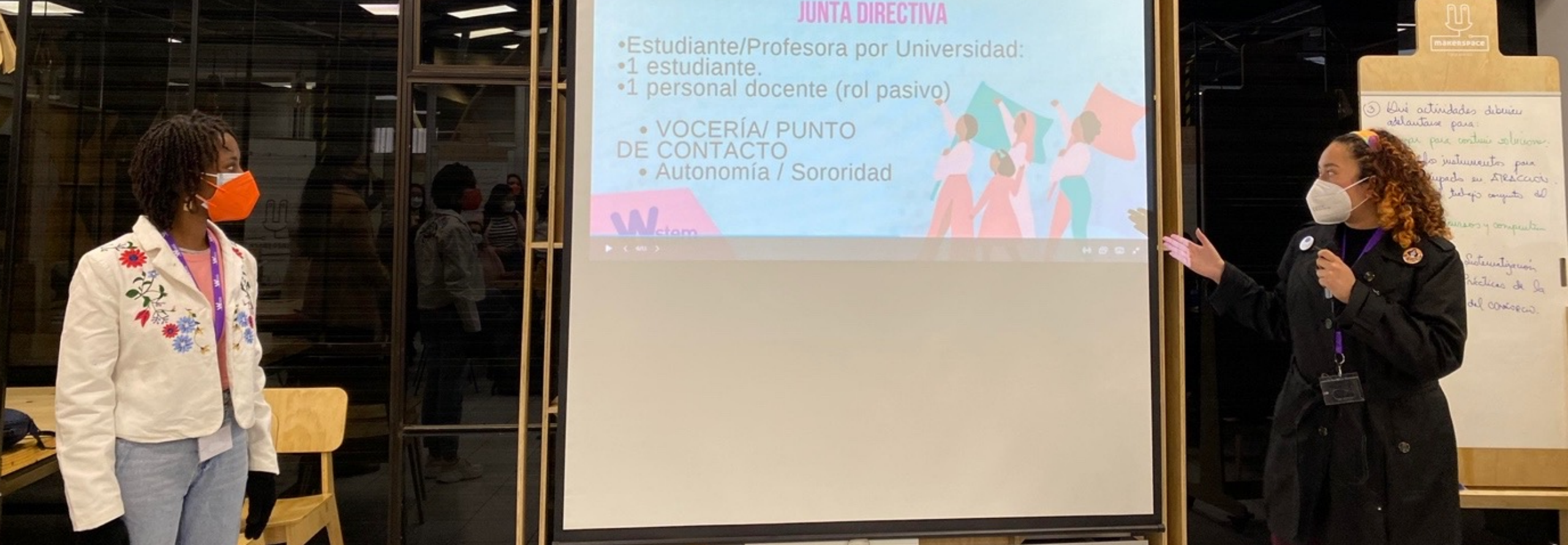
- Identify tutors among the academic staff
- Engage students from first year
- Engage students as mentors

Training

- Training for tutors about co-education
- Training for mentors and mentees about gender equality and inclusion

Implementation

- Share the initial questionnaire
- Organise follow-up meetings
- Collect feedback



Strengthening the network

STEAM-Labs

A co-education
approach in secondary
school

CreaSTEAM project

Co-thinking and Creation for STEAM diversity-gap reduction

- **Acronym**
 - CreaSTEAM
- **Funding**
 - European Union. Erasmus + KA2 – Cooperation and Innovation for Good Practices. Strategic Partnerships for school education
- **Reference**
 - 2020-1-ES01-KA201-082601
- **Dates**
 - 01/10/2020 a 30/09/2022
- **Budget**
 - 240.736€



Fonseca, D., García-Holgado, A., García-Peñalvo, F. J., Jurado, E., Olivella, R., Amo, D., Maffeo, G., Yiğit, Ö., Keskin, Y., Sevinç, G., Quass, K., & Hofmann, C. (2021). CreaSTEAM. Hacia la mejora de brechas en diversidad mediante la recopilación de proyectos, buenas prácticas y espacios STEAM. In M. L. Sein-Echaluce Lacleta, Á. Fidalgo Blanco, & F. J. García-Peñalvo (Eds.), *Innovaciones docentes en tiempos de pandemia. Actas del VI Congreso Internacional sobre Aprendizaje, Innovación y Cooperación, CINAIC 2021 (20-22 de Octubre de 2021, Madrid, España)* (pp. 38-43). Servicio de Publicaciones Universidad de Zaragoza. doi:10.26754/CINAIC.2021.0007

CreaSTEAM Consortium



Clemens-Brentano-
Europaschule
Kooperative Gesamtschule mit Gymnasialer Oberstufe



**T.C. MİLLÎ
EĞİTİM BAKANLIĞI**



T.C. MİLLÎ EĞİTİM BAKANLIĞI
BURSA/NİLÜFER-Sadettin Türkün Ortaokulu

Legal name	Country
UNIVERSIDAD DE SALAMANCA	Spain
Federazione Istituti Di Attività Educative	Italy
Bursa İl Millî Eğitim Müdürlüğü	Turkey
Sadettin Türkün Ortaokulu	Turkey
Studienseminar GHRF Gießen	Germany
Clemens-Brentano-Europaschule	Germany

CreaSTEAM Objectives

- Develop a framework for secondary schools to create a collaborative space in which diversity and inclusion in STEAM is promoted
- Establish mechanisms to foster collaboration between STEAM communities and initiatives and secondary schools




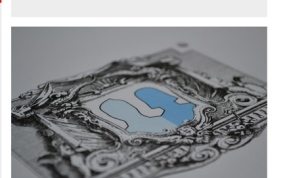
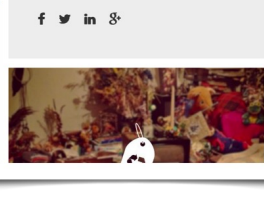


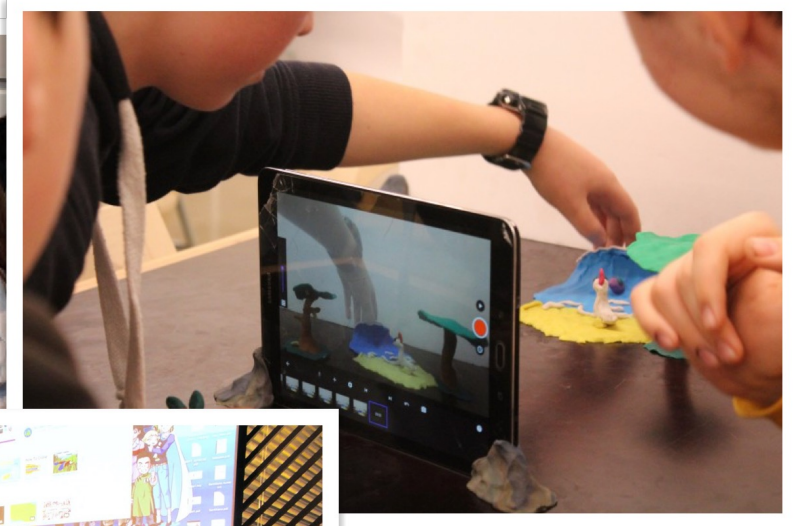
STEAM-Labs

- STEAM-Labs merge three concepts
 - Fab-Labs
 - Media Labs
 - User Labs
- They seek to create inclusive spaces that work with STEAM in an integrated way
 - Science
 - Technology
 - Engineering
 - **Arts**
 - Mathematics

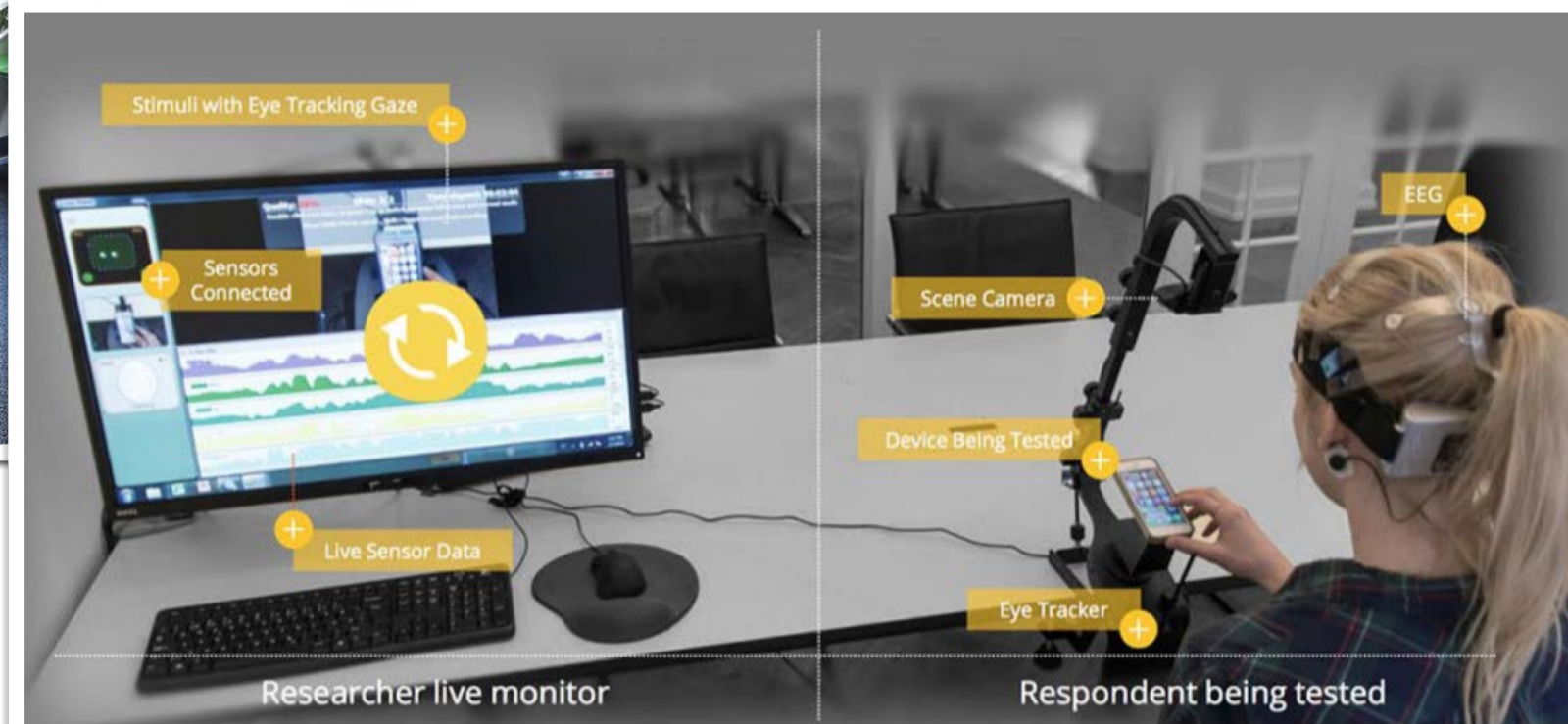
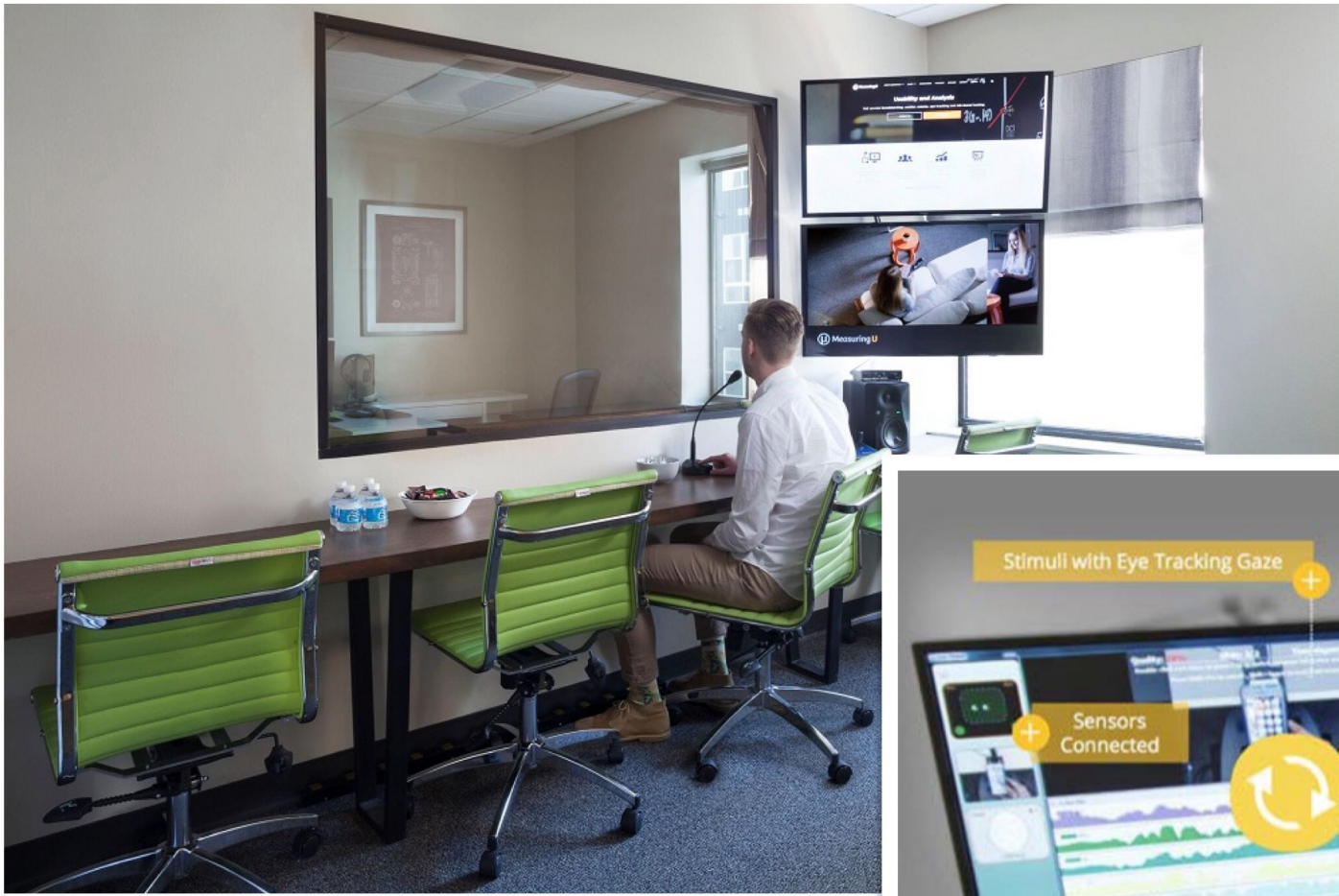


Fab labs

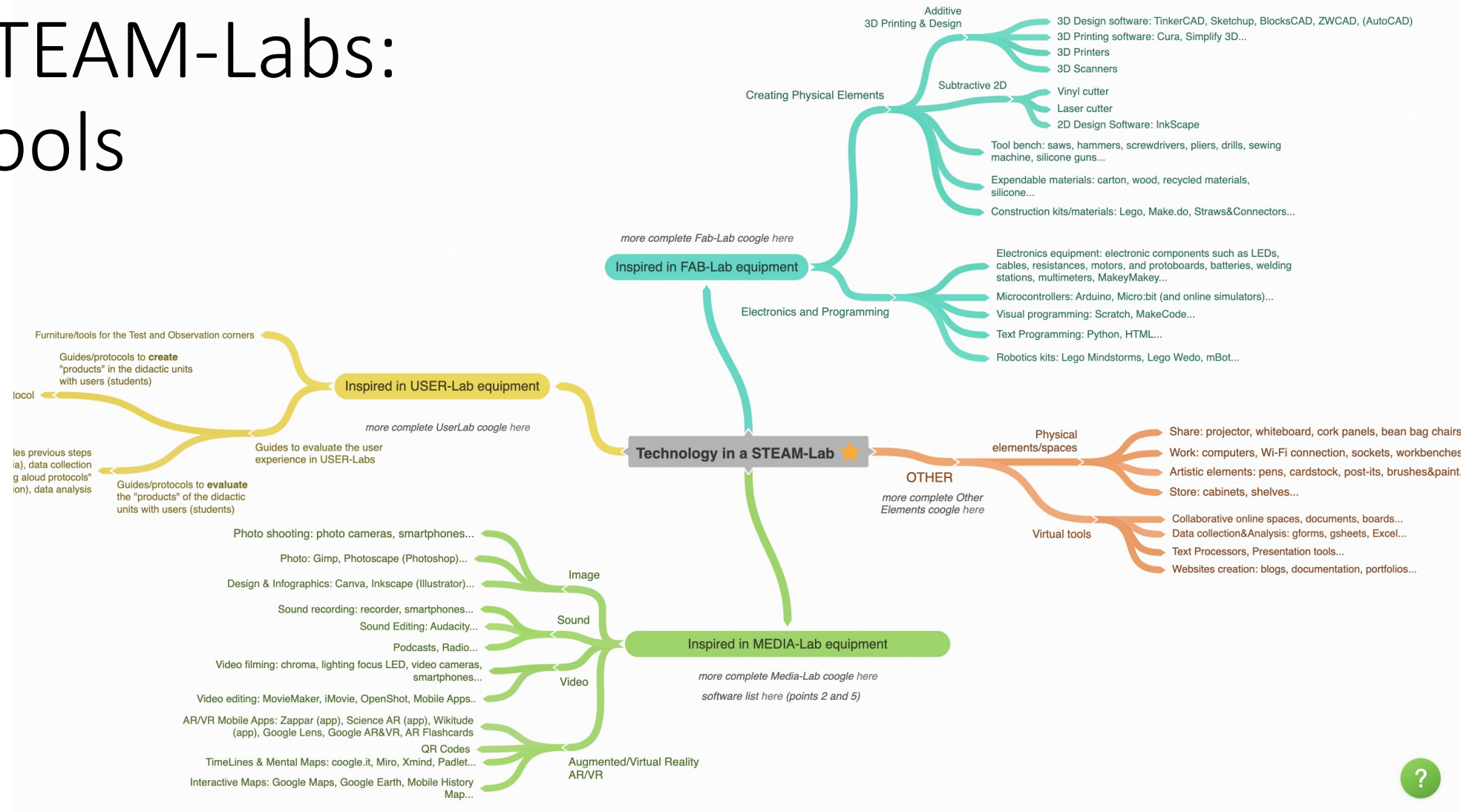
<p>HackForGood 2017 SALAMANCA DATA DRIVEN ECONOMY</p>	<p>FINALIZADA, MESA REDONDA MEDIALAB Presenta: Anatomía de la Crisis</p> <p>f t in g+</p>	
<p>CONVOCATORIA, FINALIZADA, SEMINARIO, TALLER HackForGood_2017</p> <p>f t in g+</p>	 <p>DESTELLOS DE LA NATURALEZA</p>	<p>FINALIZADA, SEMINARIO DATALAB Nuevo Curso</p> <p>f t in g+</p>
<p>Copiad Malditos</p> 	<p>FINALIZADA, MESA REDONDA, SEMINARIO MEDIALAB Presenta: Destellos de la Naturaleza</p> <p>f t in g+</p>	
<p>FINALIZADA, MESA REDONDA MEDIALAB Presenta: Copiad Malditos</p>		<p>FINALIZADA, MESA REDONDA MEDIALAB Presenta: El Poder de las Redes</p>



User Labs



STEAM-Labs: Tools



https://coggle.it/diagram/X-Cy2_YZrx-l8zDJ/t/technology-in-a-steam-lab-star/87aa2de749f590535e3050cd2eb3f71eea7934008b241419a12782b21f23872e?present=1

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SEFI ANNUAL CONFERENCE
19-22 September 2022
BARCELONA



Gender mainstreaming in Engineering Education

Dr. Alicia García-Holgado
GRIAL Research Group
Computer Science and Automation
Department
Universidad de Salamanca
aliciagh@usal.es [@aliciagh_](https://www.instagram.com/aliciagh_)

