

Making STEM education more exciting and inclusive with making

An exploration of conditions for implementing socially innovative approaches in secondary education

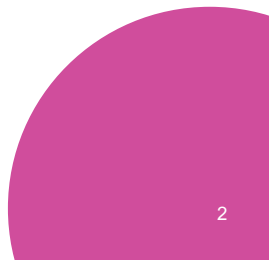
Elisabeth Unterfrauner & Claudia M. Fabian
Centre for Social Innovation, Vienna





Overview

- Introduction to ZSI and approach to SI
- Characteristics of SI in education
- What is STEM and what are the fields of tension and challenges in current STE(A)M education?
- Proposed STEAM approach
- Conditions for implementing STEAM in secondary education
- Outlook



“ALL INNOVATIONS ARE SOCIALLY RELEVANT.”

ZSI is an applied social scientific institute which contributes to mitigating social challenges by providing scientific evidence for decision-making and by developing concepts for the implementation of interventions in different policy areas and societal fields.

As innovation research institute ZSI dealt with social innovation as of its foundation.

Since 1990 the Centre has carried out more than 750 research and pilot projects for clients from all over the world.



ZSI in a nutshell

- A private non-profit institute since 1990
- Self-governed and independent
- Competitive project-based financing
- 60+ experts employed
- Different types of projects (research, evaluation, training, coordination and networking projects, advisory services for public institutions, science-society projects)
- Clients from different background: ministries, municipalities, EC, European Parliament, OECD, ILO, other public bodies, NGOs
- Extensive experience in EU funded projects (e.g. 52 H2020 projects, over 50 Horizon Europe projects)



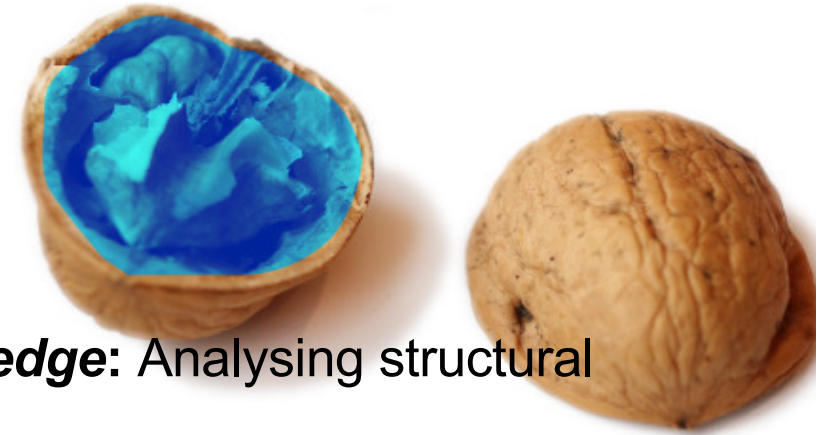


Definition of social innovation

Social innovations are **novel or more effective practices** that prove capable to tackle **societal issues** and are **adopted and successfully utilised** by individuals, groups and organisations concerned.

(Centre for Social Innovation)

Transformative SI



System analysis - „what is it" – *system's knowledge*: Analysing structural framework conditions

System design - „what could be" – *transformation knowledge*: Researching, identifying and testing alternatives that are fair for society as a whole and embedded in our planetary boundaries (social and socio-technical innovations; overcoming "imperial lifestyles")

"how we get from where we are to where we should be" – *process knowledge*: Social co-design of new technologies and innovations, exploration and valuation of changes

System assessment: Evaluating the interventions and monitoring the impact



Road-STEAMer project

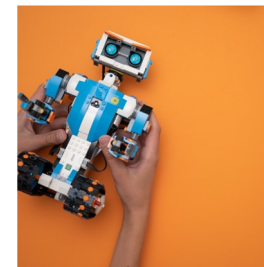
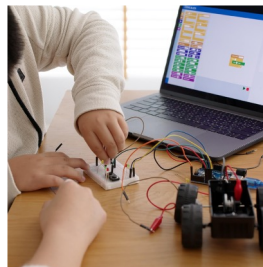
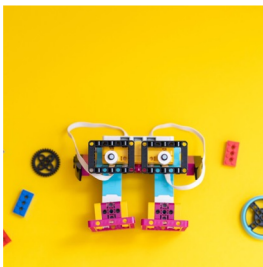
DEVELOPING A STEAM ROADMAP FOR SCIENCE EDUCATION IN HORIZON EUROPE

September 2022 – August 2025

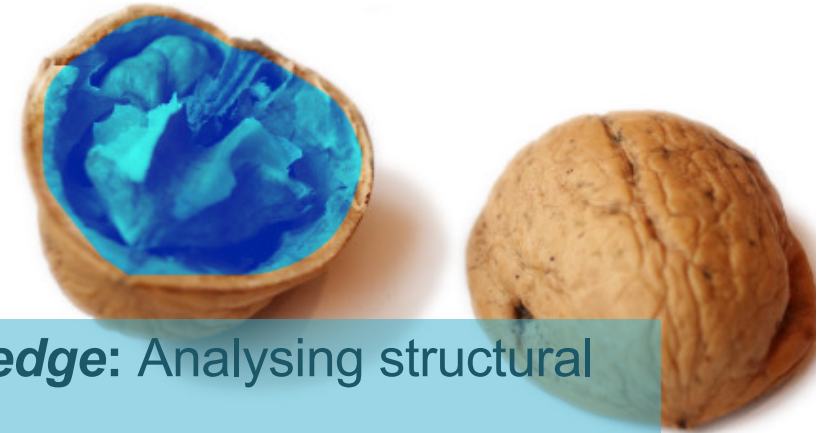
Coordinated by The Lisbon Council, 12 partners (EA, Ecsite, Traces, Uni Malta, Panteion University, Uni Exeter, Politecnico di Milano, ScienceView, Engineering, ESHA)

Objectives:

- Co-creating a STEAM roadmap
- Bridging open science with open school



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Analysis of socio-economic context and needs



Desktop Research

Literature analysis, secondary data analysis

Co-creation workshop with
stakeholders and consortium
members

For individual prosperity (higher pay)

For the (national) economy (contribution to GDP)

Neglect of other subjects to contribute (also) economically

STE(A)M economically important

Inequalities manifest early on (elementary school)

Gender

Ethnicity/migration background

Science and educational resources

Higher income compensates for other intersectional factors

Rejection experiences at school

Intersectional factors have an impact

Disparities in STE(A)M participation and achievements

Diversity of those working in STEM fields improves the quality of research

Social and epistemic justice (replacing "Leaky pipeline metaphor")

More inclusivity in STEAM approaches and inclusive pedagogy

The need for widened sociocultural participation and deconstruction of STE(A)M stereotypes

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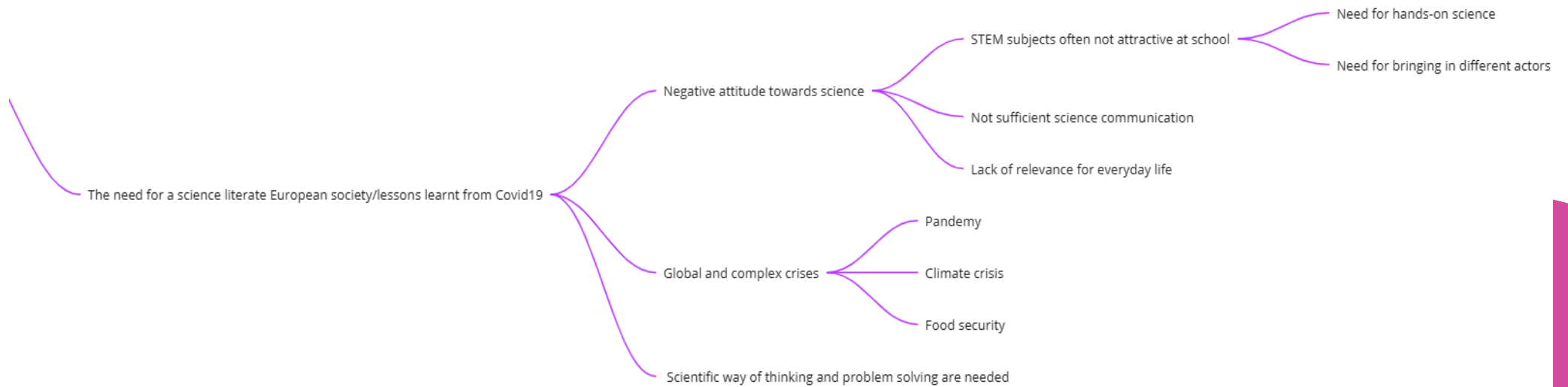
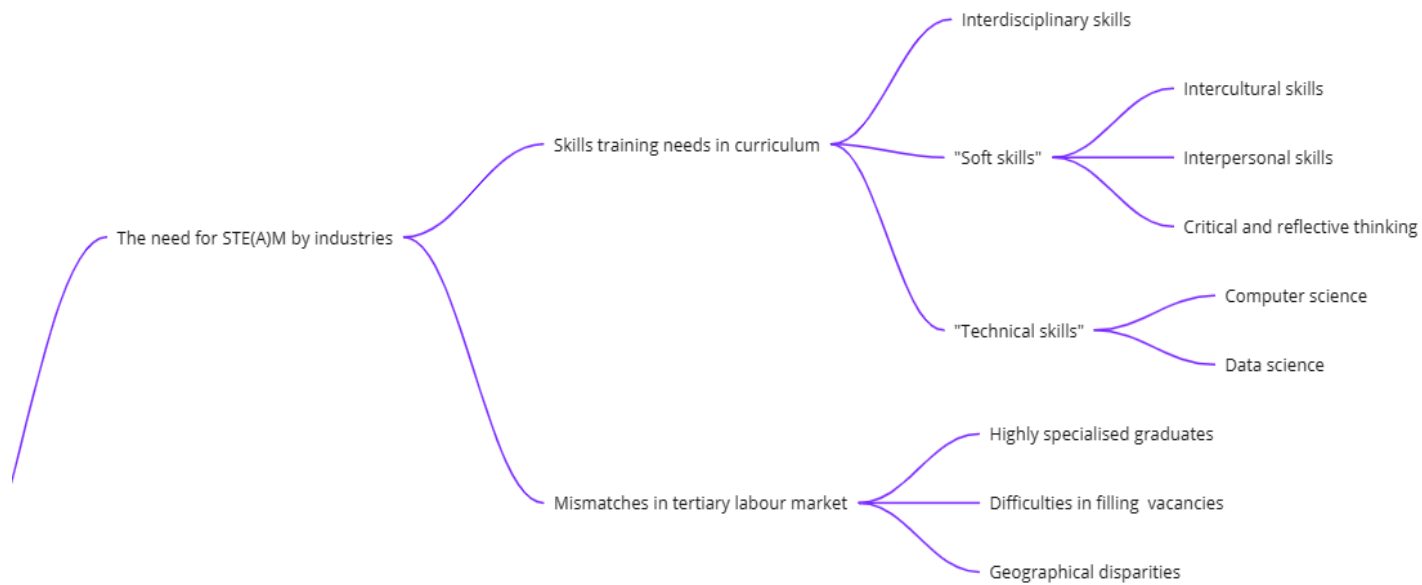
More inclusivity in STEAM approaches and inclusive pedagogy

Rejection experiences at school

The need for widened sociocultural participation and
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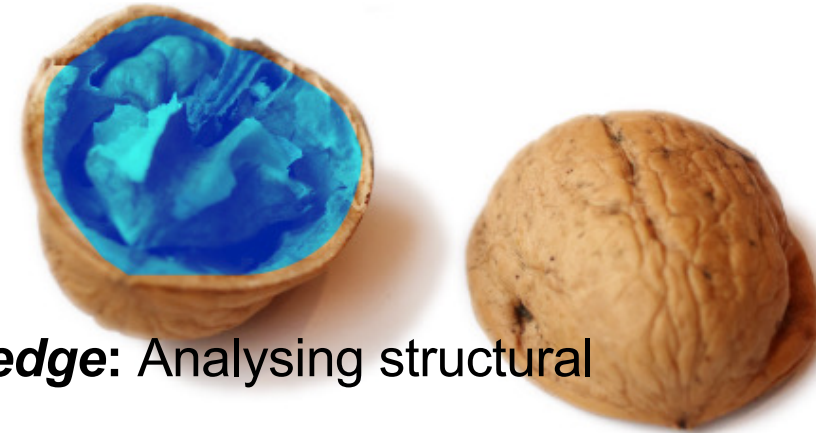


SI and education- dimensions of SI

- **Level of innovation:** Macro, meso, micro level
→ currently on micro-level: school initiatives → meso and macro level necessary
(→ reforms and change in institutional regulations)
- **Type of education:** formal and non-formal
→ formal secondary education
- **Types of social innovation in education:**
 - (a) societal challenges and social demands;
 - (b) concepts and understanding;
 - (c) resources, capacities and constraints;
 - (d) governance, networks, actors;
 - (e) process dynamics; and
 - (f) institutions

(Behrend et al. 2022; Howaldt et al. 2017; Schröder and Krüger 2019, cited in Maldonado&Schröder, Encyclopedia of Social Innovation, 2023).

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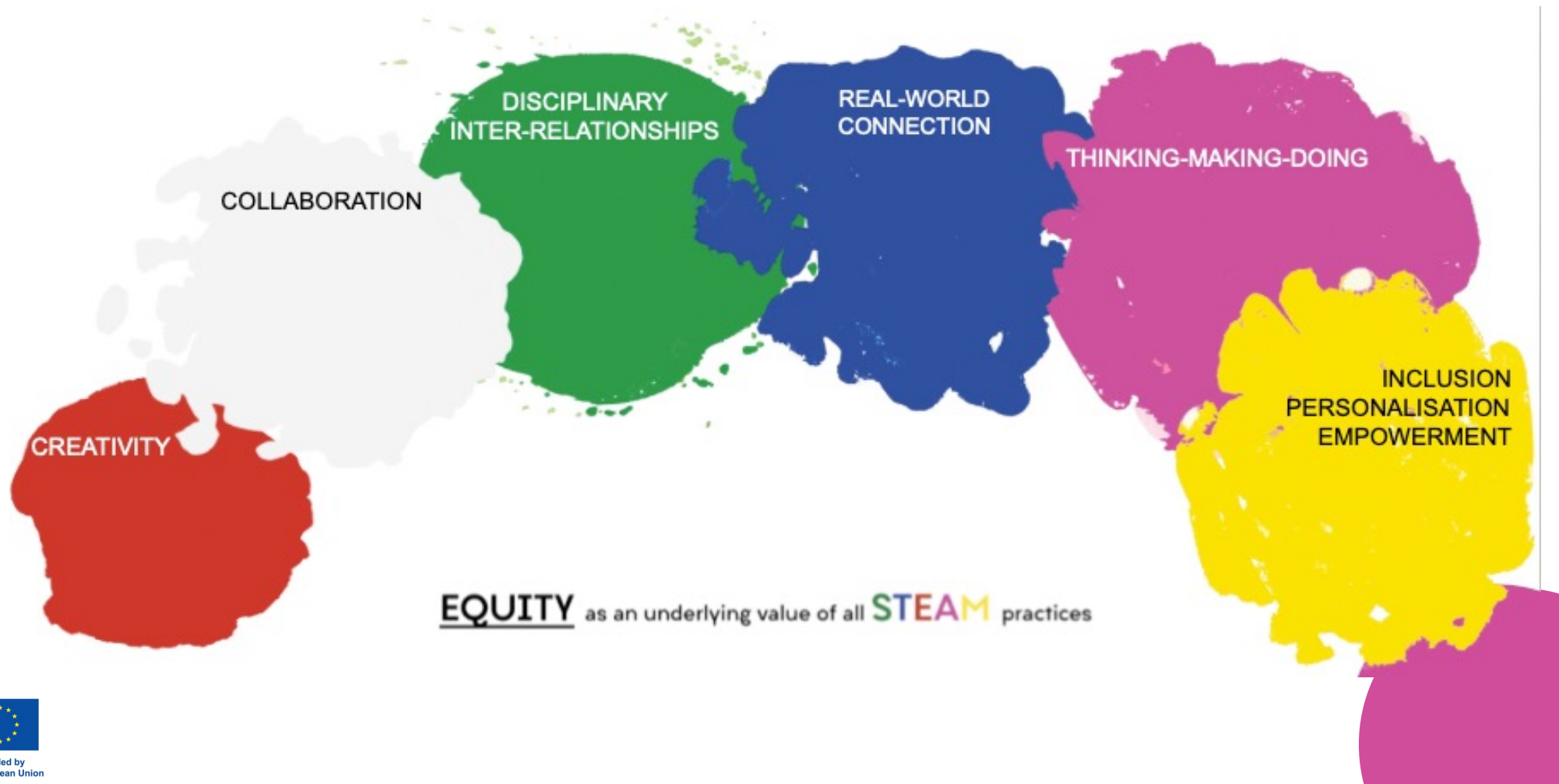


What is STEAM?

STEAM education is a teaching practice challenging the view that science, technology, engineering and mathematics are detached disciplines that require unique and context-sensitive methodologies and content.

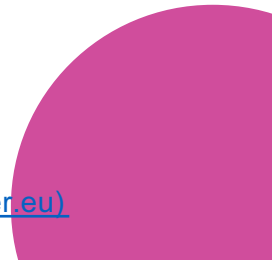


STEAM Approach



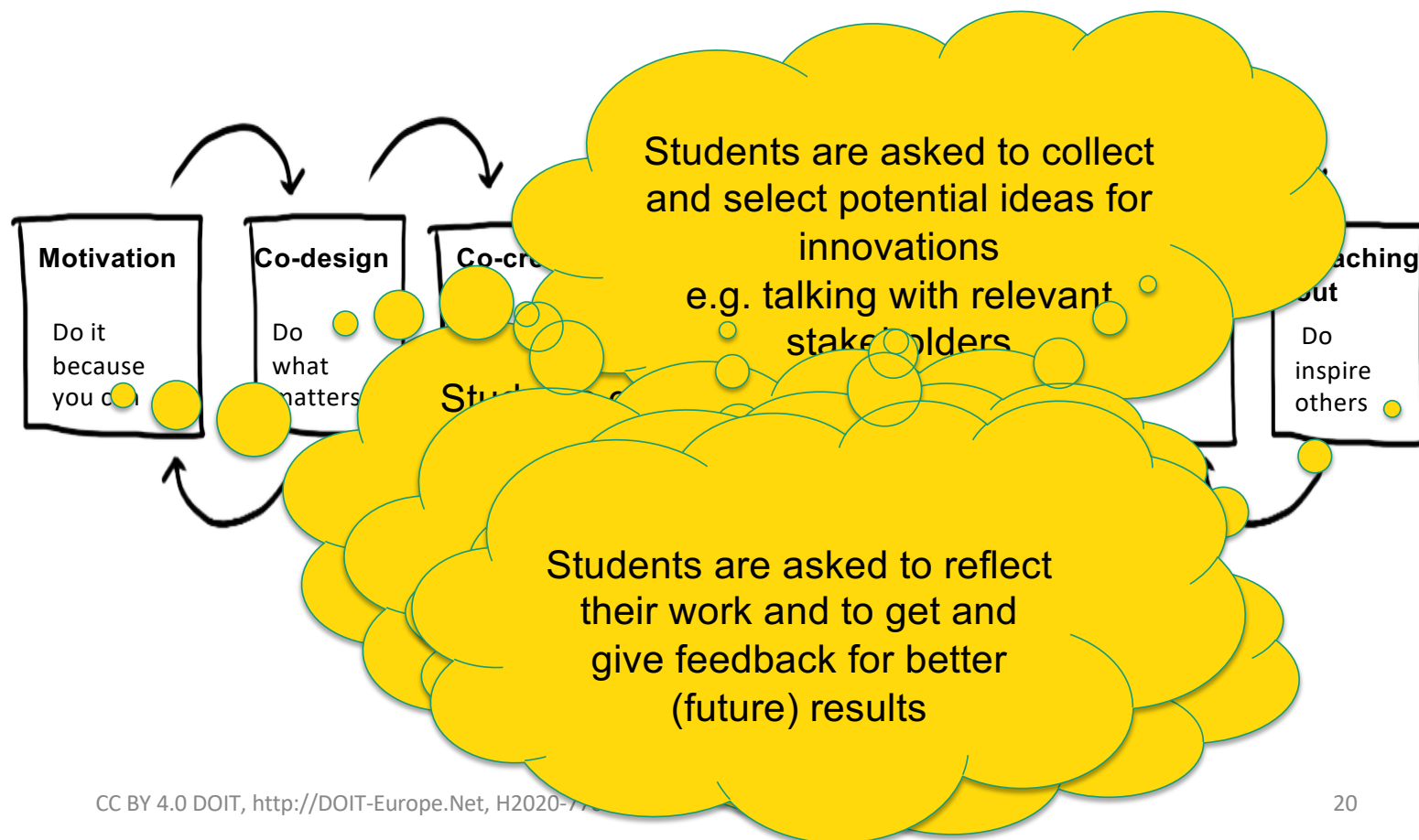
STEAM Approach example: the DOIT project

DOIT aimed to collect, develop, publish and spread materials and experiences for an **early entrepreneurship** education for children from **6 to 16** that built upon **social innovations** within makerspace settings.

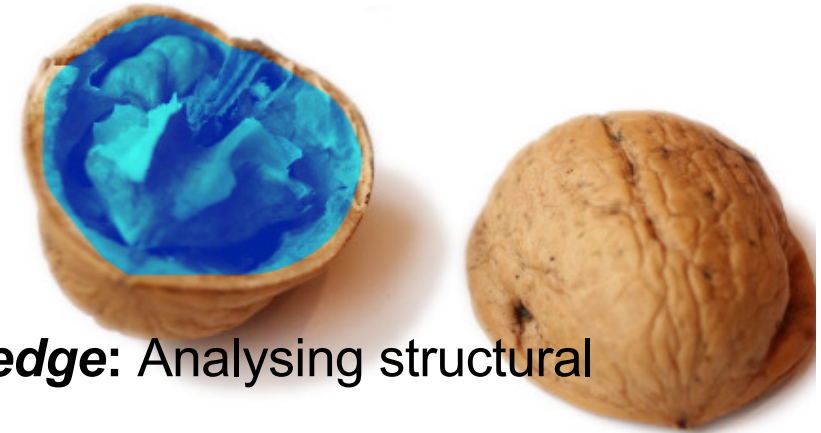


DOIT programme

- 7 steps for young social innovators



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Policy recommendations for transformative SI – reflection exercise

For the approach to become a true social innovation, it must be utilised and practiced by educational institutions. → step in our shoes → policy recommendations

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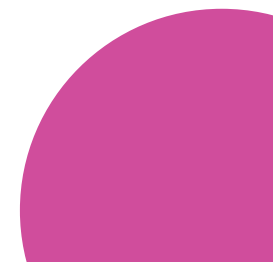
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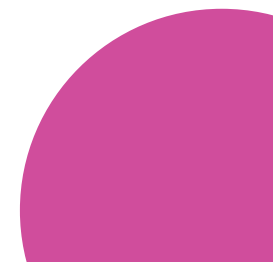
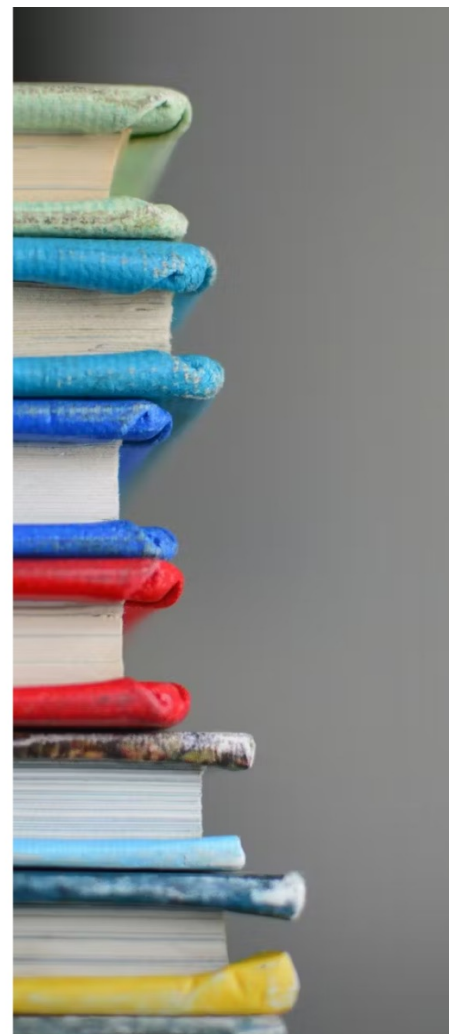
What is the policy you would like to change for
STEAM education in schools?



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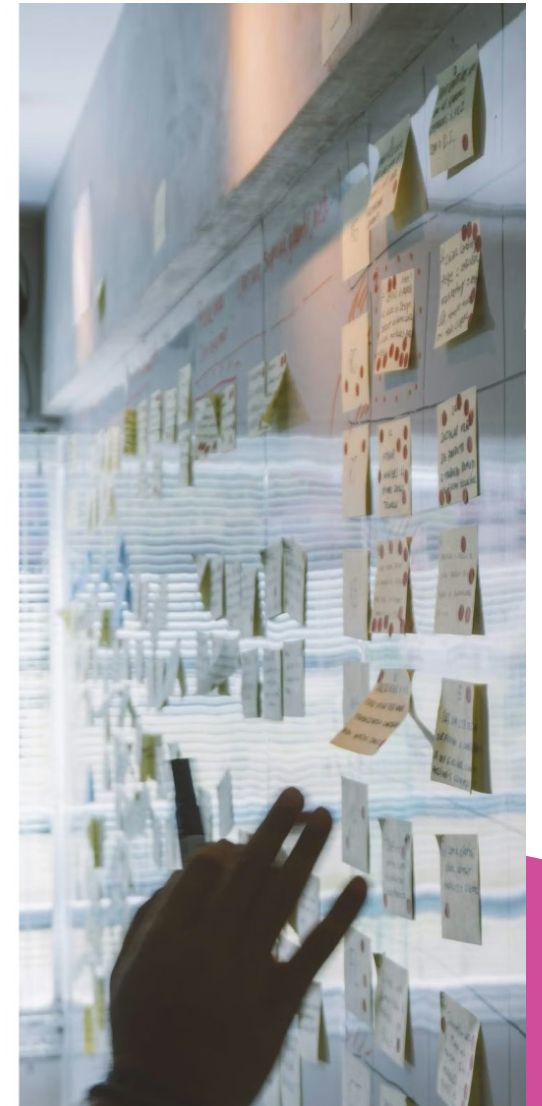


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Who are the policymakers you would need to convince?



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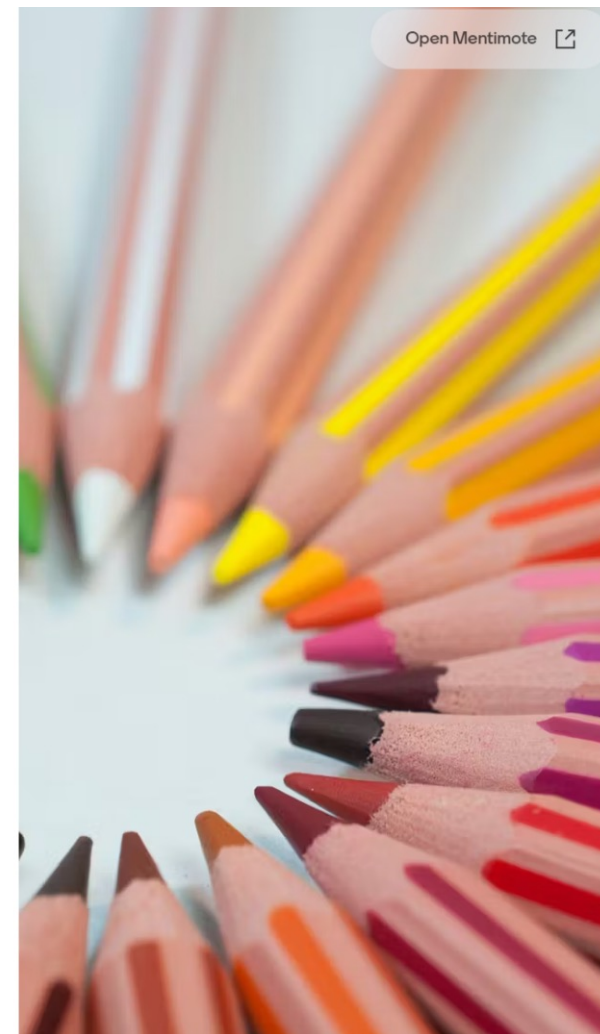


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What are the winning points to convince this policymaker of your position?



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What should this policymaker do?



Or use QR code



Results from previous workshop

n=40; stakeholders from two maker projects

- Policy recommendation advocating for the integration of maker education into school curricula → Ministry of Education, Teacher associations, and Members of Parliament.
- Benefits of Integration → decreased unemployment and school dropouts, increased innovation & creativity.
- Learning Enhancement → Contributions to students' skill development and self-awareness through hands-on experiences and project-based learning.
- Involvement of Companies and SMEs → to enhance learning transfer and employability
- Funding and Quality Assurance → Funding to be from government and public bodies; emphasising the importance of openness and quality in education materials and approaches
- Making Learning More 'Real' → Involving companies and SMEs in education, creating makerspaces, and training teachers will make learning more exciting and realistic.



Outlook

- Policy mapping → policy gap analysis → policy recommendations
- Roadmap for STEAM education



Stay in touch

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Policy recommendations for transformative SI

- (1) What is the policy you would like to change or influence for transformative SI?
- (2) Who are the policymakers you would need to convince?
- (3) What is the entry point to grab the attention of these policymakers?
- (4) What are the winning points to convince this policymaker of your position?
- (5) What is the long-term change you would see if policy shifted in your favour?
- (6) What would the direct benefit be?
- (7) What would the wider benefits be?
- (8) What should this policymaker do?

