

NextGEng

International Cooperation Framework for
Next Generation Engineering Students

Experiences of international co-teaching in a European higher education context

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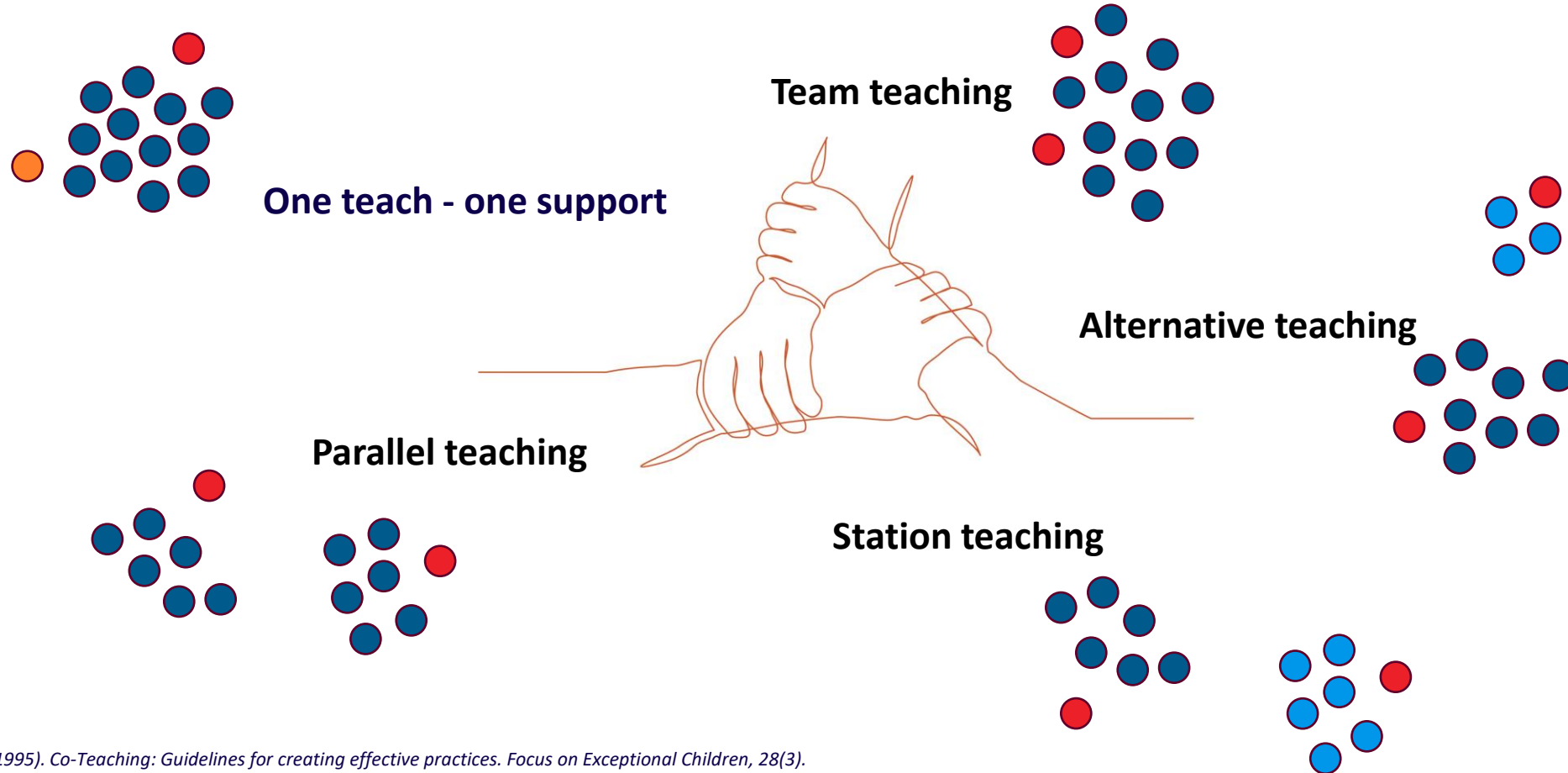
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Methods of implementing co-teaching



Cook, L. & Friend, M. (1995). *Co-Teaching: Guidelines for creating effective practices. Focus on Exceptional Children*, 28(3).



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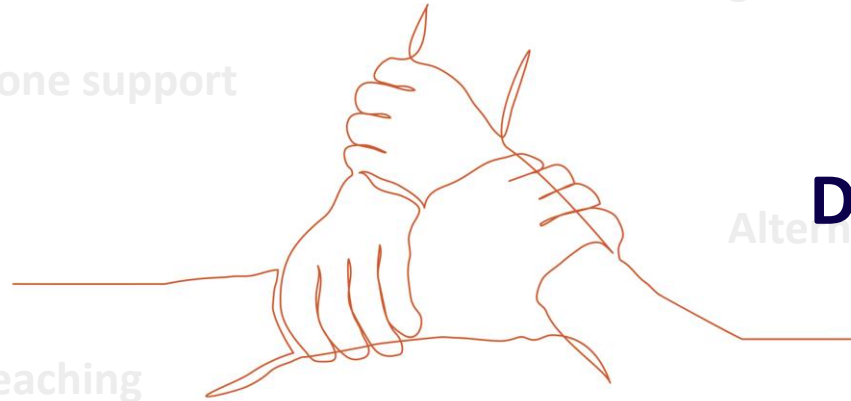
Collaboration as a driver of pedagogical change

Setting shared goals

Co-planning

Debriefing among
co-teachers

Interaction of co-teachers
as part of active learning



Haag, K., Pickett, S.B., Trujillo, G. & Andrews, T.C. (2023). Co-Teaching in Undergraduate STEM Education: A Lever for Pedagogical Change toward Evidence-Based Teaching? CBE – Life Sci Educ March 1, 2023 22:es1. DOI:10.1187/cbe.22-08-0169



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Focusing on engineering education 5.0

| THIRD INDUSTRIAL REVOLUTION "Digital revolution" (Approx. 1950s-1990s) | | | | INDUSTRY 4.0 (first quarter of XXI C.) | | | | Beyond 2030 Towards singularity? | | | |
|---|------|--|------|---|------|---------------------|------|---|------|------|------|
| Transition from analogue to digital electronics. Digital information and communication technologies. Internet and digital cellular phones. Micro and nanotechnology and micro and nanofabrication. Shifting to renewable energies | | | | Cyberphysical systems and IoT. Artificial intelligence, machine & deep learning Big data and data science. Flexible and solid freeform fabrication. Simulations, augmented and virtual reality. | | | | Biohybrid artificial systems. Intelligent machines and processes. Quantum supremacy. Biofabrication of vascularized organs. Materials made to order, smart materials & structures Nanobiotechnology and biological computing. Extended life, synthetic biology and artificial life. Space colonization. | | | |
| Photonics (1960-) | | Additive manufacturing (1983 & 90s-) | | 5G wireless communication (2020-) | | | | | | | |
| Metamaterials (1967-) | | www (1989-) | | Quantum computing materialized (2010-) | | | | | | | |
| Laser technology (1960-) | | Tissue engineering (1990s-) | | Biofabrication (2000-) | | | | | | | |
| ENGINEERING EDUCATION 3.0 (Approx. 1960s-1990s) | | | | ENGINEERING EDUCATION 4.0 (2000-present) | | | | ENGINEERING EDUCATION 5.0 (2020s-future) | | | |
| Incorporation of quality control and KPIs. Accreditation bodies for standard curricula. ICT applied to quality promotion and effectiveness. New areas: informatics, biomedical, space, telecom. | | | | Student-centered (Bologna model). Supported by PBL activities. Professional and transversal outcomes. Research supported: Nano, bio, info, cogno. | | | | Holistic, flexible and dynamic approach. Student-centered and sustainability-focused. PBL hybridized with service-learning. Focus on personal and professional development. Research-oriented and technology-aided. Collaborative, enjoyable, humanistic, international. Ethical compromise of students and institutions. Engineers as solvers of global challenges. | | | |
| IFMBE (1959-) | | Bologna Declaration (1999) | | CDIO Initiative (2000-) | | | | | | | |
| IEEE (1963-) | | ABET (1980-) | | Erasmus (1987-) | | Makers mov. (2005-) | | | | | |
| Rise of accreditation (1960s-80s) | | Washington Accord (1989-) | | Khan Academy (2008-) | | | | | | | |
| NASA's foundation (1958) | | Open source software & hardware (1990s-) | | MOOCs (2012-) | | | | | | | |
| Cultural Revolution in China (1966-76) | | | | 2030 Agenda: Sustainable development goals (2015-30) | | | | | | | |
| US Civil Rights Movements (1950-70) | | End of Apartheid (1990-93) | | Arab Spring (2010-12) | | Society 5.0 (Japan) | | | | | |
| Cuban Revolution (1953-59) | | HIV outbreak (1981) | | New Silk Road Initiative (2011) | | | | | | | |
| Women's liberation movs. (1960-present) | | | | Increasing concern about sustainability | | | | Increasing uncertainty and challenges | | | |
| 1940 | 1950 | 1960 | 1970 | 1980 | 1990 | 2000 | 2010 | 2020 | 2030 | 2040 | 2050 |

Díaz Lantada, A. (2020). Engineering Education 5.0: Continuously Evolving Engineering Education. *International Journal of Engineering Education*. 36. 1814-1832.



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Experiences of international co-teaching in a European higher education context

Projects that enabled my journey of co-teaching:

- NextGEng courses implemented Autumn 2023, Spring 2024
- NextGEng CEL projects Spring 2024
- HEIBuss-project 2018
- International Co-operation Project (ICP) implemented between Autumn 2009 –
- Teacher exchange program (Erasmus) from 2009 –



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Teacher exchange program (Erasmus) from 2009 - and NextGEng courses implemented Autumn 2023, Spring 2024

Long-term collaboration with European universities:

- Hochschule Esslingen - University of Applied Sciences, Esslingen Germany 2009-
- Universitete de Haute-Alsace, Mulhouse France 2010-
- University of JAEN, Campus Las Lagunillas S/N, Jaén Spain 2023 –
- Technical University of Cluj-Napoca, Romania 2019



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Expanding co-teaching toward collaboration between companies and higher education

Jamk – **Moventas** – HE Esslingen , HE Esslingen – **Festo** – Jamk, Jamk – **Valtra** – HE Esslingen, HE Esslingen – **Festool** – Jamk, HE Esslingen – **Kärcher** – Jamk, HE Esslingen – **Komet** – Jamk, HE Esslingen – **Heller** – Jamk, Jamk – **Pickval** – HE Esslingen, HE Esslingen – **Werner Bayer** – Jamk, Jamk – **Valmet** – HE Esslingen (ICP)

TUCN – **BOSH** – Jamk (HEIBus)

JUA – **ISR** – Jamk – TUCN, Jamk – **Valmet** – TUCN – JUA (NextGEng)



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Experienced ways of co-teaching

Teacher exchange program :

- Design of materials together or separately
- Lecture alone and one only to help with the language
- Separately, helping different groups of students with calculation exercises Lecture by one
- Together, assisting different groups of students in calculation exercises Lecture by one
- Lecture alone, but also discussing experiences with another teacher
- Lecture over the internet with students from another country



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Experienced ways of co-teaching

Projects:

- Separate lectures from different teachers based on their own strengths
- Creating project objectives and rules of the projects together or separately, comparing and summarising later
- Separately helping different project groups
- Together, helping different project groups
- Evaluations separately and comparisons separately or together
- Evaluations and comparisons jointly
- Allocation of areas of guidance according to teachers' strengths



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Good practices

- Requires strong trust
- Material on the templates of the target audience
- Good to have examples and applications also from the lecturer's own environment/culture
- If possible, an on-site guest lecturer who brings in a local lecturer to discuss the topic
- Lecturers jointly involved in helping students with their assignments/homework
- Objectives and evaluation criteria agreed jointly in projects and individually conducted evaluations compared together
- Project management together and separately, taking into account different views
- FLEXIBILITY



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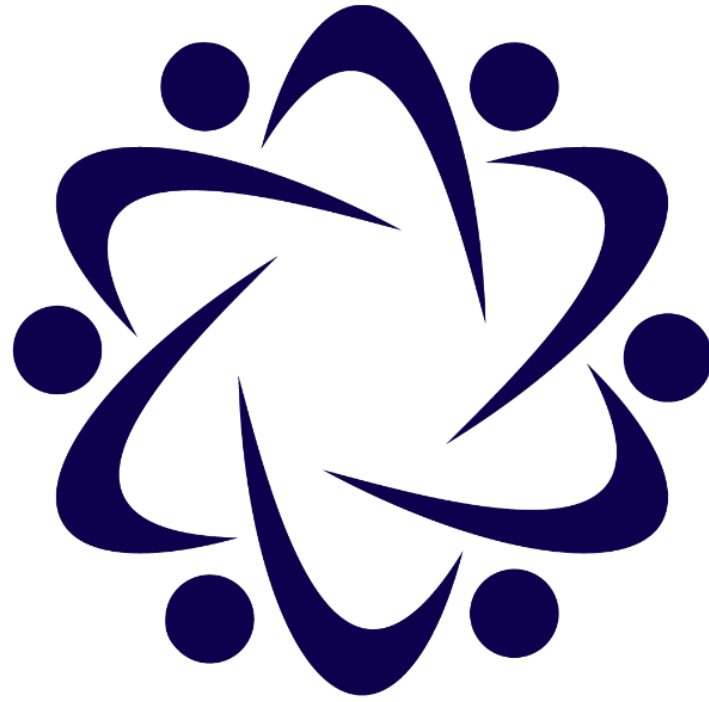
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Thank you!