



The challenge of working with the future within STEM education

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> The I SEE project – *Inclusive STEM Education to Enhance the capacity to aspire and imagine future careers*

> Intro

In post-modern societies, where social acceleration is a source of anxiety and frenetic standstill (Rosa, 2013), the young generation struggles to project themselves into the future and to develop scope as future professionals. Particularly, the following are observed:

- the difficulties of the younger generation in coping with an unpredictable future and with the global challenges of this changing and fragile world (*invisible horizon*)
- the difficulties to find clues in the past to interpret the present (*speechless past*)
- a frantic present, completely oriented toward seizing the moment and keeping open all possible scenarios (*frenetic standstill*; presents as “dust of moving splinters”, C. Leccardi)

> Goal

To design innovative approaches and **teaching modules** on STEM advanced topics (e.g. climate change, artificial intelligence, quantum computing), to foster students’ capacities to imagine the future (*future-scaffolding skills*) and aspire to STEM careers.

> Intellectual outputs

- Teaching-learning modules (O1-O2)
- Guidelines for teachers (O3)
- Case studies & research reports (O4)
- Policy recommendations (O5)x

> The ambition: “Science as a way to take care of students dystopic perceptions of time”

- **Present:** from being perceived as a frenetic standstill to becoming viewed as a collection of events that can be organized in a comprehensible picture
- **Future:** from being distant and unimaginable, to becoming conceivable as a set of possibilities, addressable through concrete actions and within the students’ reach (in the sense that they found room to see themselves as agents of their own future)

> Keyword: “Future-scaffolding skills”

Abilities that enable students to construct visions of the future that empower action in the present with an eye on the horizon

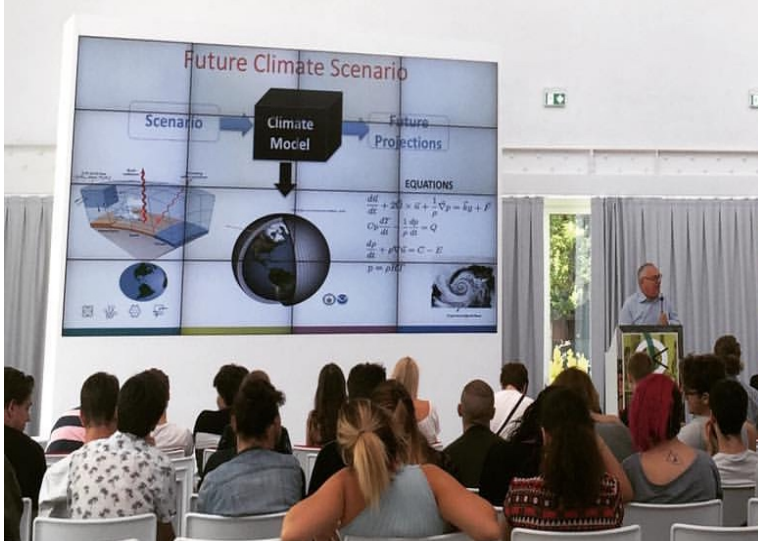
> I SEE module first Implementation



- **24 students** (8 students from each of the partnering schools and, hence, 8 students per country: Finland, Iceland and Italy)
- **1 intensive week-long programme** of student group work, exercises, plenary lectures, a panel discussion and students’ presentations

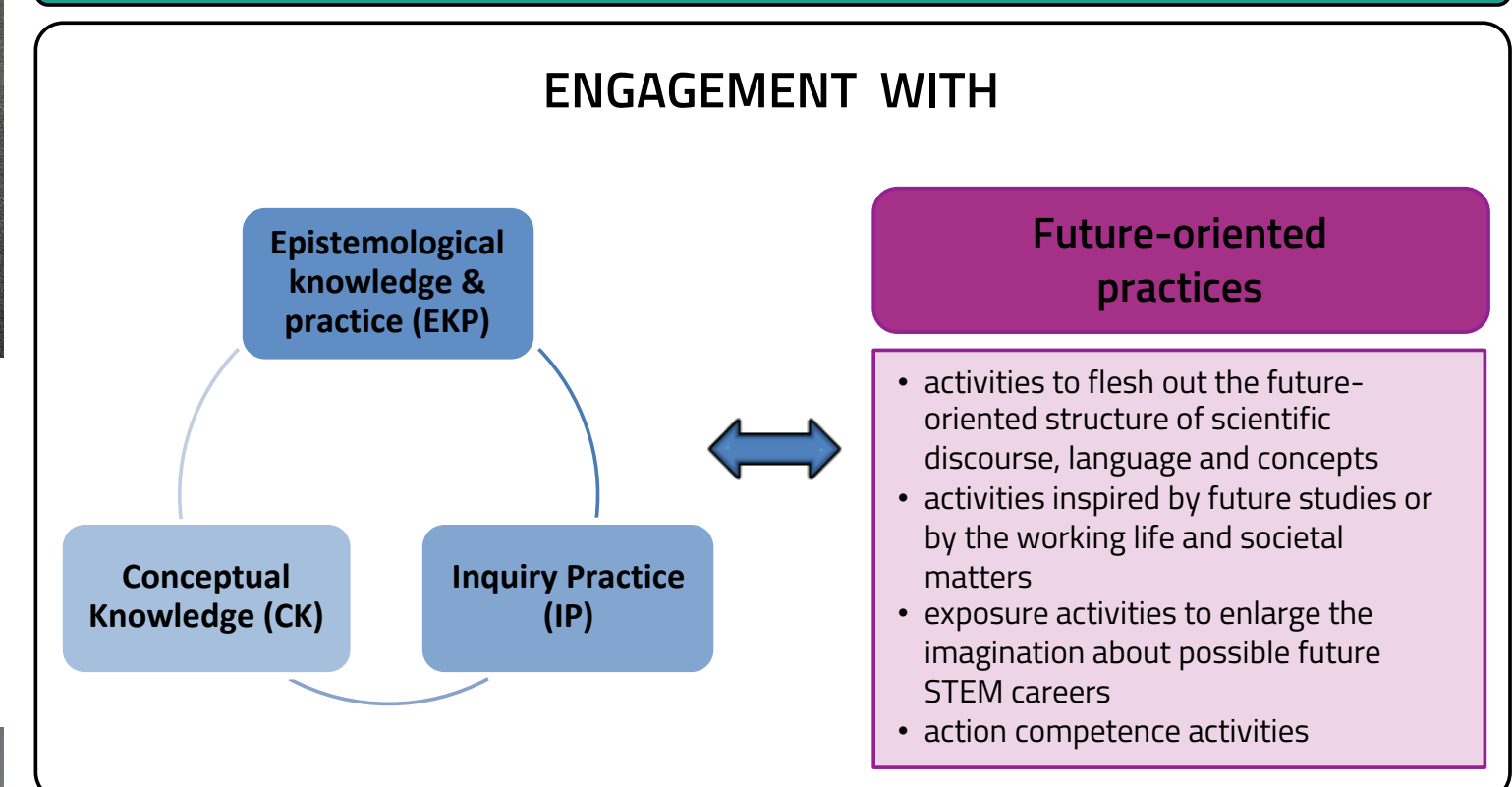
- **First I SEE MODULE** focused on climate change, consisted of a unified set of activities aimed at developing **students’ conceptual and epistemological knowledge and skills**, **future-scaffolding skills**, and **action competence and agency** (*)
- **Specific tools** have been designed to collect qualitative and a variety of data sources (e.g. **focus groups**, **individual interviews**, etc.) were collected and analysed through an iterative process that came up with a bottom-up de-briefing phase

Students’ encountering with the focal issue: developing a preliminary level of awareness of the ways in which conceptual and epistemological scientific knowledge, the specific language, the methodological and the pedagogical approaches will interweave in the module



Conceptual and epistemological activities: modelling physical and chemical phenomena affecting the greenhouse effect

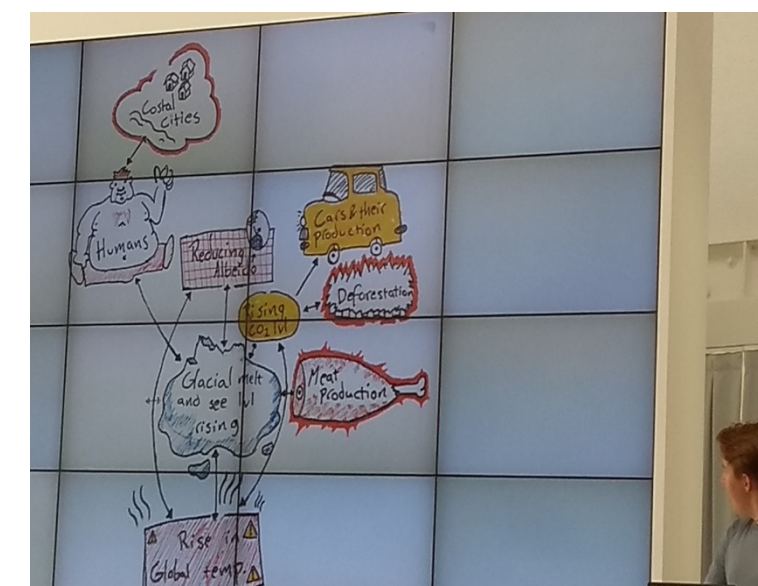
ENCOUNTERING WITH THE FOCAL ISSUE



SYNTHESIS OF IDEAS AND PRACTICES

planning actions to contribute to ones’ own desirable futures

(*) Structure for I SEE model inspired by the SSI-TL model (Sadler et al., 2007)



Future-scaffolding activities: understanding climate change as a complex system; identifying feedback loops, causal relationships and leverage points



Action competence activities: visioning desirable futures in 2030 and telling their success story – in the form of back-casting activity during a final creative presentation to the whole group

RQ:

How did the module impact students’ attitudes toward present and future?

Future & Agency

Students’ initial views confirmed the trends of a widespread feeling of negativity as well as a tendency to remove the future from personal horizon.

In the end, there were widespread feelings of major serenity, positivity and awareness, particularly the school helped the students in:

- **becoming more confident in themselves** and in their ability to manage difficult situations; a sense of serenity and a positive attitude toward the future increased
- **widening their perspectives** and developing new ways of thinking, opening views, seeing new options and the many possibilities, breaking down the barriers and let the imagination go on
- **see the future within their reach**, i.e. they found ways to see themselves as agents and actors of their own future, to have a critical view for observing the world around them

I always had a negative view of the future. But after being here and hearing all the views then it has really opened up for me the possibility that we can fix things. It has changed for me my negative perspective of everything is hopeless. [...] I'm more confidence in what I can do about the situation. [...] The school conveyed me serenity and hope in the future, it helped me to open my mind and to think differently and eliminate some fears.

Cultural insights

There were **difficulties in overcoming some initial barriers** (language, behaviour and ways of expressing/interacting, cultural background, ...)

After having overcome the initial barriers, the cultural differences became fruitful and a chance to learn; indeed the meeting with different cultures:

- gave them **something beyond conceptual knowledge**, that is, an awareness of others’ lifestyles, approaches, ways of reasoning, environmental cultures, etc. in dealing with the same problems
- made them able to **enlarge their horizons and open new perspectives**
- created the opportunity to **share values and desires to act together for changing the world internationally**

It was difficult to agree the various ideas among different nationalities but it was interesting to see approaches from countries with different climate, structures, etc. in dealing with the same problems that affect all of us, because we are all habitants of the same Earth. [...] This fact that problems can be addressed by different points of view, more or less favourable depending on where you live, where you are working and with your means.

STEM careers

Most of the students already had an idea about a desirable field of work or university study but the summer school influenced them in some ways with respect to their choice of field, such as:

- **Fostering interest toward STEM** and pushing to reflect on the importance of STEM in society and the kind of impact STEM professions could have
- **Grasping the importance of teaching STEM** and fostering a STEM thinking/knowledge/awareness
- **Enlarging imagination toward new kinds of professions**, seeing jobs that they had never imagined before and seeing the possibility to create their own job in the future
- **Breaking the barriers among the disciplines** and seeing collaboration among them as powerful
- **Perceiving STEM as a passion** to be cultivated outside of work

I've seen that it is possible for me to go into a STEM field and have influence on the world through STEM. [...] The school was a brilliant example to see that in the world of jobs you need to develop transversal skills, you can no longer be too attached to usual professional categories, you need to be able to collaborate with various experts.

CONCLUSION

WHERE WE ARE ...

- The module seemed to have a positive impact on students’ perception of the future and sense of agency
- Tentative analysis of students’ expressions has revealed a systematic development in their futures thinking



FUTURE ACTIONS ...

- We need to understand how the module brought about these outcomes
- We need to recognise more systematically shifts in the vocabulary within students’ discourse
- We need to find analytic lenses for refining our “rough” definition of *future-scaffolding skills*

Main references

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