

VARIATION in PROBLEMS AND PROJECTS

Anette Kolmos, Professor
UNESCO PBL Centre
Aalborg University





New innovations

- ▶ Progressing leadership, organisational and complex problem solving competences – PBL competences
- ▶ **New types of projects – from discipline to interdisciplinary mega-projects**
- ▶ Digitalisation of lectures and more emphasize on facilitation and supervisio with more emphasise on projects
- ▶ Sustainable Development Goals



PBL competences at Aalborg University

Metacognitive competences, e.g.:

- Personal competence profile
 - Professional understanding
 - Collaboration
 - Project competences
 - Career and learning goals
- Individual and collective learning goal and strategies
- Use of digital learning- and collaboration in learning strategies
- Optimising individual learning
- Motivation for learning
- Strategies for change
- Anticipation for the future

Problem oriented competences, e.g.:

- Problem identification
- Problem types
- Methods for problem analysis
- Social and technical complexity
- Creativity
- User involvement
- Actor analysis
- Understanding cultural contexts
- Sustainability
- UN global goals - SDG
- Ethics
- Problem formulation
- Criteria for problem solving

Interpersonal competences, e.g.:

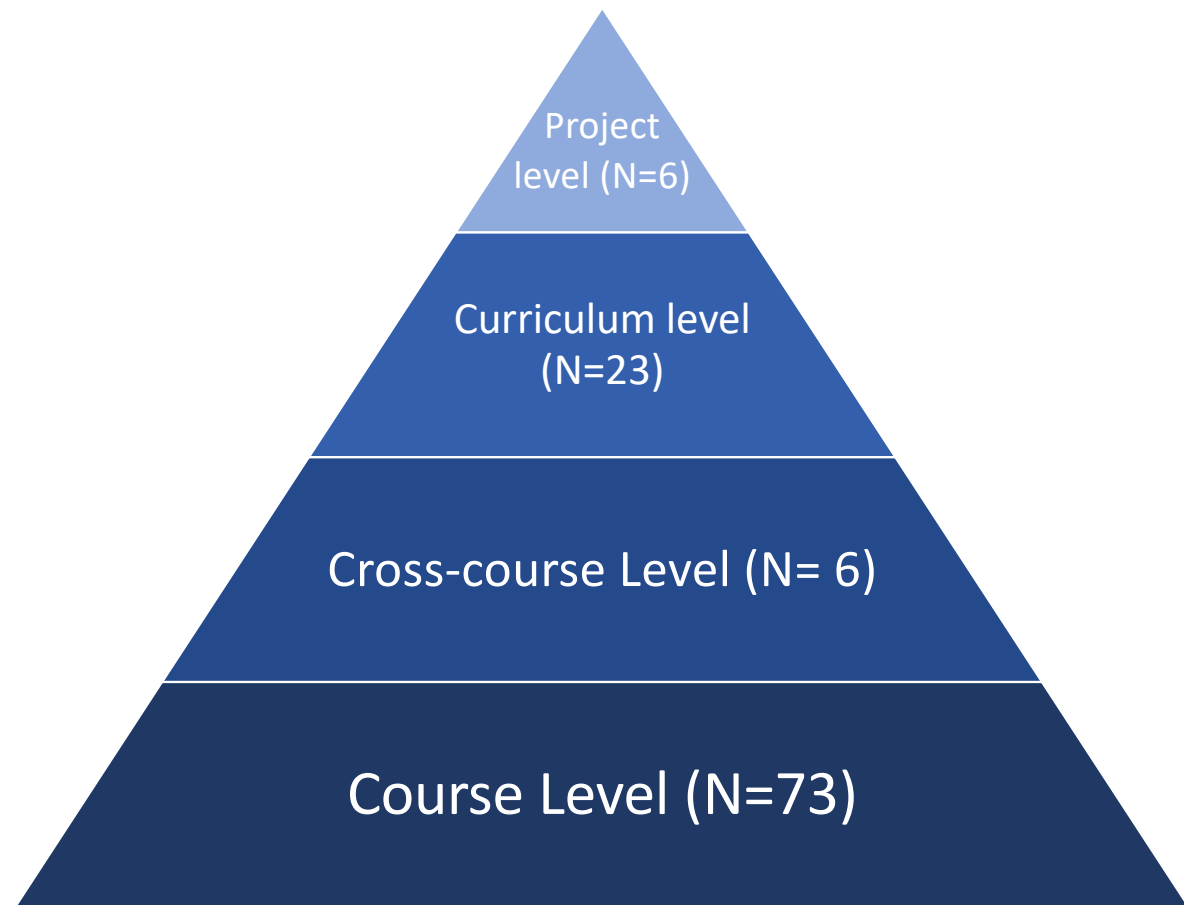
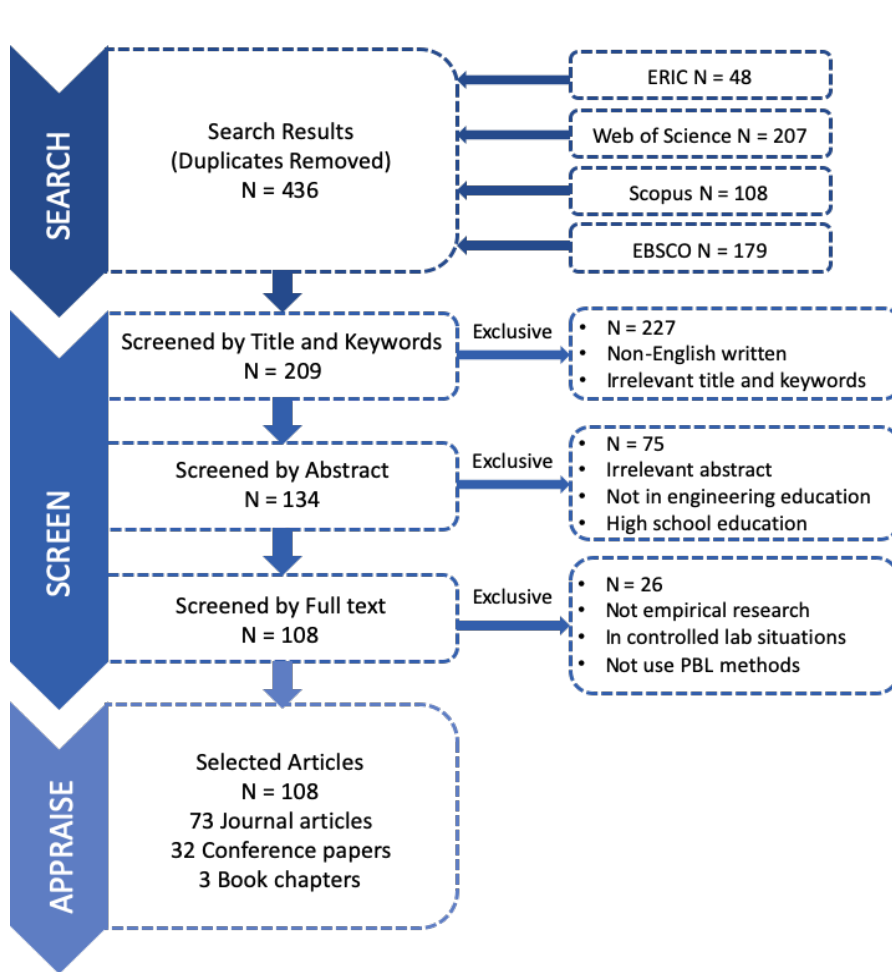
- Teambuilding
- Team culture
- Team roles
- Digital collaboration
- Communication-strategies
- Managing diversity
- Conflict prevention and management
- Creating a constructive dialogue
- Decision making processes
- Collaboration in and between groups
- Collaboration with supervisors and external partners

Leadership and organisational competences, e.g.:

- Project management
- Delegation of work and team roles
- Setting objectives
- Defining and structuring activities
- Time- and activity management
- Agile management systems
- Digital project management tools
- Managing different types of meetings
- Scientific communication
- Management of external collaborations

Review on PBL – Keywords – Chen et al. 2020

Methods and Findings: Implementation of PBL in EE

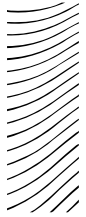


Variation is a condition in evolution



Variation:
Ladybugs

<https://www.pinterest.dk/pin/134826582567083870/>



Variation: wind turbines

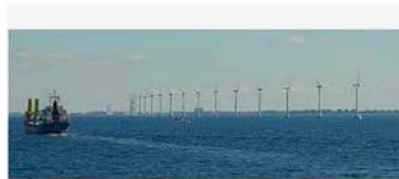
Variation – or
creativity?



Wind turbine committee celebrates 30 years annive...
vindenergi.dtu.dk



Wind turbine products | Wind turbine applic...
danfoss.com



Wind power in Denmark - Wikipedia
en.wikipedia.org



12 percent of Danish wind energy to be prod...
thelocal.dk



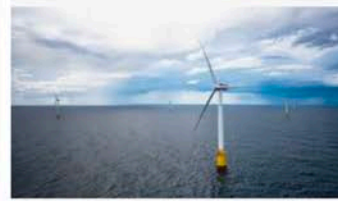
Få Wind Turbines af Eri...
saxo.com



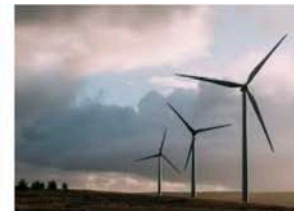
Wind turbines cover Denmark's power dem...
en.energinet.dk



wind turbines on sea – Brintbranchen
brintbranchen.dk



The Future is Bright for Floating Wind Turbines - St...
stormgeo.com



Wind power is the beginning of a more sust...
netavisensyddanmark.dk



Wind Turbines at Sunset, Green Stock-video (100 ...
shutterstock.com



A great interest for large wind turbines in ...



What are wind generators and Just how to install yo...



Fil:Lincs Offshore Wind Farm - geo...



Wind turbines and services | Siemens Gamesa



National Testing Centre for Large Wind Turbines...

Variation in learning – sameness and difference

Phenomenography, Marton,
Booth, Swedish tradition

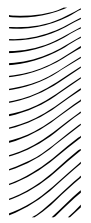
Variation in individuals'
perspectives → collaboration

Variation in the progression of
learning experiences → the
individual and collaborative
learning

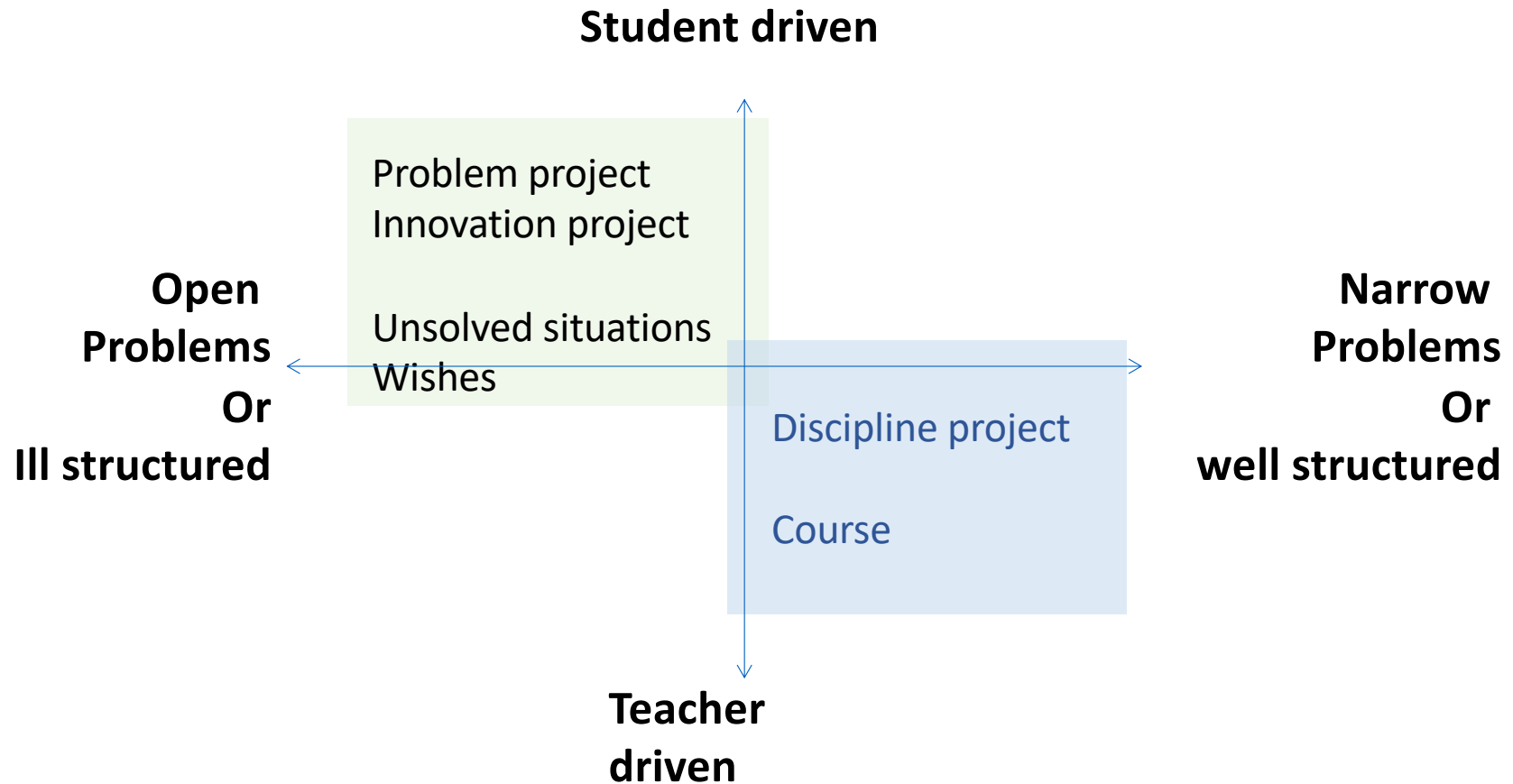


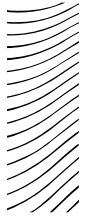
Sameness in order to transfer
(Marton, 2006)

Difference in order to learn

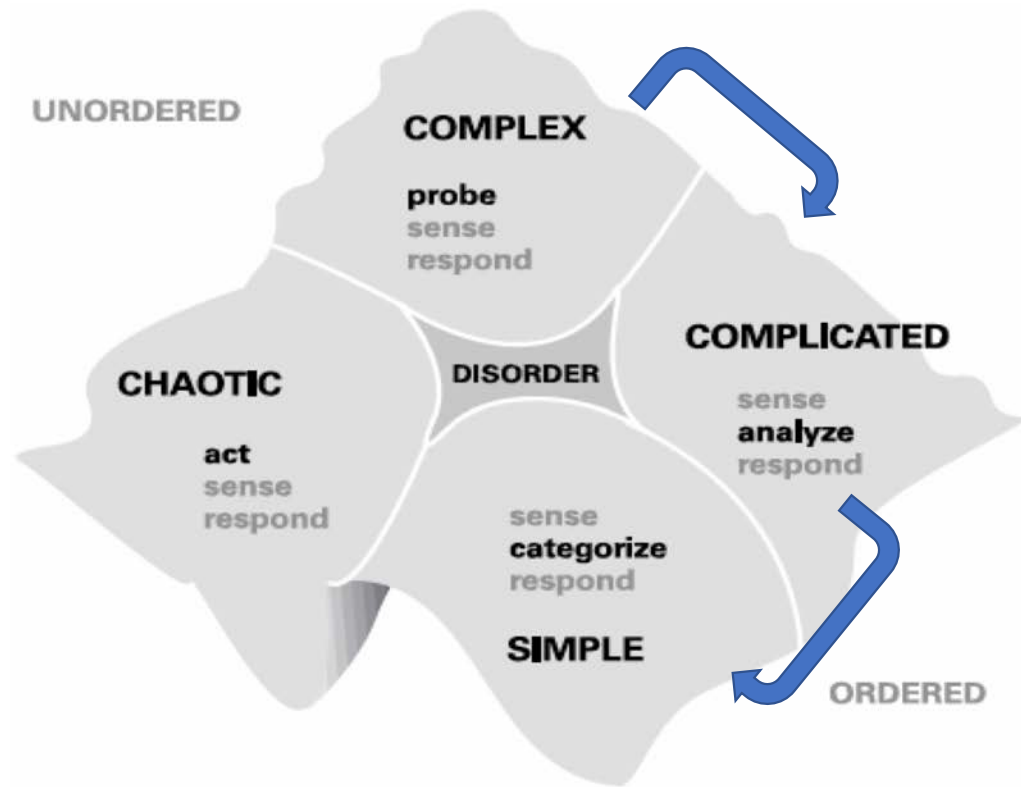


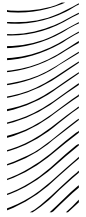
Variation in problem/projects



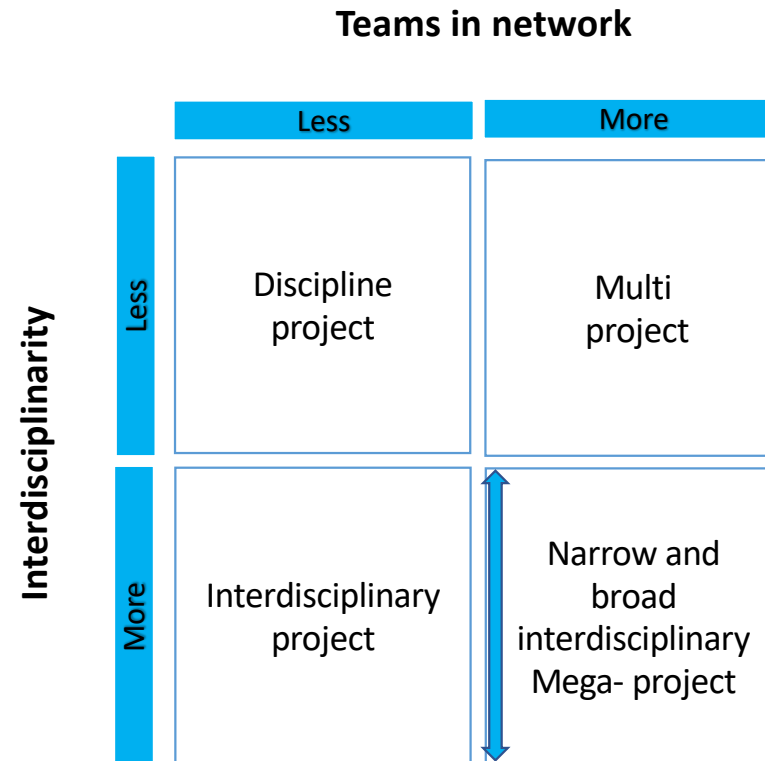


The Cynefin framework





Variation in projects





Discipline project – e.g Anti Sway System for a Ship to Shore Crane



Teams in network

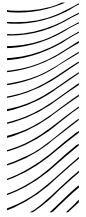
		Teams in network	
		Less	More
Interdisciplinarity	Less	Discipline project	Multi project
	More	Interdisciplinary project	Narrow and broad interdisciplinary Mega- project

Multi-project

<https://twitter.com/GirafAutismApp>; <https://giraf.cs.aau.dk/>
http://people.cs.aau.dk/~ulrik/Giraf/Projects2012/Oasis_sw604f12.pdf

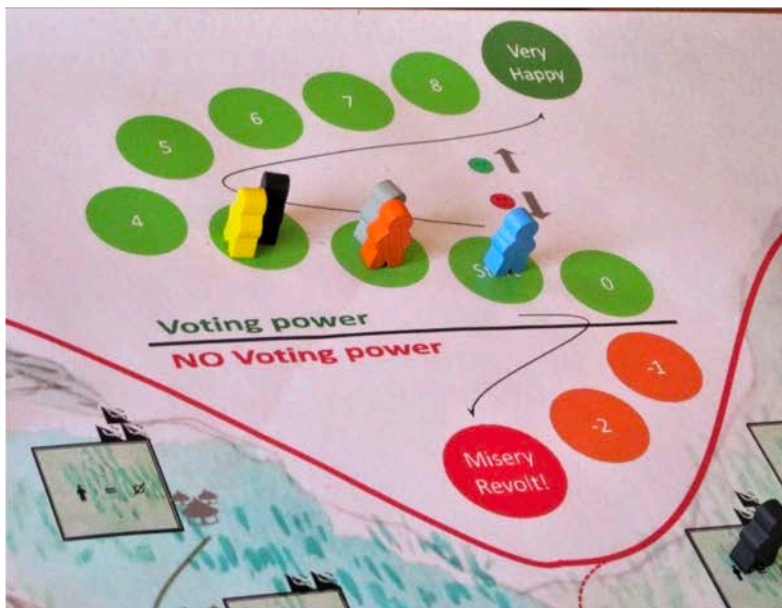
Teams in network

Less	More
Discipline project	Multi project
Interdisciplinary project	Narrow and broad interdisciplinary Mega- project



Interdisciplinary project

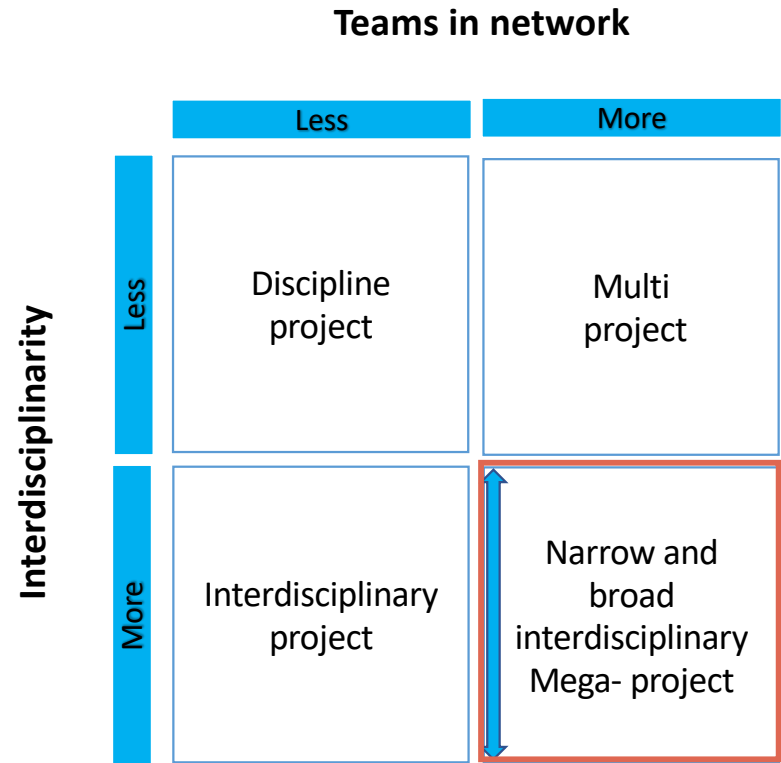
Media Technology: A sustainable city game designed as a medium and catalyzer for learning activities



		Teams in network	
		Less	More
Interdisciplinarity	Less	Discipline project	Multi project
	More	Interdisciplinary project	Narrow and broad interdisciplinary Mega- project

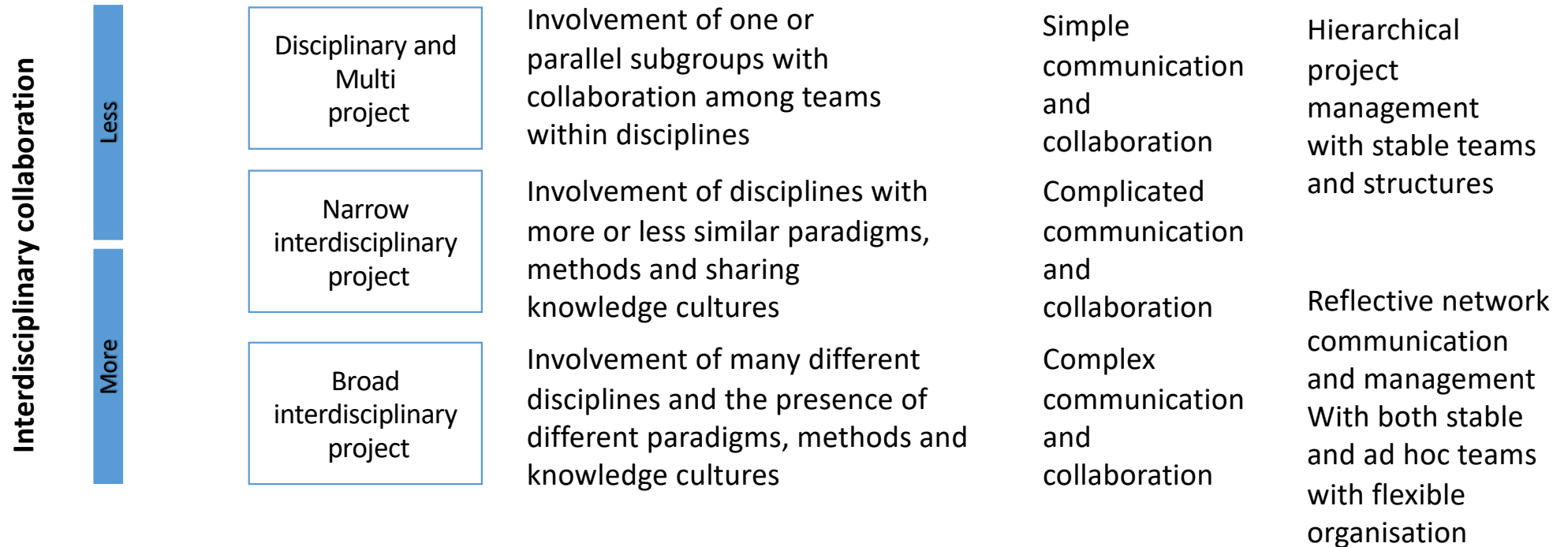


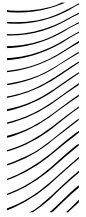
Megaprojects





Variations in interdisciplinary collaboration in mega-projects

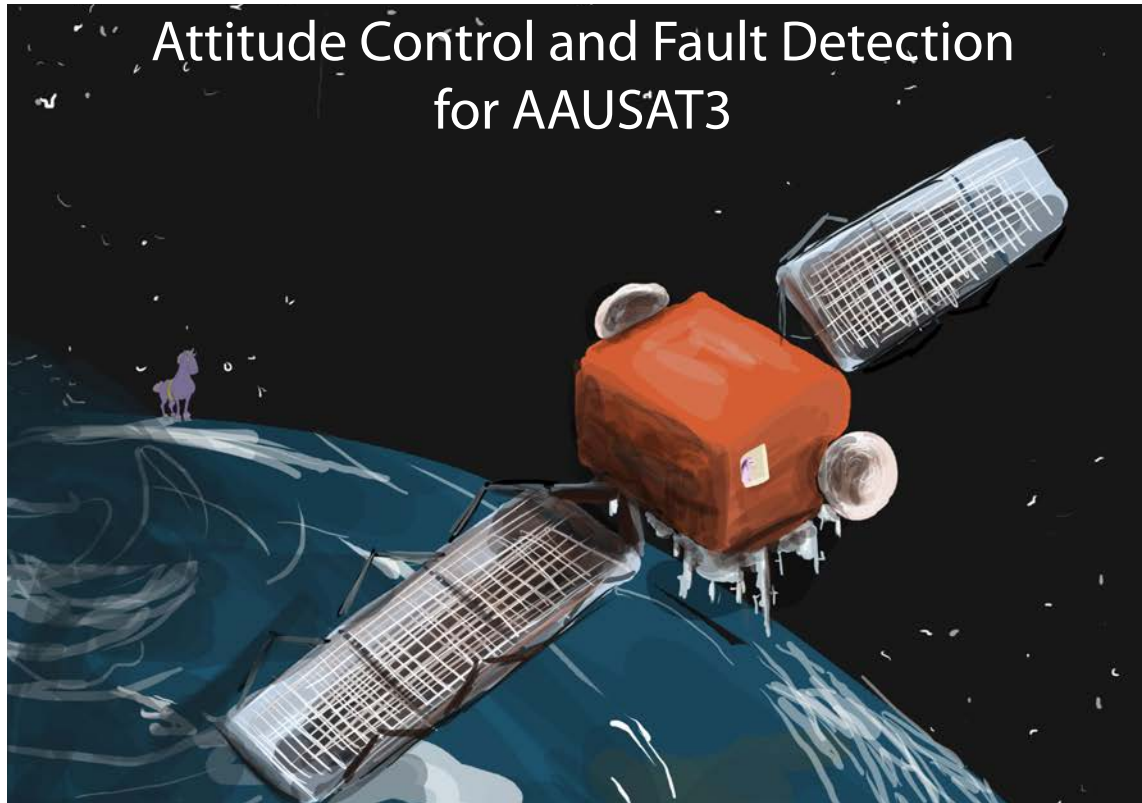




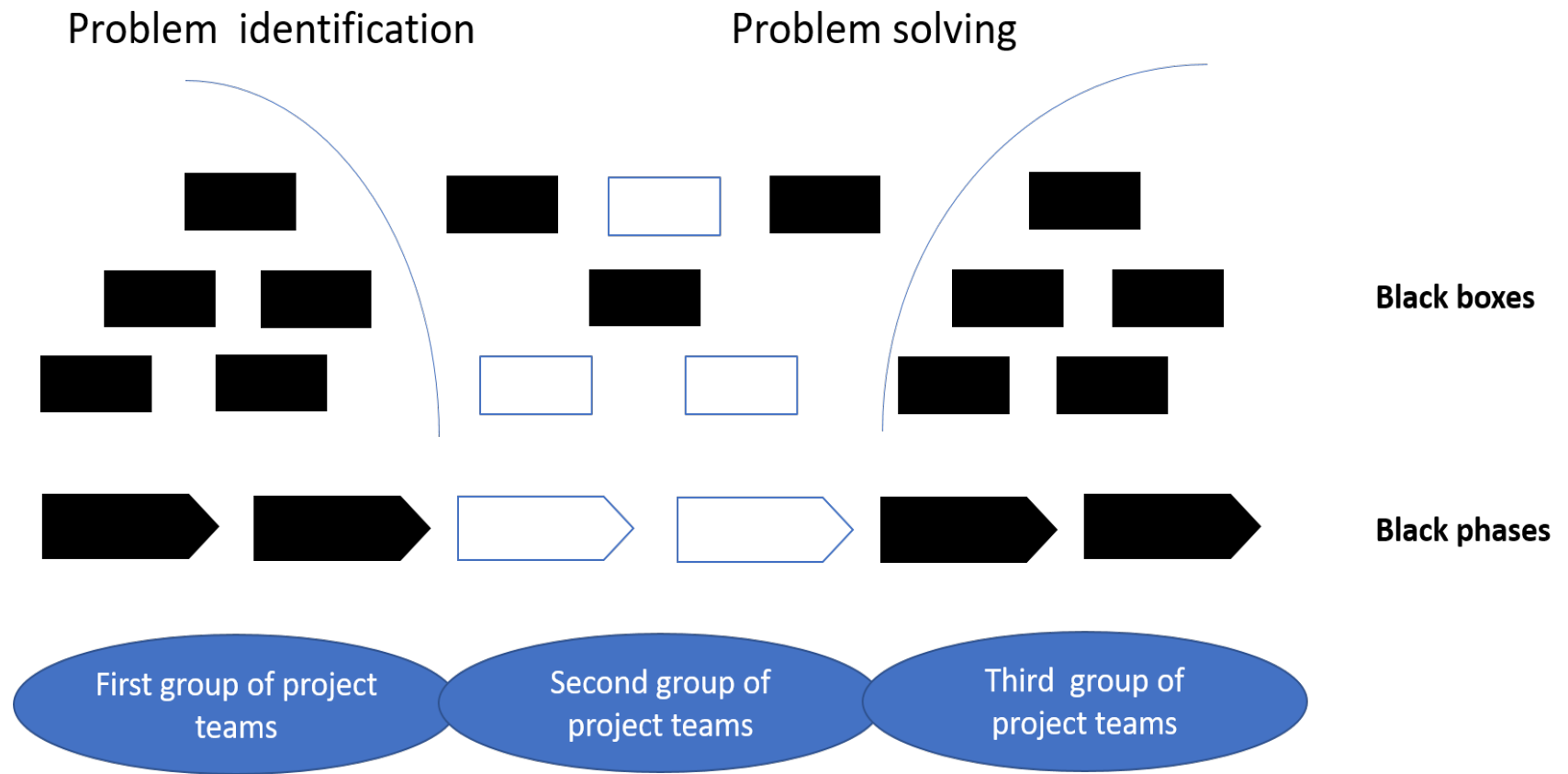
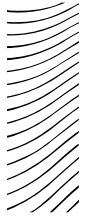
Narrow interdisciplinary megaproject

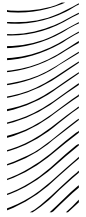
<https://www.youtube.com/watch?v=UMnpVCDeQIE>

<http://www.space.aau.dk/>



		Teams in network	
		Less	More
Interdisciplinarity	Less	Discipline project	Multi project
	More	Interdisciplinary project	Narrow and broad interdisciplinary Mega-project





Industry 4.0 smart lab – working



Robotics
Automation

Electronics

Computer Science

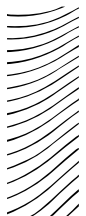
Management

Broad interdisciplinary Mega-projects

<https://www.megaprojects.aau.dk/>

- Ambitious projects addressing significant societal challenges with sustainable relevance
- Addresses the UN SDGs
- Consists of semester projects that all contribute to the solution for the megaproject's challenges
- Characterised by being interdisciplinary and extending over several years
- Involves student interaction and knowledge sharing among the participating groups
- Open for collaboration with external partners, including public and private organisations, and other universities





MEGAPROJECTS OF SPRING 2020

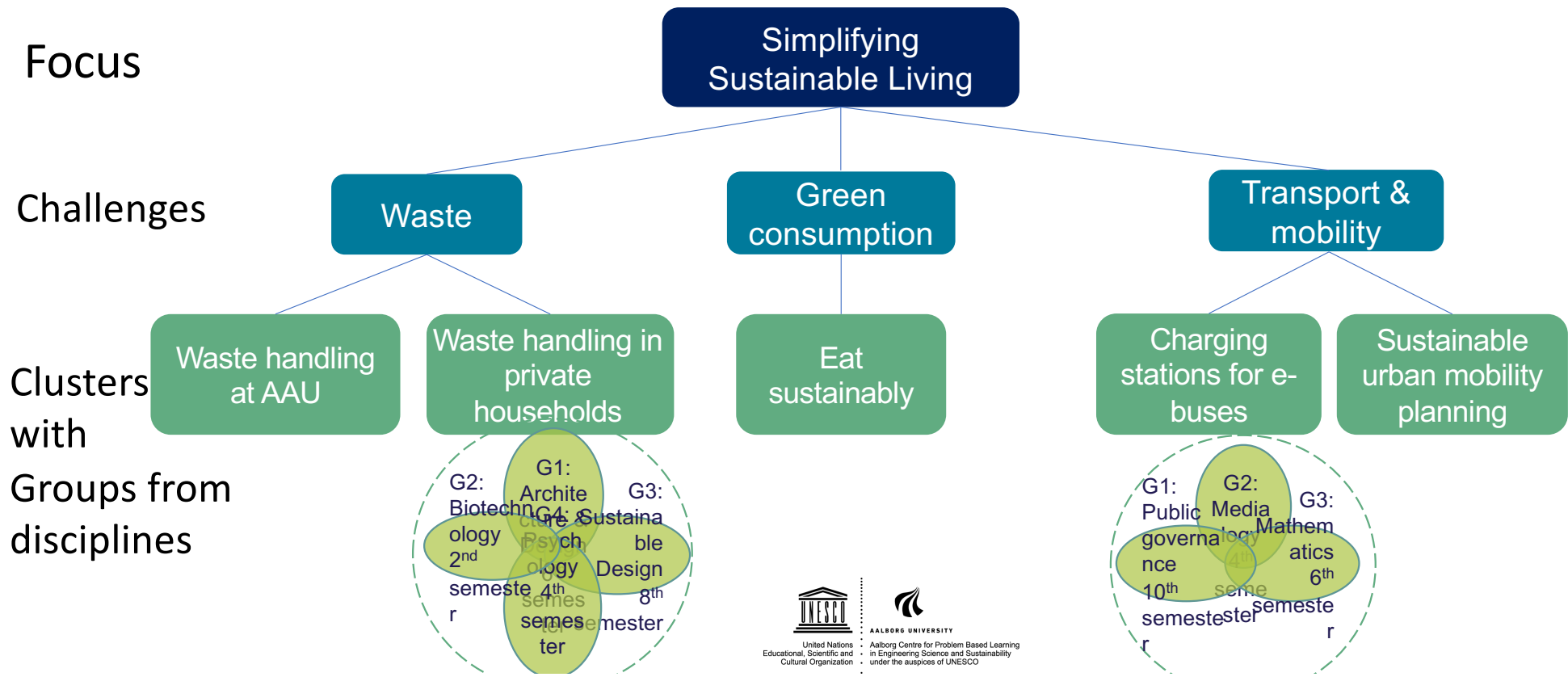


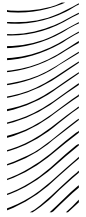
**Simplifying
Sustainable Living**



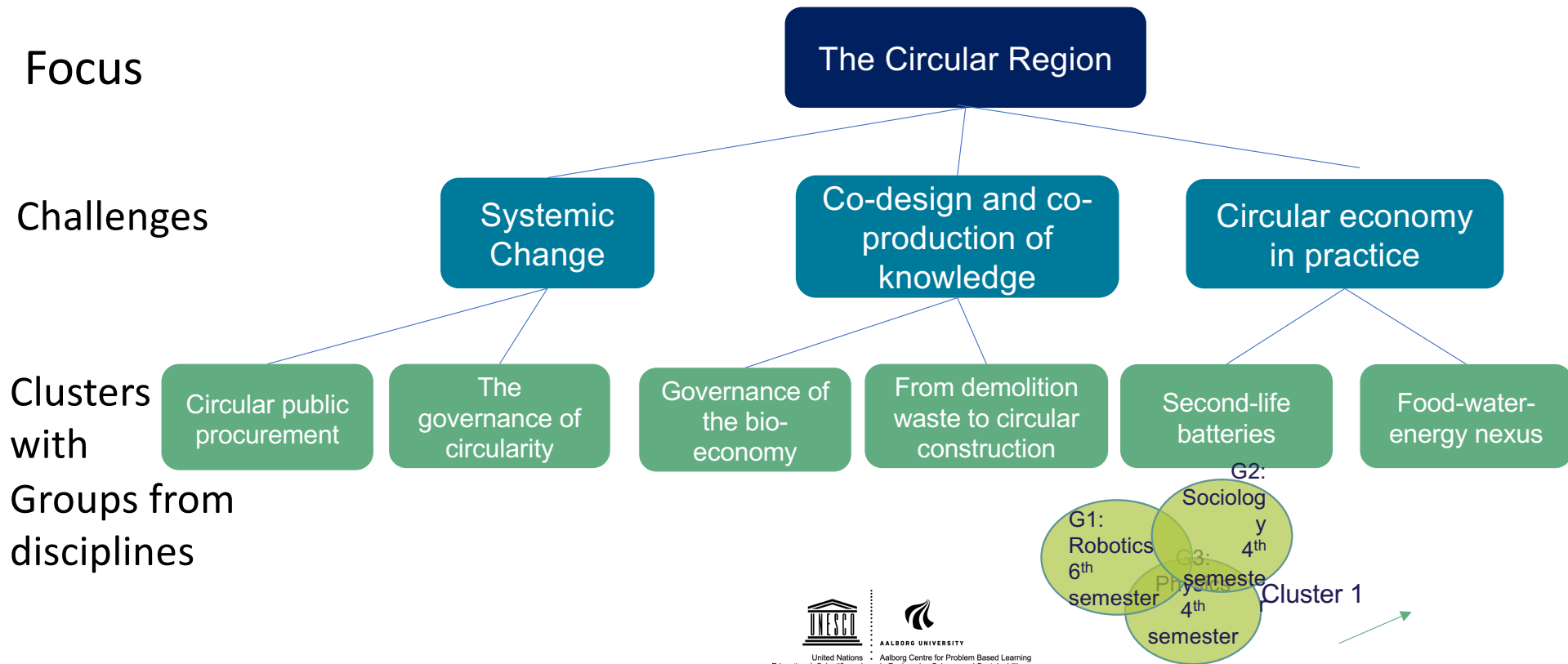
The Circular Region

SIMPLIFYING SUSTAINABLE LIVING





THE CIRCULAR REGION



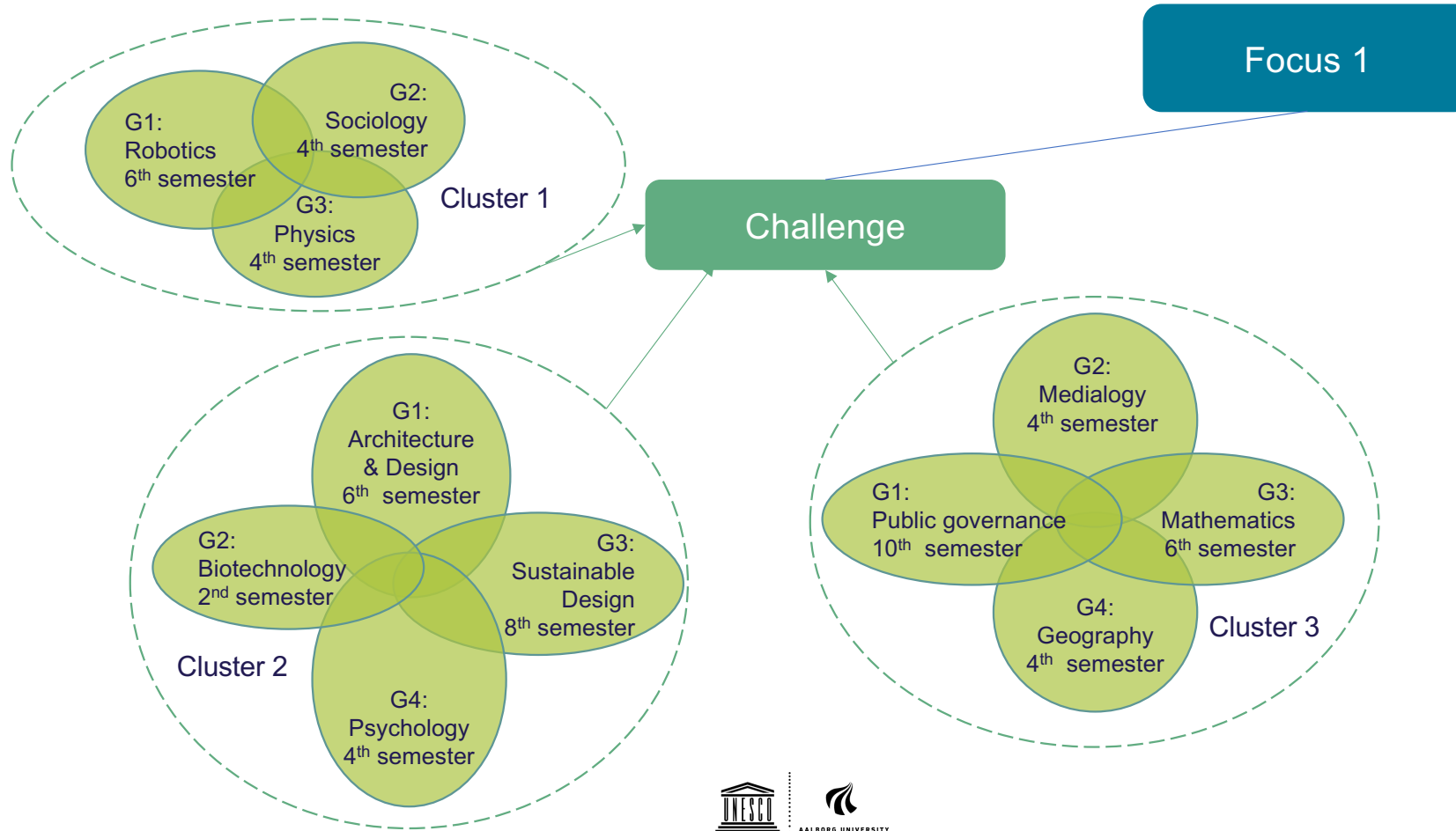
Focus

Challenges

Clusters with Groups from disciplines

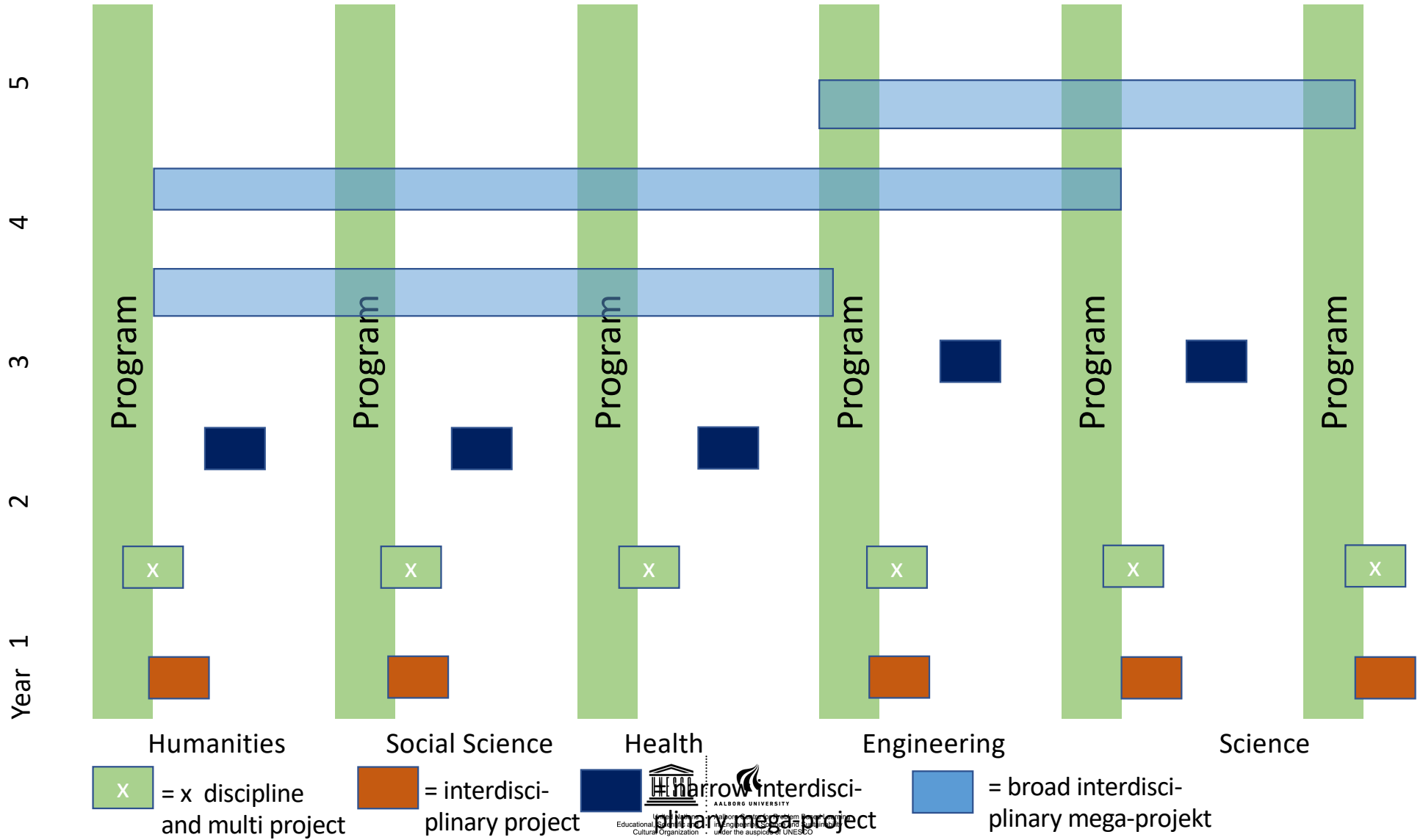


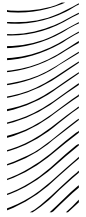
WORKING ON A MEGAPROJECT



	Disciplinary approach	Narrow interdisciplinarity	Broad interdisciplinarity
Project types	Discipline and multi-projects	Interdisciplinary projects Narrow mega-projects	Broad interdisciplinary mega-projects
Problem analysis	Understanding the problems in the discipline domain and how the discipline relates to other disciplines	Understanding problems related to parts of a system or parts of a process by combining a few core disciplines	Understanding problems in a comprehensive system perspective by making a synthesis of different discipline approaches
Project management	From stable teams and structures → agile systems/flexible structure with ad hoc groups		
Collaboration	From simple within same knowledge paradigm → difficult with different knowledge		

Kolmos et al, 2020





References

- Aalborg University. (2020). *Megaprojects*. Retrieved from <https://www.megaprojects.aau.dk/>
- AAU Racing. (2020). *AAU Racing*. Retrieved from <https://auracing.dk/>
- Chen, J., A. Kolmos and X. Du (2020). "Forms of implementation and challenges of PBL in engineering education: a review of literature." European Journal of Engineering
- Holgaard, J. E., A. Guerra, A. Kolmos and L. S. Petersen (2017). "Getting a hold on the problem in a problem-based learning environment." International Journal of Engineering Education **33**(3): 1070-1085.
- Holgaard, J. E. and A. Kolmos (2019). Progression in PBL competences. SEFI annual conference 2019, SEFI: European Association for Engineering Education.
- Klein, J. T. (2010). "A taxonomy of interdisciplinarity." The Oxford handbook of interdisciplinarity **15**: 15-30.
- Kolmos, A., Bertel, L. B., Holgaard, J. E. and Routhe, H. W. (2020). "Project Types and Complex Problem-Solving Competencies: Towards a Conceptual Framework, International Research Symposium on PBL, Aalborg Universitetsforlag. In press.
- Marton, F. (2006). "Sameness and difference in transfer." The journal of the learning sciences **15**(4): 499-535.
- Snowden, D. J. and M. E. Boone (2007). "A leader's framework for decision making." Harvard business review **85**(11): 68.