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The Challenge of Working With the Future Within STEM Education

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Abstract: Global crises and societal uncertainty mean that youth perceive the future no longer as a promise but as a threat, and have difficulty projecting themselves into the future. Future studies and action competence pedagogies partly inform our EU-funded strategic partnership to develop teaching strategies and materials that build future-scaffolding skills. The first teaching module on climate was implemented in June 2017 in Italy, with 24 Finnish, Icelandic and Italian upper secondary school students and their teachers. Qualitative data were analysed to shed light on how the module impacted on students' attitudes toward present and future.

Introduction

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. Whereas for past generations science and technology were seen as positive possibilities for addressing challenges, now students perceive them as sources themselves of fears (Eurobarometer, 2015). In the face of such a changing world, what possibilities does STEM education offer for enabling young people to live their present in order to create their own future?

Although the interdisciplinary field of *futures studies* has been investigating this problem from a wide perspective, the inclusion of such perspectives within school science curricula is rather rare (for an interesting exception, see Paige and Lloyd, 2016). The notion of agency as a goal of education presents another pedagogical response to the complex challenges of the future, emphasising the ability to take enlightened decisions and actions as individuals and communities (Mogensen & Schnack, 2010). Agency and action competence are relevant to STEM education if students are to be able to overcome fear of the future and instead define their roles and ways forward through socio-scientific issues (Roth & Lee, 2004).

Our recent EU project I SEE (https://iseeproject.eu) studies the potential of *future studies* and action competence pedagogies within STEM education to support students in projecting themselves into the future as agents and active citizens.

Project, goal and methods

The project is formed by a strategic partnership among three secondary schools, two universities, an environmental NGO, a teachers' association and a private foundation coming from four European countries (Italy, Finland, Iceland and the United Kingdom). The project designs innovative approaches and teaching modules on cross-cutting and societally relevant fields to address the above-mentioned concerns. We have defined specific *future-scaffolding skills* (Levrini, Tasquier & Branchetti, *under review*) that should be developed through science education to render it personally, socially, professionally and scientifically relevant and enhance students' capacity to envisage themselves as agents of change and push their imagination towards future careers in STEM. Modules build on the action competence approach combined with the idea of *exposure,* i.e. to be able to choose an alternative future and become an agent of it, an individual has to be exposed to it. The first module, focusing on climate change, was implemented in June 2017 in Bologna, Italy, with a culturally diverse group of 24 Finnish, Icelandic and Italian upper secondary school students and their teachers.

The module implementation was monitored and analysed to answer this research question: *How did the module impact students' attitudes toward present and future?* During the whole implementation, specific tools were designed to collect mainly qualitative data. At this level, we analysed focus group discussions and individual interviews, the aim of which was to let the students express themselves about their overall experience of the module. Data were analysed through an iterative process that came up with a bottom-up de-briefing phase, conceived for identifying the emergent aspects in the data and generate first interpretative ideas.

Preliminary results

By analysing students' discourses during the focus groups and the interviews, we identified three main themes: i) future and agency; ii) cultural insights; and iii) STEM careers. The themes have been pointed out by highlighting students' sentences and grouping them.

With respect to the first theme, students' initial views confirmed the trends pointed out by the Eurobarometer report (2015) and showed a widespread feeling of negativity as well as a tendency to remove the future from their personal horizon because it is too fear-inducing. Indeed, they revealed a tendency to look to the future with pessimism and saw little hope for being able to do something about either their future or present, mainly citing a sense of negativity conveyed by the media. During the interviews, they declared to be aware that their positions deeply changed and became more positive. As evidenced by their words, they: a) became more confident in themselves and in their ability to manage difficult situations, b) acquired a sense of security in the sense of widening their perspectives and developing new ways of thinking, and c) saw the future within their reach and found ways to see themselves as agents and actors of their own future.

With respect to the second theme, the cultural issue appeared to be a constant reference for the students. They revealed that meeting with different cultures gave them something beyond conceptual knowledge, that is, an awareness of others' lifestyles, approaches, ways of reasoning, environmental cultures, etc., but that all the cultures present were still dealing with the same problems. What emerged with a strong emphasis from all students from the three different countries is the great opportunity they had to share values and desires to act together for changing the world internationally.

The third theme regarding STEM careers particularly referred to the students coming from one of the countries. Thanks to their experience with the first module, the students could see new kinds of professions; they saw jobs that they had never imagined before and, in this sense, they saw the possibility to create their own job in the future – not necessarily a conventional or existing one.

Conclusion

The students' reactions that emerged from the focus groups and the individual interviews imply that the activities of the module had a positive impact on students' perception of the future and sense of agency, on the personal experience of cultural diversities as well as on the capability to imagine future careers. To understand how the module brought about these outcomes, we have started a detailed analysis of students' discourse in the audio-recordings. We have already recognised systematic shifts and reactions within their discourse and perceived some new vocabulary that became part of their way of thinking about future. The results of this analysis will provide means to connect the outcomes to the *future-scaffolding skills* which were taught in the module. According to the preliminary analysis, many students abandoned their fear-inducing deterministic future views and started to talk about *future scenarios*, referring to a variety of possible, probable, plausible and desirable futures. They also showed vocabulary pertaining to *complex systems* and reasoned in terms of *circular causality*. Such findings from the discourse analysis help us understand which *future-scaffolding skills* were learned during the module and how they may contribute to students' thinking.

References

Eurobarometer (2015). Public opinion on future innovations, science and technology. *National report Italy, Eurobarometer Qualitative Study*, June 2015.

Levrini, O., Tasquier, G., Branchetti, L. (under review). Developing future-scaffolding skills through Science Education. Submitted to *International Journal of Science Education.*

Mogensen, F., & Schnack, K. (2010). The action competence approach and the 'new' discourses of education for sustainable development, competence and quality criteria. *Environmental Education Research*, 16*(1)*, 59-74.

Paige, K., & Lloyd, D. (2016). Use of Future Scenarios as a Pedagogical Approach for Science Teacher Education. *Research in Science Education* (1-23).

Rosa H. (2013). *Beschleunigung und Entfremdung - Entwurf einer kritischen Theorie spätmoderner Zeitlichkeit, Suhrkamp (*Eng. Trans: *Acceleration and Alienation - Towards a Critical Theory of Late-Modern Temporality*, 2015).

Roth, W.M., & Lee, S. (2004). Science education as/for participation in the community. *Science Education*, 88, 263-291.