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MONOGRAFIE

Co-Create

Competence development and educational research through the lens of knowledge co-creation

Editors
Valentina Tudisca, Claudia Pennacchiotti, Adriana Valente

Consiglio Nazionale delle Ricerche
E-PUBLISHING IRPPS

IRPPS Monografie

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2021

Co-create. Competence development and educational research through the lens of knowledge co-creationa. Editors: Valentina Tudisca, Claudia Pennacchiotti, Adriana Valente
Roma: Istituto di Ricerche sulla Popolazione e le Politiche Sociali
2021, pp. 86 (IRPPS Monografie)

CNR-IRPPS e-Publishing: http://www.irpps.cnr.it/e-pub/ojs/
ISBN (online): 978-88-98822-22-5
DOI: 10.1460/978-88-98822-22-5

Editing e composizione: Laura Sperandio

Citare come segue:

Co-create. Competence development and educational research through the lens of knowledge co-creationa. Editors: Valentina Tudisca, Claudia Pennacchiotti, Adriana Valente
Roma: *CNR-IRPPS e-Publishing*.
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Istituto di Ricerche sulla Popolazione e le Politiche Sociali
Via Palestro, 32 – 00185 Roma, Italy
http://www.irpps.cnr.it/e-pub/ojs/

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Contents

Reshaping education curricula through the lens of knowledge co-creation – Introductory remarks

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The major periods of social change, like the one we are experiencing, represent a breaking point that push the different social systems, in an osmotic relationship, to look for new forms of equilibrium, in a dynamic process constantly evolving as external conditions change.

Although upsetting, this process could allow social systems to reach unexpected ideas and opportunities, overcoming already known perspectives.

The social distancing, caused from the Covid–19 pandemics, is affecting the educational community with great difficulties and new challenges. It revealed inequalities and vulnerabilities, but it has also surfaced extraordinary human resourcefulness and potential that could represent a starting point to reshape our world and education.

We must not passively sit back and observe what plays out. Wondering about the possible futures of education, inside and outside of the educational community, is becoming more and more urgent under many points of view, involving several issues: social and gender issues, social exclusion and marginalization, strengthening the use of technologies and digitalization, environmental issues, the transition into the labour market.

How to reshape the relationship among school, education, society and work? What competences are crucial for the personal and social fulfilment and social inclusion? What is the specific weight of competences and knowledge in the educational process? How could the relationship between teachers and students be reshaped?

Facing these questions entails dealing with uncertainty and complexity, looking for sustainable answers to interconnected problems that do not entail "one" solution, but involve multiple values, interests, perspectives and needs.

As outlined by Funtowicz e Ravetz[1]*, facing complexity and uncertainty implies the need to involve a wide variety of stakeholders in reflecting on possible solutions. This inclusive approach enhances the chances to reach shared and sustainable solutions that prefigure*

[1] Funtowicz, S. e Ravetz, J. 1997, Environmental problems, post-normal science, and extended peer communities. Etudes et Recherches sur les Systèmes Agraires et le Développement, 30.

desirable futures for the communities and, at the same time, can improve the resiliency to social changes at individual and collective level.

Reshaping education, for all intents and purposes, is a plural and collective process; communities (civil society, university, school, lifelong learning, research, business) should be able to take part responsibly and consciously in the educational process.

Since several years – even more now, during the pandemics – the environment and social context changes are pushing on the educational systems. The educational systems must take charge of them and reshape several fronts, starting to imagine possible/desirable futures: redefining target competences, restructuring the relationship with external stakeholders (social, cultural, economic) and, finally, revising the "official" and "implemented" curricula.

The current volume aims to present to researchers, teachers, societal and political actors a variety of educational experiences, realized before the pandemics, coming from different levels of education – high school and higher education – and lifelong learning, that focus on participatory processes of co-creation of educational implemented curricula, by means of community engagement (learners, teachers, researchers, civil society, policy makers).

At the same time, in this volume, attention is paid to:

- *the competences, soft skills and social values promoted in learners by the co-creation process in itself;*
- *the "implemented curriculum" as a whole of transdisciplinary activities that enhance the development of target competences, also taking into account relevant elements like practices realized locally and stakeholders' views, as envisaged by the UNESCO[2] concept of "curriculum system" and "curriculum framework".*

In particular, the volume describes case studies, experiences and theoretical reflections engaging teachers, learners, scientists and other societal actors throughout the entire research and innovation process as co-producers and co-designers of educational scenarios. All the described case studies are inspired by the Responsible Research and Innovation (RRI) framework, aiming to align the research process and its outcomes with the needs, values and expectations of the communities, enacting personal and societal dimensions of curriculum implementation.

[2] International Bureau Education-UNESCO, 2013: Glossary of Curriculum Terminology, UNESCO-IBE.

In this context, the development of educational curricula and scenarios is not a "neutral" matter, but one that reflects the assimilation of specific values by societies and the view of how societies are envisioning themselves and their future. This is why actively involving different actors in this task can be considered as a political action, from the perspective of integrating active citizenship visions, needs and desires into science and innovation. Therefore, developing educational curricula concerns transforming visions on future-oriented learning into school practices.

Competences and societal values promoted by the co-creation process in itself – through formal education, as well as informal and non-formal – are intended as a combination of knowledge, skills and attitudes that are key issue for taking care of individual and collective future. In particular, in the last years, a debate on building competences and soft skills needed for a knowledge society to flourish is increasingly emerging. Among them, European Commission identifies: learning to learn, critical thinking, sense of initiative and entrepreneurship, social skills and problem solving. These competences embed attitudes that are crucial to act as responsible citizens, which is directly connected to RRI in the development of more inclusive societies and in promoting innovation processes in which the different actors involved are fostered to become human beings able to manage knowledge and take part consciously in the decision-making processes, being aware of their own impact in the socio-political sphere. In particular, the volume enhances considerations on how the active involvement of teachers, learners and societal actors throughout the entire research and innovation process – from the perspective of integrating citizenship visions, needs and desires into science and innovation – leads to the increase of specific competences linked with the key competences formalized by the European Commission in 2018[3].

The specific topics covered by this volume include:

- *embedding the RRI framework in educational project development in the field of high-school physical education (Erasmus + Sport project DIYPES, Chapter 1);*
- *embedding RRI in higher education curriculum (EnRRICH project, Chapter 2);*
- *co-creating digital cultural contents to address the issue of migration starting from high school historical-philosophical curricula (project "Philosophy and Migration. Designing, implementing and promoting digital cultural content", Chapter 3);*

[3] Council of the European Union. (2018). Council recommendation of 22 May 2018 on key competences for life-long learning. Official Journal of the European Union 2018/C 189/0), 1-13.

- *adopting RRI principles in Continuing Medical Education (Chapter 4);*
- *promoting key competences functional to personal fulfilment and active citizenship and employability in a knowledge society by means of the of co-creation of Alternating Training paths in high school (Erasmus + project DESCI, Chapter 5);*
- *promoting key competences and soft skills in implementing participatory, innovative methodologies for high school physical education curriculum reform (Erasmus + Sport project DIYPES, Chapter 6).*

In line with the co-creation approach that inspired the development of this volume and the following peer review process of their papers, authors had the chance to exchange views among themselves and with the other participants during the "Co-create! Co-creation of curricula, tools and educational scenarios to build soft competences for personal development and employability" Conference, held in the Science Centre AHHAA of Tartu, Estonia, on 17 September 2018, within the "RRI-SIS2018 Multi-conference" (15-17 September 2018), and to revise and enrich their papers by taking advantage of the debate and of the collective process of knowledge creation.

The volume editors wish to acknowledge the following program committee members of the RRI-SIS 2018 Co-create! Conference for their rigorous review of the chapters that were accepted for inclusion in this book:

- Sveva Avveduto, Institute for Research on Population and Social Policies of the National Research Council of Italy, Rome, Italy;
- Balint Balázs, Environmental social science research group, Budapest, Hungary;
- Silvia Caravita, consultant, didactic of science expert, Italy;
- Graça S. Carvalho, University of Minho, Braga, Portugal;
- Chiara Cavallaro, Institute for the Study of Regionalism, Federalism and Self-Government of the National Research Council of Italy, Rome, Italy;
- Claudia Ceccarelli, Institute for Complex Systems of the National Research Council of Italy, Rome, Italy;
- Fiona Catherine Chambers, University College Cork, Cork, Ireland;
- Antonella Ciocia, Institute for Research on Population and Social Policies of the National Research Council of Italy, Rome, Italy;

- Paola De Castro, National Institute of Health of Italy, Rome, Italy;
- Marco De Cave, Futuro Digitale Non-profit Association, Cosenza, Italy;
- Anna-Liisa Elorinne, University of Eastern Finland, Joensuu, Finland;
- Elisabetta Falchetti, ECCOM Association, Rome, Italy;
- Giordana Francia, The International Committee for the Development of Peoples, Rome, Italy;
- Peter Gray, Norwegian University of Science and Technology, Trondheim, Norway;
- Erich Griessler, Institute for Advanced Studies, Vienna, Austria;
- Claudia Gina Hassan, University of Rome Tor Vergata, Rome, Italy;
- Alba L'Astorina, The Institute for Electromagnetic Sensing of the Environment of the National Research Council of Italy, Milan, Italy;
- Paolo Landri, Institute for Research on Population and Social Policies of the National Research Council of Italy, Fisciano, Italy;
- Daniela Luzi, Institute for Research on Population and Social Policies of the National Research Council of Italy, Rome, Italy;
- Michela Mayer, Institute for Research on Population and Social Policies of the National Research Council of Italy and Science Education/Sustainability Education expert, Rome, Italy;
- Marisa Michelini, Udine University and the International Research Group on Physics Teaching, Italy;
- Marco Pennacchiotti, Principal Engineer at BMW, Munich, Germany;
- Sébastien Pesce, Université François-Rabelais, Tours, France;
- Gema Revuelta De La Poza, Pompeu Fabra University, Barcelona, Spain;
- Paolo Russo, Stati Generali dell'Innovazione, Rome, Italy;
- Charly Ryan, The University of Winchester, Winchester, the United Kingdom;
- Sabah Selmaoui, Université Cadi Ayyad, Marrakech, Maroc;
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- Rachele Villani, Fondazione Bruno Kessler, Trento, Italy;

- Vania Virgili, National Institute for Nuclear Physics, Rome, Italy;
- Nina Zugic, Consultant, the United Kingdom.

The editors also wish to acknowledge the European Horizon 2020 project MARINA for promoting the RRI-SIS 2018 Multi-conference and the Science Centre AHHAA of Tartu for the valuable support to the organization of the Conference.

Finally, the editors wish to acknowledge Laura Sperandio (CNR, Italy) for contributing to the editing of the volume.

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CHAPTER 1

Participatory physical education and sport curriculum reform in the context of the Responsible Research and Innovation framework – the DIYPES project

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This project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Abstract This paper explores the suitability of an Erasmus+ Sport Collaborative Partnership – DIYPES project, aimed at testing participatory approaches to physical education and sport classes' curriculum and contents – within the Responsible Research and Innovation framework indicators.
The steps of the DIYPES intervention Standard Operation Procedure (SOP) are confronted with the RRI process and outcomes indicators proposed by RRI-Tools, a FP7 project having as main preoccupation RRI defining and development, and making the RRI concept operational.
Results show that DIYPES intervention methodology follows, up to a high extent, the majority of the proposed indicators, thus aligning the project processes and (envisioned – given that project is still under implementation) results within the RRI endeavors.
In conclusion, for fostering the achievement of applicable, acceptable and sustainable results it is relevant to test (both prospectively and retrospectively) the compatibility of a cross-country, collaborative curriculum reform project methodology within the RRI proposed framework or concepts. RRI can be proposed as a cornerstone reference in designing collaborative curriculum reform projects, at least in the field of physical education and sports.

Keywords: Physical education and sport curriculum reform; participatory approaches; youth physical activity; Responsible Research and Innovation

1.1 Introduction

The technological advancements at the end of the 20th century and beginning of the 21st century have led to changes in the natural, built, social and work environments, which affected the lifestyles, health and wellbeing of populations and individuals (McMichael *et al*. 2008). Consecutive to the shift from hard to soft industries (e. g. services), many urban environments became increasingly crowded and less active-transportation friendly, thus being physically active has turned from a reflex and necessity to a voluntary choice, sometimes hard to uptake – given the non-stimulating/non-supportive home, work, social and built environments or busy schedules (World Health Organization 2017) (Hallal *et al*. 2012) (Moore *et al*. 2003).

Although the health and productivity related benefits of being physically active have been proven in the scientific literature (Warburton *et al*. 2017) (Center for Disease Control and Prevention 2018) and widely acknowledged for all age categories, from children to older adults, increased percentages of the populations from developing and developed countries are still not sufficiently active (World Health Organization 2018a).

The children and youth reaching the World Health Organization (WHO) recommended levels of physical activity (i. e. at least 60 minutes of moderate to vigorous physical activity daily) is low, WHO estimating that more than 80% of the world's adolescent population is insufficiently physically active (World Health Organization 2018b). The increased importance of being active in this age group (relative to the other age groups) resides in the added physical and cognitive developmental benefits as well as in the set of motor skills necessary for up taking (or maintaining practicing) a sport or a specific type of physical activity later in life (i. e. in the adulthood) (Telama *et al*. 1997). In this context, of motor skills development, physical education and sport (PES) plays an essential role in modeling children and youth's appetite and abilities for practicing a sport or a physical activity. The structured contents (and the delivery by a specialist – the PES teacher), the compulsoriness and the regularity of the delivery (one or more times/week) and the fact that it is organized in the school environment, thus being available to all children enrolled in the educational system, makes PES one of the most important tools for stimulating and maintaining children and youth's interest in sports and physical activity in general (Kerr *et al*. 2018).

However, a cumulus of factors, including (reported) busy school schedule, improper PES school infrastructure, lack of interest for the proposed activities, or lack of skills for performing in evaluation norms/standards have led to decreases in participation and

engagement of students in PES classes, especially at the transition from grades 5-8 to grades 9-12.

1.1.1 The DIYPES Project – General description

In the light of the previously presented facts, the 2-year (2017-2018) Erasmus + Sport, DIYPES (Do it yourself! A participative approach to increase participation and engagement of high school students in physical education and sport classes) project – www.diypes.eu, aimed at exploring innovative approaches to PES classes, to stimulate high-school students' participation (attendance) and engagement (involvement, intensity). DIYPES methodology included a participatory approach to PES class contents reform, with PES students and teachers at the core of the change, through offering their input in regards to the necessary, desirable but also feasible changes, given the national PES curriculum and the schools' PES infrastructure and equipment. DIYPES approach was meant to be mainly non-structural, and rather procedural, set in within the current legal and logistic frameworks in each of the 5 project countries (i. e. Albania, Italy, Malta, Romania and Slovakia), and only meaning to improve methods and means/activities within the PES classes as a solution for making these classes more attractive for students. Thus, in summary, DIYPES intervention followed 3 main principles for implementation: 1) Participation and collaboration (PES teachers – high-school students – DIYPES researchers) in the development and delivery of the PES classes; 2) Making best use of the school units available PES resources (infrastructure, equipment, PES teachers' qualifications or fields of expertise); 3) Complying with the national/regional PES curriculum and adjacent educational objectives. DIYPES project concept was guided by the self-determination theory (Ryan *et al*. 2000) that identifies three universal, psychological needs, respectively: 1) Competence – an individual seeking to control the outcome of the activities she/he is involved into and to experience mastery of the activity; 2) Relatedness – described as the universal need to interact, to be connected to and experience caring for others; 3) Autonomy – described as the universal urge to be causal agent of own life and act in harmony with own integrated self. DIYPES design aims to encompass all these 3 characteristics in order to engage students in the development and delivery of their own PES classes.

The aim of this paper is to present the DIYPES project intervention methodology in the light of the Responsible Research and Innovation (RRI) framework, by emphasizing the aspects of RRI considered in all phases of the DIYPES project, from the proposal/grant

writing to the intervention planning, implementation, evaluation and dissemination and further implementation or scale up.

1.1.2 Responsible Research and Innovation (RRI) – concept & frameworks

Responsible Research and Innovation (RRI) is a concept of rather recent development (Owen *et al*. 2012), defined by the European Commission as: "an approach that anticipates and assesses potential implications and societal expectations with regard to research and innovation, with the aim to foster the design of inclusive and sustainable research and innovation" (European Commission 2018a). RRI promotes and implies the collaboration of different societal actors (researchers, policy makers, private sector representatives, civil-society and citizens) throughout the entire research and innovation process, with the aim of aligning the research process and its consecutive outcomes with the needs, values and expectations of the society.

In this context, according to a RRI dedicated FP7 funded program, RRI-Tools (RRI-Tools Consortium 2018), RRI framework comprises a set of 4 process dimensions and 3 categories of outcomes, that research and innovation (R&I) processes should align to or aim for in order to be considered as "responsible". In brief, the 4 process dimensions are, recommended to be followed by any R&I process, in order to be considered "responsible", are: 1) Diversity and inclusiveness; 2) Anticipation & reflectivity; 3) Openness and transparency and 4) Responsiveness & adaptiveness to change. The 3 categories of outcomes, essential for any R&I process to aim for or include, in order to be considered "responsible", are (RRI-Tools Consortium): 1) Learning outcomes: including engaged publics and responsible actors & institutions, facilitating the sustainability (institutionalization?) of R&I results; 2) R&I outcomes: assuming ethically acceptable, sustainable and socially desirable R&I outcomes, through transparent processes and continuous, meaningful deliberation to incorporate societal voices in R&I; 3) Solutions to societal challenges: especially by searching for solutions to address the seven societal "Grand Challenges" formulated by the European Commission (European Commission 2018b).

The European Commission proposes a similar framework for defining and operationalizing RRI, comprised of 6 dimensions covering the importance of promoting: public engagement in R&I, gender equality, teaching of Science Education in schools, access of stakeholders throughout the R&I process, ethical conduct or research and the anticipation of societal implication of these processes (European Commission 2014).

As mentioned in the paper aim, in what follows we will present the DIYPES project methodology in the light of the RRI framework described above. More specifically, we will try to answer the following questions: how many (and up to what extent) of the RRI processes and outcomes related proposed "indicators" have been incorporated into the DIYPES intervention methodology and how are these aspects relevant in the light of the potential for practical use of DIYPES results/products?

1.2 DIYPES project intervention in the context of RRI framework

The DIYPES project intervention consisted of 3 months (12 school weeks) of PES classes adapted to the high-school students' expressed preferences and needs, but also considering the requirements of national PES curriculum in each partner country, the PE teachers' opinions and the high-schools' available PES infrastructure and equipment. The actual intervention implementation, that took place in the spring semester of the 2017-2018 school year, was preceded by a comprehensive data collection process, that took place in the Fall semester of the same school year. The data collection methods were: pre-intervention questionnaires addressed to students, focus-group discussion with students, semi-structured interviews with PES teachers and observation of the school PES infrastructure and equipment.

The data collected through the tools above mentioned constituted the evidence base for the planning and delivery of the adapted PES classes in each of the 45 high-school classes from the 15 high-schools in the 5 partner countries. A dedicated intervention plan and PES lesson plans were developed for each group (class) of students, in accordance to their own characteristics (physical potential), curriculum (for each grade) and expressed needs and preferences (extracted from the group discussion). PES specialists and the PES teachers from the selected high-schools contributed to the development and refining of the intervention plan and PES lessons plans, but offering regular feedback to the research team in regards to the feasibility for implementing the proposed, new activities, as well as the students' reactions to the new PES class contents.

In what follows we will present the DIYPES intervention timeline, from data collection, to the implementation, evaluation and dissemination phases of the process. The methods used in each phase will be described in the context of the RRI framework, by considering both the process dimensions and the outcomes indicators proposed by RRI-Tools (RRI-Tools Consortium 2018). The information presented is part of the DIYPES intervention Standard Operation Procedure (SOP), a document developed by DIYPES project coordinators,

University Babes-Bolyai, amended and agreed upon by project partners. This document represented the common methodological basis for comparative intervention implementation in the five project countries: Albania, Italy, Malta, Romania and Slovakia. All the documents mentioned below, in Table 1, (e. g. Collaboration protocols, Informed Consents, Pre-Intervention Questionnaire, Focus-Group guides, etc.), were also developed by DIYPES project coordinator, as part of Intervention planning, and amended and approved by project partners, as integrative part of the SOP.

1.2.1 DIYPES methodology in the context of the RRI framework

In what follow, we will present in Tables 1.1 and 1.2, below, the DIYPES intervention SOP steps in the context of the RRI proposed process dimensions and outcomes (according to the RRI-Tools project framework).

Table 1.1 DIYPES intervention methodology in the context of the RRI process dimensions

DIYPES Methods	**RRI Process Dimensions**			
	Diverse & Inclusive	**Anticipative & Reflective**	**Open & Transparent**	**Responsive & Adaptive to change**
Pre-intervention data collection	YES partially	YES	YES	YES partially
	Not consulting parents, sport NGOs or other stakeholders in the data collection process	Adequate literature review conducted, policy-oriented outcomes envisioned	Presenting project aims, methods and envisioned outcomes to all participants	Adaptations to the data collection instruments were operated in the limits of research rigors
Intervention contents development	YES	YES	YES	YES
	Collaboration with students and PES teachers & specialists for intervention development	Tailored intervention and lesson plans – different expressed needs & preferences	Data collection results shared with students, PES teachers & specialists	Intervention plans adapted to settings' characteristics and PES teachers' opinions
Intervention Implementation & Process Evaluation	YES partially	YES	YES partially	YES partially
	Due to students' low engagement in the process evaluation	By conducting (pre and within intervention) PES class structured observation	Methods explained to teachers but not to students – time restraints	Only following pro-active teachers' or students' request – time restraints
Summative Evaluation	YES	YES partially	YES	YES partially
	Students and teachers involved	Only short term impact evaluated	Methods and envisioned results described	Instruments finalized before applying

Table 1.2 DIYPES Outcomes in the context of the RRI outcomes

DIYPES Outcomes	**RRI Outcomes**		
	Learning Outcomes	**R&I Outcomes**	**Solutions to Societal Challenges**
Data analysis and report development	YES partially	YES partially	YES
	Using national dissemination meetings to validate and contextualize the results obtained in each setting	DIYPES methods sustainability, scale-up, institutionalization – out of the project influence	"Health, demographic change and wellbeing"; "Europe in a changing world – inclusive, innovative and reflective societies"
Dissemination and further implementation	YES	YES partially	YES
	Raising awareness & empowering PES teachers, setting-up exploratory work	Consultations regarding the final products Dissemination meetings addressing sustainability	Wide range of stakeholders involved; Driving changes in the curriculum

The DIYPES project intervention, aimed at exploring participative approaches to high-school PES curriculum reform managed to address (partially or fully) all the RRI process dimensions and outcomes. The main limitations were related to: 1) the lack of engagement of parents and other local PA/PES related stakeholders (e.g. sports clubs), aspect that was not considered due to its added complexity given the research oriented methodology and 2) the limited input of participants (PES teachers, students) in some parts of the projects (i.e. data collection instruments, dissemination tools) due to lack of resources (but also interest of the participants) to do so, but also given the methodological rigors of collecting similar data in 5 partner countries – different input from different stakeholders could have resulted in differenced in the data collection tools and the lack of homogeneity in the reporting and data interpretation of inter-country data.

1.3 Discussion

Even though DIYPES project concept was based (mainly) on the participatory approach to high-school PES curriculum reform, more specifically on involving students into providing information on current PES class and their needs and preferences for more attractive PES class, and stimulating researcher-teacher cooperation during the intervention planning and implementation, it can be observed from Tables 1.1 and 1.2 that the majority of the process and outcomes RRI indicators proposed in the RRI-Tools framework are consistent with the DIYPES project methodology. In this context, given the complexity of the RRI concept and the current lack of standardization and generally accepted definitions of concepts comprised

by RRI, in this paper we would like to propose the idea of using a participatory approach to R&I processes as a primary or preliminary vision for reaching a RRI process and outcomes. By designing a research project in a participatory manner, planning to engage as many (significant) stakeholders as possible, as early as possible in the research process, can lead to or contribute to achieving all the rest of the RRI endeavors, both process and outcomes wise. As a matter a fact, the European Commission acknowledges the importance of participation as a drive for RRI; public engagement (PE) in RRI is defined as: "co-creating the future with citizens and civil society organizations, and also bringing on board the widest possible diversity of actors that would not normally interact with each other, on matters of science and technology". The 3 main conditions for achieving PE in RRI are: 1) establishing iterative and inclusive participatory dialogues between all interested stakeholders; 2) co-creation of mutually beneficial research outcomes and policy agendas for tackling societal challenges and 3) fostering wider acceptability of research results (European Commission 2018c). Within DIYPES, we managed to partially achieve each of these conditions, as follows: 1) although communication and participation was the main project concept, we did not consider all actors (e.g. parents, sports clubs), neither did we managed to incorporate feedback in all phases of the project. This in part consecutive to lack of collective knowledge in regards to the roles of all actors, and part to research methodology (rigor) limitations; 2) although research outcomes were discussed and adjusted to address all expressed needs, the policy agenda (i.e. Curriculum reform) is preponderantly dependent on the decision-making/political wish, thus limiting our potential contribution; 3) through national dissemination meetings we will try to increase knowledge and awareness about the importance of the topic and the project results, with the hope of increasing the acceptability and further implementation of the lessons learned. So, even though DIYPES approach has both some limitations and omissions in achieving all RRI endeavors, it is important to acknowledge its orientation towards collaboration, participation and orientation towards practice, for achieving the final aim, that is more attractive PES classes for high-school students (Valente *et al*. 2018).

RRI is a complex concept (both in defining and implementation) so it cannot be simplified only to participation or collaboration. However, as we tried to demonstrate above in DIYPES project description, by starting off (an R&I initiative) with the mindset of participatory approach, one research endeavor can be conducted towards RRI.

Given our experience, we consider it is important, in all phases of a multi-country curriculum reform initiative, to check or test (both prospective and retrospective) the use of

RRI concepts, in order to facilitate the obtaining of applicable, acceptable and sustainable results; especially in the field of physical education, a school subject that, through its arts or skills oriented contents, appeals more to the emotional than cognitive side of students, it is essential to explore the most engaging but at the same time effective solutions.

1.4 Conclusions

For fostering the achievement of applicable, acceptable and sustainable results it is relevant to test (both prospectively and retrospectively) the compatibility of an inter-country, collaborative curriculum reform project methodology within the RRI framework. RRI can be proposed as a cornerstone reference in designing collaborative curriculum reform projects, at least in the field of physical education and sport domain.

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CHAPTER 2

Philosophy and Migrations. Designing, implementing and promoting digital cultural contents

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Abstract The project "Philosophy and Migration. Designing, implementing and promoting digital cultural content" stems from an idea developed by a group of researchers of the Institute for the European Intellectual Lexicon and History of Ideas of the National Research Council of Italy (ILIESI-CNR) and the Roman section of the Italian Philosophical Society (SFI). The project was addressed to both Philosophy teachers and students (aged 16-19) of high school with the aim of innovating and integrating the historical-philosophical curricula with the study of the migratory issue, in order to develop a correct knowledge in the juridical, economic, social and cultural aspects. It also focused on enhancing digital skills and promoting values and competences related to social inclusion and responsible citizenship. The issue of migration was addressed through the critical-philosophical analysis of 3 key concepts – *Conflict*, *Borders* and *Labour* – matching curricular training contents and interaction with the territory. At the end of the project students published on a website created by themselves original digital cultural contents, in the form of a hypertext, a storytelling and a timeline.

Keywords: Philosophy, migrations, digital content, high school

Premise

The project presented is a spinoff of the conference "*Migrations*. Responsibility of Philosophy and Global Challenges" organized by the Italian Philosophical Society in Rome in Autumn 2016 in order to foster philosophers' interest in imaging and planning new actions and strategies to face a global issue that characterizes our time at different latitudes[4].

Indeed, recent migratory flows, affecting the whole Europe, had such an impact on society, economy, educational systems, to undermine the internal policies and the relationships between several European members, forcing Western philosophical tradition to rethink itself and redefine its categories.

After the conference, a group of researchers of the Institute for the European Intellectual Lexicon and History of Ideas–National Research Council (ILIESI-CNR) and the Italian

Acknowledgments A special thank goes to ILIESI-CNR researchers Maria Eugenia Cadeddu, Cristina Marras, Ada Russo and Valentina Di Lisio, who conceived this project and carried it on in all its phases. Without their expertise and dedication nothing of what is described in this article would have been possible.

[4] The Italian title includes a wordplay: the word "migrations" sounds as composed by the prefix 'migr' and the term 'actions'. For the proceedings of the congress see Gambetti *et al.* (2017).

Philosophical Society–section of Rome (SFI) planned and carried out an updating course for Philosophy teachers and an Alternating Training project for high school students (aged 16-19). These two activities lasted from October 2017 to April 2018, aimed at achieving the following main tasks:

- innovating the historical-philosophical *curricula*;
- experimenting the use of new technologies in learning processes, in order to enhance digital skills in teachers and students;
- adopting participatory processes, involving teachers, students, scientists and other social actors in planning the activities and realizing a final product;
- enhancing competences for social inclusion, responsible citizenship, the promotion of values of culture of peace and non-violence, and the appreciation of cultural diversity (Goal 4.7 of the 2030 Agenda for Sustainable Development).

The issue of migration was addressed through a critical-philosophical analysis of 3 key concepts – *Conflict*, *Borders* and *Labour*. The involvement of various local social actors allowed students to visit some "places of migration" of Rome urban area, meaningful for both their cultural role and their welcoming nature. At the end of the activity, students created the website https://filosofiamigrazioni.wordpress.com where to publish original digital cultural contents and to tell the experience they lived.

In this paper the teachers training and the students' activity will be presented, followed by a section about the evaluation and modelling and dissemination stage, still ongoing.

2.1 Teachers training

In October 2017 13 Philosophy teachers from as many high schools of Rome attended a 2-day/15-hour training course focused on Philosophy and Migrations. The course, organized in 4 panels, each dedicated to a keyword – *Conflict*, *Borders*, *Labour* and *Paideia* – involved researchers in different fields: historians of Philosophy and Religions, political scientists, philosophers, scholars of migrations and experts in integration processes at school.

The course had two specific tasks: firstly, to provide teachers with teaching tools (documents, regulations, official researches, right data, dedicated institutional sites) to develop a correct knowledge of current migrations in Italy and in Europe, usable to promote in their students the ability to go beyond information conveyed by the mass media, often attentive to sensationalist facts or crime episodes. Secondly, to use these tools in the classes, enhancing

professional skills of teachers, their creativity and ability to plan and manage projects, skills often inhibited by school routine or official programs.

Each teacher was invited to design and create a 10-hour teaching module for a selected class, to be integrated in the official historical-philosophical *curricula*. He/she had to choose one of the 4 concepts proposed and develop it in a personal way on the basis of his/her own interests, teaching planning and working time; he/she had to select authors and texts of the philosophical curriculum and integrate them with the most recent philosophical publications; he/she had to organize the class and coordinate the working groups.

Each teacher was also deeply involved in the design and evaluation of all the activities, including the choice of quality indicators of students training process.

During the teacher training phase, particular value was given to linguistic aspects, considering that many of the prejudices and conflicts involving migrants depend on the lack of understanding of terms describing migrations. A glossary was provided to define migrant-related expressions such as *economic migran*t, *forced migrant*, *irregular*, *second generation migrant*, *asylum seeker*, *refugee*, *unaccompanied minor* (Cherubini *et al*. 2016). Special attention was also paid to migrant accommodation places, to distinguish first reception centres from extraordinary reception ones and the so-called *hot spots* (Accorinti *et al*. 2017; Cadeddu and Nasso 2016). At the same time the main documents and studies produced by the European Migration Network, the United Nations, and the main laws in force within the EU were presented.

Rethinking migrations from a philosophical point of view meant to reconsider concepts as *Conflict*, interpreting it not only as a destructive element within a society, but as a space for comparison, a force that can trigger positive dynamics – according to Gilles Deleuze (1993). Also *Labour* is a category through which rethinking migrations, as they are mainly caused by the search for a job and better living conditions. Locke's, Smith's, Marx' classic philosophical thought on labour has been "contaminated" by more recent investigations of authors such as Appadurai (1993), believing that migrants' conditions are potentially paradigmatic of all workers. The Welfare State model, hardly conquered in the 60s and 70s of the twentieth century, is currently deeply challenged by the mobility and flexibility that characterize the global economy, which generates brutal exclusions or relegates migrants in special areas.

The concept of *Border* has also been reconsidered in a dialectical way, not only as a physical and mental limit, but also as a porous place, a passage zone, a threshold, a space for contact between cultures (Benhabib 2005).

Migrations require teachers to rethink also their *Paideia*, their educational aims and contents, even going back to discover again the strength and relevance of texts of our cultural tradition such as Aeschylus' *Suppliants*, which founded the value of obligation to welcome refugees. The teachers in training have also learned about the many good practices of school integration in our country; among many negative indicators detected by international surveys, Italy has the merit of an effective and widespread experience of educational integration practices.

At the end of the two training days, 3 teachers accepted the invitation to extend their didactic module to 40 hours, involving their class in a real integrated didactic project that included visits to the territory and interactions with other social actors. The projects had to focus on one of the key concepts – *Conflict, Borders, Labour* – with the aim at developing a specific final product. The 3 classes were representative of three different types of non-vocational schools – a scientific, a linguistic and a human sciences high school – socially representative of 3 different areas of Rome – city Centre, West Rome and South Rome (Table 2.1).

Table 2.1 Schools involved in the project

School	Area	Specialization	N. Students	Research Topic	Final Product
School A	Rome Centre	Humanities	25	Conflict	Hypertext
School B	West Rome	Maths and Science	20	Borders	Storytelling
School C	South Rome	Languages	22	Labour	Timeline

2.2 Students activity

A number of 67 students participated in the project. In the time frame January-April 2018, they followed an articulated training course and worked together with CNR and SFI researchers on the topic of migration with the purpose of:

- deepening issues related to Philosophy and migrations;
- creating a collaborative website dedicated to the analysis of current migrations;
- narrating their experience.

They had to choose specific communication strategies and to mainly use their mobile phone and open source digital programs in order to create a hypertext, a timeline, a storytelling, in relation to the chosen key concepts. Each student was involved in taking on realistic tasks,

identifying him/herself with the figures of reporter, researcher and storyteller. The activity had the structure introduced in Table 2.2 and described in the following subsections.

Table 2.2 Students activity

Project stage	Activity	Setting	Cognitive Skills stimulated	Number of hours spent by each class
Tuning in	Warm up	CNR	Organising Sharing ideas Planning Questioning	4 hours
Finding out	Outside visit	Unaccompanied minor reception centre/Special reception centre for adults/Online newspaper editor	Observing Researching Note taking Asking questions	4 hours
		Intercultural library		4 hours
	Welcoming visitors	At school	Collaborating Comparing Listening	4 hours
Sorting out	Class activity	Classroom	Reading Writing Interpreting Guessing	10 hours
	Workshop	School computer lab	Selecting information Making connections Reporting Using IT	8 hours
Reflecting	Presentation	CNR	Performing Speaking	6 hours
	Evaluation		Assessing	

2.2.1 Tuning in

In the tuning in phase each class groups had a first informative meeting, in which:

- the whole project was presented and all its phases were communicated;
- the aims and purposes were shared;
- usable digital tools and programs were illustrated;
- structured materials to correctly use digital sources were provided;
- roles were assigned (administrator, editor, author, collaborator, subscriber);
- students' knowledge on migration and use of technologies was evaluated.

All students received a small handbook with guidelines for creating the final product, including: main links to institutional sites on the presence of migrants in Italy; suggestions on how to assess websites and sources reliability; main licenses for the use of images, videos, digital documents; open source sites to download books, images, audio and video files; open tools for creating videos, texts and images editing. Each group appointed two administrators for communication between their class and the external tutors and the administrators of the other two classes, and all the students were invited to share a Google Drive folder where collecting all working materials.

2.2.2 Finding out

The finding out phase is the true heart of the whole project. Each class had to visit a place of migration in Rome and to closely come in contact with migrants.

School A visited the editorial office of an online newspaper, which mainly deals with gathering testimonies, telling facts, events, parties of foreign communities living in a large area of Rome extending from the richest central districts, where foreigners mainly work in wealthy families, to the most peripheral and poor areas of the city. Students, playing the role of reporter, learned how a digital journal is structured and how to edit articles for publication.

School B visited a Special Reception Centre for adult migrants. Students, playing the role of researchers, followed a supposed legal migrants' path, from their landing in Italy to their integration in society; they learned about the main ways of welcoming migrants in our country and the main figures specialized in integration processes (lawyers, psychologists, social workers, cultural mediators, doctors, nurses).

School C visited a centre for unaccompanied minors run by the Catholic Church. This was maybe the strongest experience, because Italian students interacted with migrants of their own age and, despite their good intention, they clashed with many psychological, cultural and linguistic barriers. Specifically. they shared the care of the garden, one of the activities carried out by foreign young guests living in the centre, and played the role of storytellers.

The 3 groups of students met for the first time about a month after the beginning of the project, at the symbolic World Citizens Intercultural Library, where students themselves felt "foreigners among foreigners". The library has a wealth of over 20,000 books written in over 25 different languages and 1200 DVDs; it is located in a peripheral and problematic area of Rome, with a high density of foreigners. It was founded in 2010 in order to give foreigners the opportunity to read books in their own language and find materials in their culture of origin,

and to encourage the integration of foreigners present on the territory and to let Romans know about different cultures. During the meeting the administrators of the 3 groups shared the communication tools – email and WhatsApp – establishing a first coordination plan for the realization of the final product.

At this stage, migration experts and Philosophy scholars 'came out' from universities or research centres to enter schools and work close to students. A CNR researcher went to school A to illustrate the Italian translation of the *Glossary of terms Relating to Asylum and Migration* issued by the European Migration Network, in order to constitute a clear, correct and shared basic vocabulary to work (Cherubini *et al*. 2016). She also showed the results of the latest research about the presence of foreigners in Italy (numbers, main countries of origin). A first linguistic screening of the use of the term *Conflict* was carried out through the analysis of the articles published on the online journal that hosted the students during the last year.

An international legal studies researcher went to school B to deal with the main Italian and European regulations and laws on migration, as the Treaty of Dublin of 2013, the relocation and resettlement mechanisms, temporary measures in derogation to face sudden influxes of migrants. Students founded the legal bases of their "reception timeline", being able to devise the path of an imaginary migrant, starting with his/her leaving from his/her native country in Africa, until the inclusion in the Italian society.

A historian of ideas went to school C to retrace the concept of *border* and *territory* in classical philosophers, such as Leibniz and Hobbes, and in a contemporary philosopher such as Benhabib (2005). Students philosophically reflected on concepts related to *Border*, such as *territory*, *relationship*, *dialogue*, *acceptance*, *recognition* and *gift*.

2.2.3 Sorting out: Class and Computer lab activity

Teachers and students were encouraged to develop and integrate the philosophical curricula with research and simulated work environments. The activity was characterized by the centrality attributed to teachers and students (learner-centred), to their skills, interests and motivations. From a philosophical point of view, the schoolbook texts took on great relevance as objects to be analysed carefully, sources of information to be interpreted and as a communication tool. It was the operational phase of the project, where teachers and students' creativity emerged, their spirit of initiative and their (digital, but not only) skills were tested and exercised. The phase related to producing digital content to be published took place at

school computer labs. Students and teachers were assisted by CNR and SFI tutors for texts reviewing, editing and publishing.

The working group A studied the phenomenon of migrations starting from the theories of the anthropologist Claude Lévi-Strauss (1958) (curricular content), giving value to the theme of recognition and relationship with the other while outlining the migrant's figure. Reflections of XX Century philosophers as Emmanuel Levinas (1998), for his face theory, Jacques Derrida (1994), for the social value of friendship, and Axel Honneth (1995), for the theme of recognition, were considered as innovative content (see the online Ipertesto 2018).

Group B addressed the theme of acceptance and integration starting from analysing the concept of tolerance as it emerges in the curricular philosopher Voltaire, then linking the concept of tolerance to the right to freedom of movement, as theorized by Hannah Arendt (1968) (innovative content), and to peace as an ethical duty as expressed by Kant in 1795 (see the online Timeline 2018).

Group C described the journey of Hamza Ali, a 19-year-old Libyan boy who leaves his country to come to Italy, which is a realistic journey, but also a cultural and spiritual journey that each individual makes to build his/her own identity. In this project the students made Leibniz (1679), curricular content, 'talk' to Martin Buber (2004), Martha Nussbaum (2010) and Paul Ricoeur, as innovative content. (see the online Storytelling 2018).

2.2.4 Reflecting

The final product, a website dedicated to the issue of Philosophy and migration, was presented during a ceremony that took place at the CNR headquarters at the end of April. Each group illustrated its work, describing the path followed, explaining the choices made and the tools used, and had to reflect on its activity and on the others' performances, activating metacognitive mechanisms, fostering awareness and self-evaluation.

Moreover, on that occasion teachers and students completed the project evaluation questionnaire. Students generally assessed the experience positively (90%) and judged the relationships developed as stimulating (78%). They appreciated the possibility of working independently, and in group, meeting other students and people, communicating, visiting places out of school, using digital tools, although these presented some difficulties. The greatest difficulty they complained about was the short time available, the difficulty of integrating this project with ordinary school activities, not being a project shared by all

teachers. Also the teachers complained about the fact that the project was not embedded into the school programmed activity and curriculum.

However, teachers and students felt strongly engaged in the research and curricula innovation activities and were proud of having the opportunity to live this new experience, important for themselves and students and teachers who will use their website as an easy and reliable consultation tool.

2.3 Evaluation, modelling and dissemination

The project "Philosophy and Migrations designing, implementing and promoting digital cultural contents" wants to enhance innovation processes according to UNESCO *Global Citizenship Education. Topics and Learning Objectives* (UNESCO 2015) and to the Agenda 2030 for Sustainable Development, mainly Goal 4, target 4.7, concerning the "*promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development*" (ONU AGENDA 2015, 17).

The short-term tasks were: carrying out a teacher training course and an alternating training project for students on global citizenship topic. The evaluation of the project in its potential outcomes (medium-long term tasks), its modelling and dissemination is still ongoing.

The project aimed at opening research and innovation to values and needs of society as supposed by the Responsible Research and Innovation (RRI) framework. The whole project (both teachers training and students' activity) was learner-centred, based on participatory pedagogy and constructivist learning approach, while the innovation of curricular contents was set as a shared goal for different stakeholders: scholars, teachers, students and other social actors.

Teachers training aimed to encourage the re-examination, construction and development of teachers' professional identity and tools. It was based on a reflective, exploratory, developmental and entrepreneurial approach: each teacher-learner was involved in active participation, collaborative creation and evaluation of knowledge and activities. Teachers, who voluntarily accepted to participate to the project, were motivated and recognized the need to deepen their knowledge in aspects related to assessment, facilitation of learning, partnership, cultural awareness.

The work of documenting and narrating different elements of hospitality and cultural integration and the creation of a dedicated website aimed to develop students' higher-order thinking skills, including critical thinking, creative thinking and metacognitive, self-regulation,

affective and social skills, as also suggested by the EU Commission (2018). It aimed to promote the so-called *hard* skills in History and Philosophy as curricular disciplines, and enhance *soft* skills and foster multiculturalism as a fundamental value. Philosophy, which strongly characterizes non-vocational Italian schools, by its nature promotes reflection, argumentation, debate and comparison between ideas (critical and analytical thinking, synthesizing and problem-solving skills), and in this project with particular reference to ethical, political and economic issues. By designing, creating and promoting digital cultural contents, students (with teachers as facilitators) practiced (verbal and written) communication skills, team working (in coordination, cooperation, mediation, negotiation while producing contents), adaptability (being open-minded, self-confident, self-aware while carrying out the research work), creativity (inspiration, insight, questioning while processing texts and materials), interpersonal skills (empathy, patience, networking, public speaking to get the final goal), time management (in planning, focusing, organizing the work to do for the project considering the ordinary school activity).

The evaluation of the students activity was integrated into the curricular assessments already performed in schools; it concerned a) knowledge of migrations issues and of digitals tools, tested through structured interviews at the beginning of the activity and through the final website at the end of the activity; b) quality of participation in the activities, detected using observation grids; c) quality of the contents produced, related to the ability to express clearly and concisely concepts (the website contents represent a migration Portfolio); d) the ability to use properly digital tools; e) the ability to reflect on their learning experience, on the changes occurred to their knowledge and opinions about migrations, and to their digital competence, within the presentation of the digital products by each group during the project closing ceremony.

Students recognized the multicultural dimension of their lives and understood the interconnectedness and interdependency of different countries and populations; they showed a sense of empathy, solidarity and respect for differences and diversity; they grasped the importance of acting effectively and responsibly at local level for a more peaceful and sustainable world.

Evaluation the project outcomes in the medium and long term is not easy because only one class is going to be monitored in the next months, since the other two left school. Currently the working group is modelling the project so that it can be transferred to other territorial realities or other types of non-vocational and vocational schools, and flexibly adapted also to other

topics. Furthermore, the implementation of the website and the dissemination of the project are being carried out[5].

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CHAPTER 3

Embedding RRI in Higher Education curriculum. Lessons learned from evaluation of the EnRRICH project

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Abstract EnRRICH is a EU funded project on Enhancing Responsible Research and Innovation through Curricula in Higher education. Its main purpose is to improve the capacity of students and staff in higher education to develop knowledge skills and attitudes to support the embedding of RRI in curricula by means of a wide range of activities. After a brief introduction to the project, the paper shortly discusses the RRI methodology adopted for evaluating pilot activities to embed RRI in HE curriculum. The core of the paper presents main results emerging from evaluation research as to the following issues: students' and teachers' experience; planning and management of activities; institutionalisation of RRI in curriculum. The paper then discuss the main challenges to embedding RRI in Higher Education through curricula that were faced by EnRRICH consortium members. Emerging recommendations close the paper.

Keywords: *Responsible Research and Innovation, higher education, curriculum*

3.1 Introduction

EnRRICH is a EU funded project aimed at improving the capacity of students and staff in higher education to develop knowledge, skills and attitudes to support the embedding of Responsible Research and Innovation (RRI) in curricula by responding to the research needs of society as expressed by civil society organisations[6]. It has identified, developed, piloted and disseminated good practice and relevant resources to embed RRI in academic curricula across Europe based on multi stakeholder inputs.

Within the project, the author of this paper acted as coordinator of evaluation which was conceived to serve both formative and summative functions. This paper synthetically presents the main learning outcomes of formative evaluation and will thereafter point out some of the main challenges to embedding RRI in the curriculum. Its contents are also based on relevant

[6] The Enhancing Responsible Research and Innovation through Curricula in Higher education (EnRRICH) project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 665759. It ran from July 2015 to March 2018.

inputs emerging from summative evaluation, as well as upon discussion with relevant stakeholders[7].

3.2 Rationale and method

Formative evaluation of the EnRRICH project was based on a constructivist approach to evaluation research which aims at understanding the evaluees' experiences by incorporating different ways of building and sharing knowledge, along with diverse epistemologies and relevance criteria (Guba & Lincoln 1989). That approach has been considered consistent with the very nature and role of the evaluee (highly diversified as to operational contexts and courses of action to be observed) and the main objective of the evaluation exercise: formative evaluation (Scriven 1980 and 1991; MEANS 1999). The constructivist approach adopted in the evaluation exercise was declined in such a way as to ensure the highest consistency with RRI Process Requirements (PRs) as outlined by Kupper *et al.* (2015), i. e. diversity and inclusion, anticipation and reflection, responsiveness and adaptive change, openness and transparency.

The actual experience on the ground of EnRRICH Consortium members in piloting activities aimed at embedding RRI in Higher Education (HE) curriculum was the main object of evaluation. Data was therefore collected concerning 11 case studies, i. e. the work done by the EnRRICH Consortium members who piloted the embedding of RRI in their own institution[8]. In total 150 pilots were run, engaging 6016 students involved in 79 university courses, mainly at BA and MA level, throughout disciplines as varied as Architecture, Business, Design, Engineering, Environmental Studies, Geography, History, Sociology, Social Work, Sustainability, Tourism, Multidisciplinary. Overall, 231 Civil Society Organizations (CSOs) were involved in the planning and delivering of pilots. As it can be argued, the observed experiences were very different in context, content and form. Yet, they were

[7] Space constraints do not allow for an in-depth discussion of all issues connected to this paper. For details, see the following documents, both retrievable from the project's website (*www.enrrich.eu*). Deliverable D6.1 "Embedding and strengthening RRI in the curriculum through pilots and good practice exchange: what we have learned so far" presents an analytical examination of the empirical evidence supporting the claims made in this paper. Vast parts of this paper already appeared developed in greater detail in Deliverable D6.3 "Lessons learned and main recommendations emerging from evaluation activities of the EnRRICH project".

[8] More specifically, evaluation concerned pilot activities run at: Queens University Belfast (UK); University College Cork (IR); Dublin Institute of Technology (IR); Irsi Caixa (ES); Università di Sassari (IT); Université de Lyon (FR); Vrije Universiteit Brussel (BE); Universität Vechta (DE); Corvinus University of Budapest (HU); Vilnius College of Technologies and Design (LT); Wageningen University (NL).

homogeneous as to their objectives (RRI related) and approach (co-creative, participatory and oriented to the common good).

Evaluation criteria and procedures were identified to acknowledge such a diversity and were identified by means of direct involvement of primary stakeholders. An international workshop with 12 HE policy experts was organized to discuss approaches and methods for evaluating RRI embedding in HE curriculum along with connected policy issues. This consultation was paired by a more specific exercise aimed at identifying EnRRICH evaluation indicators by means of direct involvement of all project Consortium members, thus including both evaluators and evaluees. A brainstorming activity was organized to obtain a first draft of criteria which were thereafter brought together in homogeneous groups. Clusters were then prioritized by EnRRICH partners as to their relevance for process and results through use of scales of obliged priorities. Projection of results on a chart prompted new group discussion and led to an improved and better shared definition of criteria and clusters. Overall results were then confronted with relevant literature on RRI (see Vargiu 2018 for an in depth presentation and discussion) and informed the setting up of data collection instruments to be used by peer evaluators, such as grids for observation and document analysis and guides for interviews and focus groups.

Empirical evidence was collected though peer evaluation based on non-standard, in depth, research techniques such as unstructured and semi-structured interviews, focus groups, analysis of documents, participant observation. Interviewees and focus group participants were generally primary stakeholders, including people responsible for pilots, teachers, students and CSO members. Data collection on case studies was performed in two rounds in the first six months of 2017. At the end of first round, evaluees shared experiences and first thoughts and analysis, which informed second round of data collection. Evaluation reports on individual case studies were then collected to inform a draft report which was shared among evaluators and EnRRICH Consortium members. A new version of draft report was then shared with project's Advisory Board members for further comments and revision prior to public dissemination of results.

3.3 Main lessons emerging from EnRRICH formative evaluation

The following pages synthetically report on the main lessons learned from self-evaluation exercise. As said, observations concern a single experience; therefore, results cannot be generalized. Yet, they are hereby presented and shortly discussed with some reference to

relevant literature as they are deemed to provide useful insights to practitioners, decision makers and scholars interested in embedding responsible research concepts and practices in HE curriculum. Space limitations don't allow for a thorough presentation of empirical data supporting the claims made hereafter. As said above, data and analytical criteria are reported in the project's Deliverable D6.1.

3.3.1 Students and teaching

Responsibility is a rather abstract notion which has very relevant practical implications. Most pilots in the EnRRICH project therefore addressed the issue by directly engaging students in learning experiences based on community engagement and real-world situations. Thus, students were confronted with complex issues which implied making connections among different disciplines and engaging collaboratively while acquiring and mobilizing transversal competences. Some students were profoundly challenged as to their usual way of looking at things. This had two-folded implications: it was observed to reinforce the learning process and engender positive change, yet sometimes making some students uneasy as it pushed them out of their comfort zone. Community Based Learning (CBL) often allowed for power, conflict and inequality issues to be addressed and dealt with.

Students seemed to much appreciate Community Based Learning (CBL) and Community Based Research (CBR) experiences. Yet, the setting up of those kinds of learning situations is very demanding in terms of trust. They also require clear and fair agreements with community partners and ask for the creation of safe and equitable conditions for all actors involved. Pre-existing trust relationships showed crucial in that respect, along with relevant relational capacity often implying specific professional skills and competences. Furthermore, ensuring safe and equitable conditions along with a meaningful cooperative experience requires time, which is not always compatible with structure of courses and often strict and rigid academic schedules; pressure for students to rapidly gain credits contributes to the sharpening of that problem.

The time issue also concerns the combination of different time scales: the institution's, the students', the community partners'. Agenda management is a power issue and reciprocal adaptations among all parties involved is crucial to set up and maintain equitable partnership. Once again, excessive institutional rigidity can be counterproductive.

Real world issues need time to be dealt with effectively and community partners' expectations in that respect do not necessarily accord with the articulation of courses in

semesters or the like. Some EnRRICH partners successfully addressed that issue by breaking down a complex societal challenge or a long CBR programme into smaller learning units or teaching modules. This often implied substantial organizational efforts and complex arrangements which could not be dealt with by a single teacher and required ad hoc working units and dedicated operational capacity. Breaking down a complex societal issue or a long duration CBR project into smaller coordinated learning units, activities or tasks also enabled active involvement of students at different levels (BA, MA and PhD).

A way to ensure connections among different learning experiences and activities was seldom worked out by referring them to Grand Societal Challenges (GSCs) and Sustainable Development Goals (SDGs). Explicit reference to wide and yet well identified matters helped frame the problem-based approach and favoured connections between local experiences and global issues. This reinforced students' sense of effectiveness. That also favoured a pragmatic approach to the need to ensure dialogue and cross-fertilization across disciplines.

3.3.2 Planning and managing RRI in curriculum

The planning and managing strategies and solutions put in place by EnRRICH partners to embed RRI in the curriculum were very diverse. This very much depended on local norms and regulations, institutional and organizational frame, operational capacity. Nonetheless, a common pedagogical approach framed the different pilot experiences which is provided for by *The EnRRICH Tool for educators* (retrievable from project's website).

Despite diversity, some common features can also be identified to draw a general typology of strategies. A first differentiation can be drawn between what can be referred to as light and deep approaches. Broadly speaking, the first kind of approach normally implies involving larger numbers of students, for a short time in intensive experiences. Typical examples of this are activities like hackathons, which expose many students to an uncommon form of learning experiences while at the same time ensuring high visibility. As a general rule, a light approach activity doesn't leave much room for developing strong relationships with stakeholders and intense forms of public engagement nor does it allow for widely articulating the learning experience. Therefore, a light approach can be typically considered for a first exposure to RRI. In order to avoid disillusion and frustration among involved actors, one should be clear about the actual transformative potential of activities carried out through a light approach. On the other side, a deep approach involves small numbers of students or is limited to individual learning experiences. Such is the case of Science Shops projects. A deep approach often

implies nearly one-to-one teacher-student relationships. Since it enables a strong mutual engagement with community partners, a deep approach can produce relevant impacts on all involved stakeholders. Activities carried out with this approach are very resource intensive and normally lead to in depth impacts, yet on a limited number of stakeholders.

The choice between a light or a deep approach depends on contingent factors. In the EnRRICH experience the choice was observed to often vary in relation to the curriculum level. Since a light approach can be used for a first contact with engaged learning for large numbers of students, they are more fit for undergraduate students, whereas postgraduate courses normally allow for the adoption of deeper approaches. The actual viability of institutional arrangements, along with relevance assigned to community partners' demands and expectations played a significant role in determining whether a top-down or bottom-up approach was to be used in designing and managing learning experiences.

RRI PRs were usefully adopted in pilot as contents of the learning experience and were sometimes also incorporated in the planning and managing of the educational process. Normally, the taking up of bottom-up deep approaches was observed to imply a more significant application of RRI PRs rather than top-down light approaches. Again, it must be observed that intense use of PRs required more relevant resources, generally for the involvement of limited numbers of students and by means of strong community engagement. That was observed to be connected to relevant impacts on all actors involved (albeit in small numbers) along with shared sense of responsibility. Widely spread institutional pressure to involve large numbers of students and ensure high visibility of initiatives may hinder such an approach and eventually lead to less intensive adoption of PRs which typically imply the opposite as to use of resources and expected results and impacts.

3.3.3 Institutionalizing RRI in curriculum

Pilot activities were observed to be most impactful whereas they addressed persons, institution and community. Thus, strategies to institutionalize RRI in curriculum needed be based on such a tri-focused theory of change. Mobilization of human and structural facilities proved more successful whereas some contextual enablers were at work. Furthermore, building on the combination of universities' three missions – teaching, research and service – turned out to be a positive factor.

Theory of change based on emancipation of involved actors was observed to be successful. Emancipation and empowerment of actors lead to their autonomy which is associated with

responsibility. Students' autonomy was enhanced by emancipatory learning processes. And involved actors' empowerment through cooperation as well as effective impacts on people, community, institutions were observed to derive from equal partnership and mutual recognition.

Sustainability of actions and durability of impacts need certain system circumstances to be at work. In the light of the EnRRICH experience we defined such circumstances as "contextual enablers". A contextual enabler is for instance the possibility for combining and aligning. As said, the great variety of strategies to embed RRI in curriculum that was observed considerably depended upon actual context specific possibilities. Various factors could be mobilized by EnRRICH partners in order to work out their pilots. The actual possibility to *combine* such different factors was observed to be crucial for ensuring successful outcomes. The lower the possibility/ability to combine factors the harder it was to overcome difficulties. That observation can be connected to Kauffman's (2000) notion of "adjacent possible", which implies that strengthening combinatory potential favours innovation and triggers change opportunities.

Combinatory capacity was observed to increase in case of *alignment of favourable conditions*. For instance, a case was observed where alignment of national policies with institutional strategies and operational facilities and capacity enabled rapid progress and positive results. Furthermore, alignment among boundary spanners within same institution (see below) was observed to lead to positive fallouts.

Regulatory flexibility and stability also act as contextual enablers. Overruling, heavy bureaucratization and excessive formalization of procedures were observed to hamper combinatory capacity. Clear and simple regulatory systems allow for flexibility. Whereas their instability produces turbulent operational environments which hamper cooperation and do not allow for processes to work out to their full potential. Continuity was observed to be seriously endangered by regulatory instability.

Engagement and stakeholders' involvement are keys to RRI: time and high mobilization of human resources are required to build trust and equitable partnership among actors to cooperatively develop common objectives, procedures and results. Some EnRRICH partners worked out agreements or collaboration plans which were conceived to mutually engage partners beyond the life span of a specific activity or project to optimize resources and ensure sustainability and continuity. Examples of this kind of strategies are community-university consortia, joint ventures for the common good or project platforms. This kind of solutions

should be conceived in such a way as to tackle asymmetries amongst actors involved so to provide for weaker partners to have direct access to resources (funding, infrastructural facilities). This way power relations could be balanced in order to ensure equitable partnerships. A competitive environment doesn't seem as the best option for this to happen.

Incentives and support act as contextual enablers. It is a truism to state that the very existence of a project such as EnRRICH facilitated Consortium members in pursuing their objectives. In fact, EU funding provided economic resources, legitimation and credibility, along with policy and conceptual framework. This was observed to be sometimes crucial to overcome resistance to change and institutional inertia. On the other hand, excessively relying upon externally funded and time-bond projects may endanger effectiveness and continuity of initiatives. Thus, projects can facilitate, but institutional strategy and policy are needed to systematically foster the embedding of RRI.

RRI and engaged scholarship were observed to unequally apply to different disciplines and subjects. Yet, for all pilots structural support through specific facilities showed crucial. People involved in activities often came from diverse backgrounds, cultures, languages, and understanding of situations. They also bared diverse interests, needs and value frames. Thus, *expert knowledge brokering* and adequate operational/organizational infrastructure was necessary to support teachers in planning and managing involvement of stakeholders, as well as tutoring students involved in CBL/CBR activities. According to Ward, House & Hamer (2009) "Knowledge brokerage can reside in individuals or structures" which link users and producers of research and can eventually facilitate co-production of knowledge.

Science shops were observed to act as knowledge brokers while ensuring active involvement of different actors throughout the learning process by virtue of relevant relational expertise and capital. It was furthermore observed that long lasting and already existing trust relationships with CSOs and community partners were crucial to establishing equitable partnership. Science shops acted as "*boundary spanners*" insofar as they enabled structural and not occasional relationships "between an organization and its exchange partners" (Scott 1992) and can therefore be seen as a key element of strategies aimed at building community-campus sustainable connections (Bringle and Hatcher 2000).

Science shops can have a crucial role within a wider boundary spanning typology to ensure community-university partnership (Weerts and Sandmann 2010). According to EnRRICH evidence, the existence of a strategic and operational alignment among different boundary spanners at work within and around an institution is liable to ensure best results. In fact,

boundary spanners are decisive in building bridges among organizations as well as within organizations (Meza-Guarneros and Martins 2016; Sinclair 2017). In the EnRRICH case, Science shops were observed to play such a role as they favoured inter as well intra-organizational cooperation.

Like any other structural facility, boundary spanners have an organizational life-cycle. Strategic development, sustainability and continuity of initiatives can be approached and pursued in very different ways depending on the specific phase of an organization's life-cycle. This was observed to be the case for new and more established Science shops. Furthermore, the organization's life-cycle often comes across with the personal and/or professional life-cycle of the people that work in those organizations: this is a factor of acute fragility in structures like public engagement units or Science shops which can often count on a limited quantity of human resources. Hence, the need for institutions and organizations to systematically address recruiting, training and team building as core strategic activities to strengthen such kinds of units.

Structural solidity intersects motivation of people involved in activities. Different actors participate depending on their specific interests which must be appreciated and appropriately dealt with. Community partners, as well as students, researchers and teachers were observed to be generally interested in the emancipatory nature of activities. Thus, interest and consequent degree of participation was observed to be mainly value driven. Practical and instrumental motivations were also relevant, yet to a minor extent.

Those observations are consistent with evidence discussed in literature on drivers for engaged scholarship. O'Meara (2008) observed that engaged scholarship is mainly driven by personal, intrinsic motivation connected with the desire to promote students' growth, consolidate personal and professional identity and foster personal commitment to social issues, places and people. Likewise, Colbeck and Weaver (2008: 16) affirm that "the overwhelming majority of goals" driving engaged scholars "were easily categorized as integrative social relationship goals, which serve to maintain or promote other people or social groups". Those personal drivers interplay with other individual features: "senior researchers are three to four times more likely to engage with the public than their juniors; and those who do mainly research are 55 per cent less likely to engage the public than those who do research and also teach" (Bauer and Jensen 2011: 6). Seniority as a robust predictor of engagement and engagement intensity is confirmed by Boltanski and Maldidier (1970), whereas no significant association between engagement and academic career success rates or scientific productivity

has been observed (Jensen 2011). EnRRICH evidence also shows that structural factors and organizational support play a major role in maximising or inhibiting individual drivers. Which is consistent with O' Meara (2008), Colbeck and Weaver (2008) and Entradas and Bauer (2017).

Therefore, it can be concluded that incentives are needed to promote engagement, notably among early stage researchers/teachers, so to foster a more widespread up take of RRI in both research and teaching. Yet, a strategically crucial factor was observed to be provisions and facilities that support engaged teaching and research practices, and thus back up individual motivation.

Such is the role of knowledge brokerage and boundary spanning staff who need to be equipped with specific competences: a kind of skills which were observed to be crucial for EnRRICH pilots. Most relevant competences are connected with the role of the boundary spanner as "network manager" which implies "the importance of building effective personal relationships with a wide range of other actors; the ability to manage in non-hierarchical decision environments through negotiation and brokering; and performing the role of 'policy entrepreneur' to connect problems to solutions, and mobilize resources and effort in the search for successful outcomes" (Williams 2002: 121).

That kind of skills are generally not required from researchers/teachers: rather, they identify a specific professional profile which institutions and organizations might think worth investing upon by setting job appointments based on a well-defined job description, attached to specific training and career tracks.

3.4 Main challenges and concluding remarks

Main challenges to embedding RRI in Higher Education through curricula were faced by EnRRICH Consortium members and others were observed, notably through activities run in WP5 on policy. They were pointed out along with recommendations in the above-mentioned report (Deliverable D6.3 of the EnRRICH project). Some of them can be hereby schematically recalled.

A competitive and turbulent environment does not favour the general up-taking of RRI by universities. Growing pressure for so called "measurable" productivity of teaching and research also plays a negative role. Likewise, instability of regulations, norms, institutional and organizational infrastructure endangers continuity of initiatives that often rely on a delicate equilibrium.

In fact, public engagement units are often very fragile, because of both internal and external factors. Internal fragility factors are connected to size of units which rely upon small numbers of highly skilled and motivated personnel. External fragility factors depend on all the above as well as upon power struggles and unbalances within universities.

Equal partnership with community stakeholders is often hard to reach and needs to be systematically addressed through well-defined and strategically oriented modes of action.

A more widespread reference than in the past to RRI and related concepts and practices is observed both among researchers and institutions as well as in policies. Yet, a more widespread RRI culture still needs to gain momentum. The emergence of new terms and concepts in theory and policies may not favour the needed sedimentation.

RRI and engaged research and teaching are still far from becoming mainstream, rather, they are pursued and practiced by a small minority. Specific policies, notably at European level, are still strongly needed. In that respect, the very existence of the SWAFS – Science With and For Society unit within DG Research has shown crucial and will still be.

Acknowledgements. The author would like to thank all EnRRICH partners that acted as peer evaluators and evaluees, along with their colleagues, students, CSOs and other stakeholders that were willing to take part in this mutual learning exercise. Special thanks go to EnRRICH Advisory Board members who provided insightful comments and precious suggestions on previous versions of this text.

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Chapter 4

Building key competences in Alternating Training for knowledgeable and reflexive citizens

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This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Abstract This study aims at detecting and enacting core key competences for students' Alternating Training scenarios by means of a reflexive Living Lab approach tested at school under the Responsible Research and Innovation framework, with reference to the system of key competences defined by EU in 2018. We focus on the implementation of Teacher and Student Living Labs, that took place in Greece, Italy and Spain during the experimentation phase of the DESCI (Developing Skills for Creativity and Innovation) project. The variety of connections between the key competences enabled and the participatory methodologies adopted is presented and debated.

Keywords: Key Competences; Responsible Research and Innovation; Living Lab; Alternating Training; Participatory methodologies

4.1 Introduction

This study started from the 3-years Erasmus Plus project DESCI, aimed at developing a methodological pattern for Alternating Training (AT) in secondary school systems centered on Living Lab (LL) environment as defined by Bergvall *et al.* (2009). The novelty introduced by DESCI approach is the application of the LL, traditionally linked to industrial and technological innovation outcomes, to the educational context. In the DESCI LLs "the students develop deliveries of social utility under the mentorship of research bodies, associations and enterprises" (Valente *et al.* 2018). By this way the Responsible Research and

Innovation (RRI) perspective to social and technological innovation seep in the school systems improving the connection between school, research, enterprise and territory; indeed, according to Owen (Stilgoe, Owen, Macnaghten 2013), responsible innovation means taking care of the future through an inclusive process and collective management of science and innovation in the present (Von Schomberg 2011), considering that formal education, as well as informal and non formal, are key issue for taking care of individual and collective future.

Thus, the school becomes a co-working space for the local community, by which students, guided by researchers, entrepreneurs and other social actors, can develop, in a LL environment, innovative ideas that are socially, ecologically and economically sustainable. This approach allows to take AT as a chance to strongly increase the capability of the students and of the school system, to take part – responsibly – in decision-making processes, becoming "knowledgeable" – as outlined by Sheila Jasanoff (Jasanoff S. 2011) – and "reflexive" actors – as learnt from Social Practice Theories (Hasselkuss, Naedeker, Liedtke 2017).

Starting from the main DESCI outcomes, this study aims at identifying a common set of key competences fostered by DESCI approach to AT, embedding RRI dimensions and functional to "personal fulfilment, active citizenship, social cohesion and employability in a knowledge society" (European Commission 2006), as stated with reference to the key competences defined by EU Commission in 2018 (European Commission 2018).

4.2 The LL at school from a linear to a circular model

Introducing RRI strategies in the educational context, while facing with social and sustainable innovation issues, entails to deal with the complexity of the real world and interlinked problems, which do not have 'one' solution (Witteveen *et al.* 2016). While dealing with the change of perspective mentioned above, the school system needs to design new possible learning paths that allow students to achieve the needed competences, based on new learning milieu.

Facing this issue, DESCI project proposes the LL as a central learning environment in AT paths for achieving these competences. Two different levels of LL environment (both centred around schools) are promoted by DESCI:

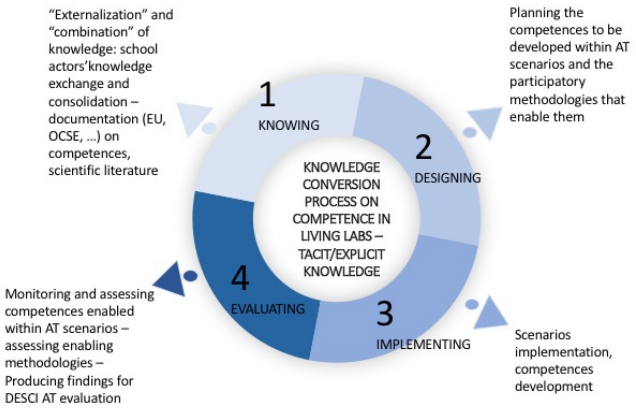
- Teachers' Living Lab (TLL): activated by teachers in order to plan competences to be activated, implement/evaluate scenarios for AT, propose methodologies, monitor the whole AT process;

- Students' Living Lab (SLL): activated by students in order to develop innovative research/industrial deliveries within AT projects and contribute in monitoring/evaluating the AT process. The SLL may integrate competences, scenarios and methodologies designed within the TLL.

Within these two LLs, actors operate at different levels of responsibility. Both LLs represent open, inclusive and multidisciplinary environments including teachers and students – with different roles, being teachers responsible for TLL and students responsible for SLL –, but also researchers, enterprises, professionals, NGOs, makers, civil society, policy makers, relatives, depending on the specific focus of the AT scenario.

Within the DESCI participatory process, TLL and SLL followed four main steps of work that refer to the four phases of the DESCI cycle: Knowing, Designing, Implementing and Evaluating. In this process, in line with the LL approach, actors played their own role (Ståhlbröst, Hols 2013), with no established authority imposing ideas before the individuals had the chance to explicit and share their own knowledge (Mayer, Valente 2009), so contributing to the collective process of knowledge creation and conversion (Polanyi 1969).

Fig. 4.1 The main stages of competences detection and management in the four DESCI phases



In Fig. 4.1 the main stages of competences detection and management in the four DESCI AT phases are described:

KNOWING PHASE: in this phase the TLL collects data on AT scientific and regulatory frameworks, on AT projects already realized, on potential partners and on the findings emerged from their evaluation of previous AT experiences.

DESIGN PHASE: within the TLL, teachers, tutors and students, in interaction with the stakeholders involved, design AT scenarios by means of a competence-based design, focused on "observable skills" (Boritz, Carnaghan 2017). In this phase:

- TLL participants detect the AT scenario selected at class/multi-class level, coherently with what stated in regulations at National and school level;
- TLL participants design and validate the AT scenario, identifying the core elements of the process that students will follow, such as:
  - target skills and competences;
  - teaching/learning methodologies, pointing out those that could support both competences development and students' activities within the SLL;
  - learning activities;
- TLL participants debate and select – by means of working/negotiating tables – the main subject, the specific competences and key competences to be integrated into the AT educational path. During the DESCI testing phase, aimed at field testing the DESCI approach in a school contest, four out of the eight wide areas of key competences listed in the EU reference framework were selected to be enhanced: "Digital competence"; "Personal, social and learning competence"; "Citizenship competence"; "Entrepreneurship competence".

IMPLEMENTING PHASE: in the framework of SLL, students implement the scenario designed by the TLL:

- detecting needs of the reference territory/context;
- developing innovative deliveries on the basis of needs detected;
- contributing to the evaluation of the outputs/deliveries produced.

In this process students can involve, by means of the SLL, actors like researchers, enterprises, citizens, civil society.

At the same time, TLL supervises the implemented AT scenarios and educational paths.

EVALUATING PHASE: the evaluation and monitoring process is an integral and substantive part of the DESCI model, realized from a bottom-up approach; the central

structure in the evaluation process is the TLL and each member covers a specific role. The process includes two different levels:

- LEVEL 1 – Students' evaluation: it provides the evaluation of competences (transversal and professional) to be acquired by students, according to the TLL, during the AT realized under the DESCI approach. DESCI adopts a structured evaluation system, merging it with the school formal evaluation of the student: the AT evaluation process is based on a qualitative approach that includes the use of rubrics, questionnaires and focus groups, and integrates the evaluation of the student's performances and learning process (endogenous evaluation) with the evaluation of the effectiveness and adequacy of the deliveries generated by students during the AT experience (exogenous evaluation). While building the DESCI model, specific evaluation tools were developed by means of a participatory process that involved the TLL members with different roles: teachers, tutors and students field-tested the DESCI evaluation process and related tools during two school years; consortium researchers, teachers and tutors improved it, on the basis of the outputs emerged from the field-testing. The active involvement of the members of the TLL in the evaluation process was promoted through different ways:
  - rubrics: teachers and school tutors evaluated student performances;
  - focus groups: external tutors evaluated the adequacy of the delivery generated compared to the needs detected in the social context/community;
  - questionnaires, gave the students the opportunity to self-evaluate their performances and delivery produced and reflect on their own learning.
- LEVEL 2 – Evaluation of the DESCI approach, on which the present work is based. The ongoing evaluation process, managed by Polibienestar-University of Valencia and CNR, was aimed at detecting the adequacy and effectiveness of the DESCI model:
  - in promoting the development, in the students involved, of DESCI target key competences with reference to the following key competences among those identified by the EU Commission (European Commission 2006 and 2018): 1. "Digital competence", 2. "Personal social and learning competence", 3. "Citizenship competence", 4. "Entrepreneurship competence". In this case, both the competences enabled in the students involved and the methodologies adopted to promote target competences were detected (*ex ante, in itinere* and *ex post*) as indicators of the DESCI adequacy in;

- in promoting a participative and inclusive approach to AT. The focus is on the different stakeholders involved in each phase of the DESCI process, on their active role and on the ways to promote inclusion and engagement, detecting:

- the methodologies applied to promote participation, in different contexts and scenarios;
- the possible existing connections between competences promoted and methodologies applied.

This evaluation level is actualized by a qualitative approach within the TLL, involving all members (consortium researchers, teachers, external AT tutors and students) by means of:

- targeted questionnaires (*ex ante* and *ex post*) for students, teachers and tutors to detect the self-perception of the effectiveness of DESCI AT paths in promoting DESCI target competences;

- a template for assessing and monitoring participatory methodologies adopted during the two-year testing phase, with reference to
- AT scenarios and paths implemented;
- accomplishing target competences, as emerging from the rubrics in the framework of students' evaluation (a target competence is taken into consideration when it is detected in the course of the evaluation of students involved in the AT paths by means of the rubrics);
- LL of reference (SLL/TLL);
- actors involved;
- limits emerged;

- focus groups promoted to foster a debate between students, teachers and tutors on competences detected by means of rubrics (evaluation – Level 1) and their connection with the methodologies adopted in the reference AT path.

The emerged data/outputs were systematized and analysed by researchers. The resulting Monitoring and Assessment Reports:

- was debated within the widened community of school stakeholders by means of DESCI World Cafés sessions;

- represents a guideline adopted in revising DESCI approach and tools: the outputs emerged in this second evaluation level was used to revise and improve the tentative version of DESCI tools.

4.3 Results – Target competences at school for a reflexive LL under the RRI approach

In order to determine the effectiveness of the DESCI approach to the AT in promoting target key competences and validate the DESCI tools, two testing phases, one per year, were planned (2016-2017/2017-2018) in the three Country partner schools (1st Experimental School of Athens – Greece, ITS E. Fermi in Frascati – Italy and Centro de Formacion Somorrostro – Spain), involving all the main stakeholders related to AT and following a RRI process. The focus on key competences promoted during the two testing years – and considered while designing the AT scenarios within the TLLs – started from and refers to the "Recommendations on key competences for lifelong learning" promoted by the EU Commission in 2006 (European Commission 2006) and included in the OECD document on 21st Century Skills and Competences for New Millennium Learners in OECD Countries (Ananiadou, Claro 2009). However, throughout the project life, a revision process of the 2006 Key competences took place and in 2018 the EU Commission published the new Recommendation (European Commission 2006) that was taken into account as well.

On this basis, during the DESCI testing phase, TLL dealt with planning the competences to be enabled and the methodologies to identify and evaluate them, moving from:

- a common framework on skills and competences (EU Commission recommendation on Key competences 2006/2018, ESCO database https://ec.europa.eu/esco/portal/alphabeticalBrowser)
- a common template for planning the AT scenarios, designed by Consortium researchers and revised by the members of the TLL, focused on "competence-based design".
- DESCI ongoing outputs, among which DESCI Virtual Library, that includes main tools and methodologies, publicly available online, for co-learning and participation, to inspire LLs. The virtual library has been enriched with the inputs of the TLLs.

The core of the DESCI experimental phase took place in the 2nd school year 2017-2018. At least 60 students per experimental school in Spain, Italy and Greece were involved in the

evaluation, for a total of 200 students. In Greece, a gymnasium was involved (students' age 12/13) and four interlinked AT scenarios were implemented: "Gastronomy Business Club", aimed at putting the students in contact with the professional field and the production-business process; "Math Club", in which students created products related to mathematics, educational and logic games; "ICT Club" aimed at developing Android applications; "Virtual enterprises", that enhanced business plans to put products developed by the school Clubs on the market. In Italy the DESCI approach was tested in a Technical School (students' age 16/17) and two scenarios were implemented: "Tech-Care", for designing a home automation system based on elderly citizens' needs; "Environmental monitoring", for designing a system to evaluate environmental parameters. Finally, in Spain a professional school was involved (students' age between 18/30), in which students developed technical solutions for "Electricity grid failure simulator trainer". Per each scenario, on the basis of a top-down and bottom-up approach – according to the Grounded Theory principles (Corley 2015) – participatory methodologies considered as able to foster some of the key competences ("Digital competence", "Personal social and learning competence", "Citizenship competence", "Entrepreneurship competence") were selected by the TLL and SLL. The target key competences supposed to be fostered by the scenarios were assessed within the TLL, following the evaluation process described in the previous paragraph. The main results from the assessment of the key competences are represented in Table 4.1.

The first column includes the four wide areas of Key competences, considered by the LLs relevant for planning AT scenarios in a top-down process. The second column shows the list of participatory methodologies used by the LLs to contribute to fostering the transversal competences linked to the four wide areas. The third column shows the transversal competences actually enacted during DESCI experimental phase, as registered in the LLs. The fourth column presents a list of the specific competences from EU 2018 that matches the transversal competences enacted during DESCI experimental phase.

Table 4.1 Main EU key competences emerged in DESCI experimentation phase linked to the referral EU Key Competences and enabling methodologies.

Wide areas of Key Competences from EU 2018	Participatory methodologies used by LLs to contribute to fostering transversal competences	Transversal competences enacted during DESCI experimental phase in the countries involved	Specific competences from the 4 wide areas of Key Competences EU 2018*
Digital competences	**GREECE** cooperative learning role playing flipped classroom laboratory sessions (including Inquiry-Based Learning/hands on) metaplan **SPAIN** ethazi **ITALY** web inquiry	**GREECE** 1. digital content creation 2. digital communication and collaboration **SPAIN** 3. security 4. contents creation 5. treatment of the information 6. communication 7. problem-solving **ITALY** 8. Evaluation skills related to critical selection of information	• information and data literacy (SP) 5 • communication and collaboration (GR- SP-IT) 2,6,8 • digital content creation (SP-GR) 1,4 • safety (including digital well-being and competences related to cybersecurity) (GR-SP) 1,3 • problem solving (SP) 7
Personal, social and learning competences	**GREECE** cooperative learning brainstorming role playing flipped classroom laboratory sessions (including Inquiry-Based Learning/hands on) metaplan **SPAIN** ethazi **ITALY** interview metaplan web inquiry round table brainstorming/round table design thinking	**GREECE** 1. managing time 2. showing responsibility in accomplishing with assigned tasks 3. making decisions 4. using appropriate language 5. presenting arguments persuasively 6. addressing an audience 7. thinking creatively **SPAIN** 8. oral communication 9. written communication 10. autonomy in accomplishing with assigned tasks 11. team-work 12. problem-solving 13. decision-making **ITALY** 14. showing responsibility in accomplishing with assigned tasks	• effectively manage time and information (GR- IT) 1,15 • problem-solving attitude/cope with uncertainty and complexity (GR-IT) 7,22 • responsibility for their own learning (GR-IT) 2,14,21 • critically reflect and make decisions (GR-SP-IT) 3,12, 13,19,22 • communicate constructively in different environments (GR- SP-IT) 4,5,6,8,9, 16,18 • Ability to work both collaboratively and autonomously (SP-IT) 10,17 • autonomous learning (SP-IT) 10 • Ability in problem solving (SP–IT) 12,20 • conflict resolution (IT-GR-SP) 11

		15. managing time 16. use of an appropriate language 17. autonomy in accomplishing with assigned tasks 18. verbal communication 19. making decisions 20. problem-solving skills 21. sense of responsibility 22. thinking creatively and fluidly	
Citizenship competences competences	**GREECE** cooperative learning brainstorming role playing laboratory sessions (including Inquiry-Based Learning/hands on) metaplan **ITALY** Interview brainstorming/Round table	**GREECE** 1. interacting with others in carrying on interviews **ITALY** 2. Sense of responsibility in carrying on interviews 3. Interacting with others 4. AT scenarios oriented to grandparents needs (taking care)	• act as responsible citizens (GR-IT) 1,2 • to engage effectively with others (SP-IT) 1,3 • sustainable issues in producing AT deliverables (IT) 4
Entrepreneurship competences	**GREECE** cooperative learning brainstorming role playing laboratory sessions (including Inquiry-Based Learning/hands on) metaplan **SPAIN** ethazi **ITALY** Web inquiry Round table	**GREECE** 1. working in teams 2. attending to quality 3. meeting commitments 4. following work schedule 5. attending to detail 6. thinking creatively **SPAIN** 7. Enterprise/innovation 8. initiatives 9. performing interview 10. team work **ITALY** 11. doing interviews 12. designing skills 13. thinking creatively and fluidly 14. team work	• act upon opportunities and ideas and transform into values for others (GR-SP-IT) 7,8,10 • creative process and innovation (GR-SP- IT) 6,7,12 • planning and management of projects (GR-SP-IT) 2,4,5,11 • taking initiative and perseverance (GR) 3 • team working (GR-SP-IT) 1, 9,13,14 • turning ideas into action (GR) 7

*The numbers in Column 4 correspond to the numbers in Column 3

From Table 4.1 we can see that the key competence area that enacted a high variety of specific competences is “Personal, social and learning competence”, that, dealing with the “ability to reflect upon oneself, effectively manage time and information, work with others in a constructive way, remain resilient and manage one's own learning and career” (European Commission 2018), also represents a fundamental milestone on which other competences are based. Among the enacted competences, those variously connected with creativity and innovation are the core ones in DESCI approach: we find most of them in “Personal, social and learning competence”, and in “Entrepreneurship competence”. Also “Digital competence” addresses to competences that are indispensable to act in our societies as knowledgeable citizens (critical evaluation of information, data security and communication/collaboration). Finally, specific competences in “Citizenship” were developed, including attitudes that are crucial to act as responsible citizens, which is directly connected to RRI. In Table 1the methodologies that mostly enabled the development of the described competences are listed as well. In this context we keep the word “methodology” as an umbrella term to include all the participatory methodologies, tools and approaches collected by the LLs. Finally, the key competences developed in DESCI LLs can be connected to the above mentioned RRI dimensions.

Anticipation & reflection: evaluation skills related to critical selection of information; critically reflecting and making decisions; coping with uncertainty and complexity; acting upon opportunities and ideas; being connected to creativity;

Diversity & inclusion: responsibility and inclusiveness in contents creation; expressing and understanding different viewpoints, managing conflict; engaging effectively with others, constructive participation in group activities;

Responsiveness & adaptive change: critical and responsible use of digital technologies for learning & at work; remaining resilient, coping with uncertainty and complexity; awareness of sustainable issues in producing AT deliverables; creativity in change, critical thinking and problem solving;

Openness & transparency: managing security issues; working with others in a constructive way, communication competences; critical thinking skills

This connection confirms the strict relationship between LL approach and the RRI frame.

4.4 Conclusions

This study proposes an open and responsible approach to apply the LL environment in the educational field of AT that promotes key competences, needed to allow students to increase their employability and express themselves, acting consciously in the system and driving innovation and social inclusion in their communities.

The DESCI field-testing pointed out that the implementation of DESCI approach in AT paths allows individuals (students and teachers) and schools to develop a variety of key competences that include creativity and innovation issues, still keeping grounded to "reflexivity" and "knowledgeability", by means of citizenship and social specific competences.

The development of key competences was linked to the participatory methodologies adopted. The autonomy of LLs to select, plan and implement methodologies and variously combine them allowed to reach relevant results in terms of enacting target key competences, beyond Countries' and schools' differences in opportunities and regulations. The present study also acknowledges the strict relationship between the LL approach and the RRI frame. Competences developed within the LLs fostered the accomplishment of RRI dimensions, by means of processes of knowledge conversion and co-creation of knowledge.

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CHAPTER 5

Collaborative Learning Recommendations for Continuing Medical Education in Virtual Learning Environments

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Abstract This project focuses on giving meaningful recommendations for students who are already Health Professionals, in the context of Continuing Medical Education (CME). CME helps those in the medical field that are seeking for continuing and further education for professional and personal enrichment to maintain competence and learn about new and developing areas in their field. The aim of the recommendations is to help students in finding appropriate educational resources to improve their learning experience and academic results. Based on the evaluation of educational resources and information about their interrelations and collaborations, several specific recommendation algorithms have been proposed, implemented and tested during a short period of time. Finally, student feedback was collected to evaluate the recommendation process. Regarding the short period of testing and the percentages of users that gave positive feedback, it is possible to conclude that personalized recommendations are useful to students improving their user experience, learning processes and stimulating further collaboration. – Collaborative Learning Recommendations for Continuing Medical Education in Virtual Learning Environments

Keywords: Recommender Systems; Collaborative Recommendations; Virtual Learning Environments

5.1 Introduction

EviMed[9] is a company based in Uruguay which offers CME courses through its virtual learning platform called *redEMC* for thousands of health professionals working in over thirty countries all over the world. Recommender systems use collaborative strategies to generate personalized recommendations of items such as *crowdsourcing*, which uses the wisdom of the crowds to solve problems relying on collaborations from volunteer participants (Surowiecki 2004), and *friendsourcing*, which is a type of crowdsourcing that uses more specific information generated by groups of socially-connected users (Bernstein *et al*. 2010). The objectives of the recommender system for redEMC are to assist users in their learning processes while interacting with large volumes of educational items and to help students enroll in new courses, which members of their academic network consider useful to achieve a more extensive training in the medical field. These objectives are set to offer students a better user

[9] URL https://evimed.net.

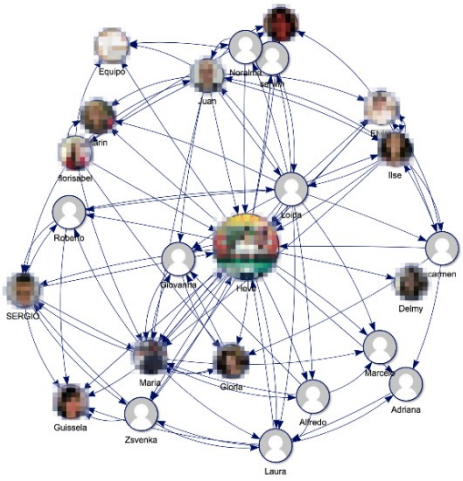
experience, which leads to greater satisfaction. From the point of view of EviMed, this allows a general growth in the enrollment of students. From the meetings with the company, it was determined that the recommender system should offer academic recommendations of *resources*, which include text and videos; *activities*, which include discussion forums, group activities, tests, among others; and *comments* from the different discussion forums. The recommender system calculates for each student the relevance of items, based on the evaluations of other colleagues, particularly those belonging to their academic network. It is also desired to provide recommendations of relevant comments published by other students or teachers so that the users can be aware of those interesting exchanges that have arisen from the discussion forums. Finally, the system aims to provide commercial recommendations of courses to students, which are of interest to colleagues in their network and can eventually be of interest to the students. Usually, the number of courses to recommend is small and there may be a small number of enrolled students. Therefore, there might not be enough information to extract from the network to generate the recommendations. Hence, the use of demographic data is proposed to characterize the preferences of students in their regions. These recommendations are planned to be made a few days before the beginning of the courses and could appear when the users log in to the system or in the daily emails that the system sends to the users. An important requirement is that the recommender system explains to the users the criteria used to generate the recommendations of resources, activities, comments and courses. This makes the system transparent to the users, having knowledge of the factors that determined the recommendations.

5.2 Collaborative Approach

The active role of students makes the recommendations possible and meaningful. Students participate deliberately and collaboratively in several ways once they are enrolled in a course offered by redEMC. For starters, they create and maintain their academic and social network of colleagues which will provide the basis for the friendsourcing strategy used whenever possible. Students must do a sequence of mandatory activities in each of the modules of the course. As the course progresses, users have the possibility to evaluate resources and activities in the form of ratings from 1 to 5 stars. The evaluations of items made by colleagues in their academic network, as well as the average evaluation value given by the users enrolled in the course, are used to generate the recommendations of resources and activities. Users also have the possibility to express that they “like” those comments in the discussion forums that are of

interest to them. The number of likes as well as the number of views of the comments, are used to generate the recommendations of comments. The interest of users regarding the courses offered by the virtual learning platform is given by the number of enrollments. At the initial stage, students were notified that their collaborations by evaluating items would improve the recommendation process for all students participating in the course. Students receive personalized recommendations and intentionally give feedback about their usefulness which are used to evaluate the recommendation algorithms, and in the future, will be used to adjust the parameters to enhance the recommendations. Figure 5.1 shows the social network of a student who enrolled in a specific course in redEMC. For privacy reasons, the images of the users were altered.

Fig. 5.1 Social network of a student in redEMC.



From the point of view of the Responsible Research and Innovation (RRI) framework (European Commission 2018), the actors involved in the research and innovation process are: *students*, who are benefited by the assistance of the recommendations in their learning processes; *teachers*, whose students will have access to educational resources that fulfil their needs; *developers*, who implement the recommender system; and *researchers*, who work together with the rest of the actors to understand the needs of the students and teachers and design the recommendation algorithms. The objective of using the RRI approach is to give additional value to the virtual learning platform taking advantage of the social interactions between users in the form of creating and maintaining their academic network, evaluating educational resources, and giving feedback about the recommendations. To align the outcome

of the recommender system with user needs, student feedback is collected and analyzed to evaluate its performance.

5.3 Recommendation Algorithms

Based on the requirements, it is intended to distinguish between recommendations of items of three different types: resources/activities, comments and courses. Hence, three recommendation algorithms are proposed; one that recommends resources and activities; another that recommends comments; and the other that recommends courses. To generate the recommendations of resources and activities of the different modules of a course, the evaluations made by colleagues in their academic network are used as well as the average evaluation value given by users enrolled in the course. In a previous research project (González *et al*. 2015), the parameter λ was used as an acceptance threshold to guarantee that the recommended items have a certain quality. In addition, it is desirable that a recommended item has a minimum number of evaluations. For that purpose, the parameter σ is defined as the minimum value of accepted evaluations. Regarding the domain of these parameters, the following applies: $0.0 \leq \lambda \leq 5.0 \wedge 0 \leq \sigma$. Defining the parameters in this way allows greater flexibility, because any of these factors can be disregarded by assigning zero to the corresponding parameter. A resource or activity is defined as a *candidate resource* to be recommended, if its average evaluation value is greater than or equal to λ, its number of evaluations is greater than or equal to σ, and the current user u, who is the student that will receive the personalized recommendations, has not viewed it. The initial parameters could be defined by an administrator and adjusted once the system is put into production. A comment is defined as a *candidate comment*, if its number of likes is greater than or equal to the minimum value of likes given by the parameter φ and its number of views is greater than or equal to the minimum value of views θ. Regarding the domain of these parameters, the following applies: $0 \leq \varphi \wedge 0 \leq \theta$. The initial values given to these parameters could also be defined by an administrator. To increase the quality of the recommendations of comments, we consider those relevant comments that have been recently published in a discussion forum. For that purpose, the publication time is used. A course is defined as a *candidate course*, if the current user has not enrolled in it. For simplicity, only one-hop relationships are considered to generate meaningful recommendations. RedEMC distinguishes three levels of relevance in user relationships which define three set of users: $N_1(u)$ = high, $N_2(u)$ = medium, and $N_3(u)$ = low. If a user v belongs to $N_1(u)$, then u knows v and v knows u. If a user v belongs to $N_2(u)$, then u

knows *v*. If a user *v* belongs to $N_3(u)$, then neither *u* nor *v* explicitly stated that they know each other, but they have some other connection: they enrolled in the course together, made a group activity together, or are Google contacts. These sets will be used to trace the origin of the recommendations, to describe the criteria used to generate the recommendations, and to improve the collaborative process from the RRI approach.

5.3.1 Recommendation Algorithm of Resources and Activities

The recommendation algorithm of resources and activities is a hybrid algorithm that uses friendsourcing and crowdsourcing approaches. The input data of the function *getRecommendationsRA* are: the current user *u*; the course *c*; the subtype *s* of the item to be recommended (resource or activity); the number of modules backwards *nmod*, whose resources or activities will be recommended; the parameters λ and σ; the maximum number *n* of items to recommend using friendsourcing; and the maximum number *m* of items to recommend using crowdsourcing. In order to apply a friendsourcing technique, it is necessary to obtain the sets of users $N_1(u)$, $N_2(u)$ and $N_3(u)$. Then, the current module *cmod* is calculated from the course *c* and the current system date. Four ordered lists L_1, L_2, L_3, L_4 are defined, which associate a relevance value with a certain item. L_1 contains pairs (item, relevance value) that are obtained by calling the function *getFriendsourcingRA* (*u*, *c*, *s*, *cmod*, *nmod*, λ, σ, $N_1(u)$). Next, the implementation of that function is explained. Initially, an ordered list *L* of pairs (item, relevance value) is defined. For each user *v* of the set $N_1(u)$, the candidate items of subtype *s* belonging to the current module and to *nmod* previous modules of the course *c*, which were evaluated by that user, are taken. For each of these items, the relevance value is calculated and then the pair is added to *L*. Some standard similarity metrics present drawbacks. In particular, cosine similarity does not take into consideration the difference in rating scale between different users (Sarwar *et al*. 2001). To determine similar behaviour in evaluating items positively or negatively, an adaptation of the similarity in the evaluations of items defined in the QHIR LACCIR research project is used (González *et al*. 2013). The evaluations of items are normalized values between 0.0 and 1.0. The similarity in the evaluations of items between users *u* and *v* is calculated as shown in equation (1), where *eval*(*u*, *i*) is the evaluation value given by the user *u* to the item *i*, *eval*(*v*, *i*) is the evaluation value given by the user *v* to the item *i*, and *niric*(*u*, *v*) is the number of items evaluated by both users. If *niric*(*u*, *v*) = 0 then *simEval*(*u*, *v*) = 0.

$$simEval(u, v) = \sum_{i=1}^{niric(u,v)} (1 - |eval(u, i) - eval(v, i)|) / niric(u, v) \quad (1)$$

Notice that sparsity occurs when there is a small number of evaluations in the academic network. To mitigate sparsity issues in the recommender system, Bayesian models can be used (Miyahara and Pazzani 2000). The relevance value of an item i is defined as shown in equation (2), where $maxMod(c)$ is the maximum number of modules of the course c at the current time, $mod(i, c)$ is the module of the course c which contains item i, $eval(v, i)$ is the evaluation value given by the user v to the item i, and $simEval(u, v)$ is the similarity in the evaluations of items between users u and v.

$$rv(u, v, i, c) = (1 / (maxMod(c) - mod(i, c) + 1)) * eval(v, i) * simEval(u, v) \quad (2)$$

Considering that more than one user of $N_1(u)$ can evaluate the same candidate item, in L there may be repeated items. To process them, a repetition coefficient is calculated for each item i of the list as shown in equation (3), where $occurs(i, L)$ is the number of occurrences of the item i in L, and $maxOccurs(L)$ is the maximum number of repeated occurrences in L.

$$rc(i, L) = (occurs(i, L) / maxOccurs(L)) \quad (3)$$

Then, the relevance value of each item of L is adjusted, multiplying the current relevance value by the repetition coefficient. After that, the list is reordered by the adjusted relevance value. The repeated items are eliminated as going through the list in descending order by the adjusted relevance value. Finally, the list L is returned. Analogously, L_2 and L_3 are obtained by calling the function previously described, but using the sets of users $N_2(u)$ and $N_3(u)$ respectively. L_4 is obtained by calling the function *getCrowdsourcingRA*, which uses a crowdsourcing technique. The function consists in taking the candidate items of subtype s, which belong to the current module or to *nmod* previous modules of the course c, and adding them to the list by the relevance value, which is the average evaluation value. The ordered set R is defined as the set which contains the recommended items for the current user. The candidate items are added to R taking one item at a time from L_1, L_2 and L_3, in descending order by the relevance value and without repeating, until reaching n items or until L_1, L_2 and L_3 are empty. Sometimes there might not be enough information in redEMC to generate recommendations of items for the current user obtained through friendsourcing, known as the

cold-start problem (Braunhofer 2014). To overcome this problem, it is proposed to use recommendations of items obtained through crowdsourcing. Subsequently, an item of L_4 is taken and added in descending order by the relevance value and without repeating to R, until reaching m items or until L_4 is empty. Finally, the ordered set R is returned.

5.3.2 Recommendation Algorithm of Comments

The recommendation algorithm of comments is a hybrid algorithm that uses friendsourcing and crowdsourcing approaches. The input data of the function *getRecommendationsCM* are the current user u, the course c, the number of days k, the parameters φ and θ, the maximum number n of comments to recommend using friendsourcing, and the maximum number m of comments to recommend using crowdsourcing. In the same way as in the previous recommendation algorithm, in order to apply a friendsourcing technique, the sets of users $N_1(u)$, $N_2(u)$ and $N_3(u)$ are obtained. Four ordered lists L_1, L_2, L_3 and L_4 are defined, which associate a relevance value with a certain comment. L_1 is an ordered list of pairs (comment, relevance value) that is obtained by calling the function *getFriendsourcingCM* (c, k, φ, θ, $N_1(u)$). Next, the implementation of that function is explained. Initially, an ordered list L of pairs (comment, relevance value) is defined. For each user v of the set $N_1(u)$, the candidate comments of the course c which were published by that user in a discussion forum in the last k days, are taken. To improve the recommendation process, Natural Language Processing techniques could be used to discard comments that are semantically duplicate (Majumder *et al.* 2016). The parameter k can be set to the average duration of a module. For each of these comments, the relevance value is calculated and then the pair is added to L. The relevance value of a comment cm is defined as shown in equation (4), where $likes(cm)$ is the number of likes of the comment, $views(cm)$ is the number of views of the comment, and $publicationTime(cm)$ is the publication time of the comment.

$$rv(cm) = (likes(cm) / views(cm)) * (1 / publicationTime(cm)) \quad (4)$$

Finally, the list L is returned. Analogously, L_2 and L_3 are obtained by calling the function previously described, but using the sets of users $N_2(u)$ and $N_3(u)$ respectively. L_4 is obtained by calling the function *getCrowdsourcingCM*, which uses a crowdsourcing technique. The function consists in taking the candidate comments of the course c, which were published in a discussion forum in the last k days, and adding them to the list order by the relevance value, which is the number of likes of the comment. The ordered set R is defined as the set which

contains the recommended comments for the current user. The candidate comments are added to R taking one comment at a time from L_1, L_2 and L_3, in descending order by the relevance value and without repeating, until reaching n comments or until L_1, L_2 and L_3 are empty. Lastly, a comment of L_4 is randomly taken and added in descending order by the relevance value and without repeating to R, until reaching m comments or until L_4 is empty. Finally, the ordered set R is returned.

5.3.3 Recommendation Algorithm of Courses

The recommendation algorithm of courses is a hybrid algorithm that uses friendsourcing, crowdsourcing and demographic approaches. The input data of the function *getRecommendationsCS* are the current user u, the maximum number n of courses to recommend using friendsourcing, and the maximum number m of courses to recommend using crowdsourcing. As in the previous algorithms, to use a friendsourcing technique, the sets of users $N_1(u)$, $N_2(u)$ and $N_3(u)$ are obtained. Four ordered lists L_1, L_2, L_3 and L_4 are defined, which associate a relevance value with a certain course. L_1 is an ordered list of pairs (course, relevance value) that is obtained by calling the function *getFriendsourcingCS* (u, $N_1(u)$). Next, the implementation of that function is explained. Initially, an ordered list L of pairs (course, relevance value) is defined. For each user v of the set $N_1(u)$, the candidate courses which that user enrolled in, are taken. For each of these courses, the relevance value is calculated and then the pair is added to L. To calculate the relevance value of a course, an adaptation to the demographic similarity defined in a previous research project for a recommender system is used, which considers demographic attributes such as age, gender and nationality of users (Yapriady and Uitdenbogerd 2005). Based on the data model and the database provided by EviMed, the information available in redEMC is analyzed. The demographic attributes to be used in the calculation of the demographic similarity are: gender, country, city, profession, medical specialization, and work experience. The gender attribute could be considered when generating the recommendations. The similarity in gender between users u and v, is defined as shown in equation (5).

$$simG(u, v) = \begin{cases} 1: & gender(u) = gender(v) \\ 0: & gender(u) \neq gender(v) \end{cases} \qquad (5)$$

The country and city attributes could also be considered in the recommendation process. The similarity in nationality is defined as shown in equation (6).

$$simN(u, v) = \begin{cases} 1: & country(u) = country(v) \wedge city(u) = city(v) \\ ½: & country(u) = country(v) \wedge city(u) \neq city(v) \\ 0: & in\ other\ case \end{cases} \quad (6)$$

The work experience attribute is of interest to consider in the recommendations. The similarity in experience is defined as shown in equation (7), where *exp*(*u*) and *exp*(*v*) are the number of years of work experience of users *u* and *v* respectively. The attribute is discretized in two ranges: users with less or equal to fifteen years of work experience and users with more than fifteen years of work experience.

$$simE(u, v) = \begin{cases} 1: & 0 \leq exp(u), exp(v) \leq 15 \vee 15 < exp(u), exp(v) \\ 0: & in\ other\ case \end{cases} \quad (7)$$

The courses which a user of the network enrolls in, with the same profession and/or specialization as those of the current user, are of great interest to consider in the recommendations. These users can be considered to have a similar academic profile. The similarity in academic profile is defined as shown in equation (8), where *prof*(*u*) and *prof*(*v*) are the professions of users *u* and *v* respectively, and *mspec*(*u*) and *mspec*(*v*) are the medical specializations of users *u* and *v* respectively.

$$simA(u, v) = \begin{cases} 1: & prof(u) = prof(v) \wedge mspec(u) = mspec(v) \\ ½: & prof(u) = prof(v) \vee mspec(u) = mspec(v) \\ 0: & in\ other\ case \end{cases} \quad (8)$$

The demographic similarity between users *u* and *v* is calculated as shown in equation (9), where $\alpha + \beta + \chi + \delta = 1$ and $\alpha < \beta < \chi < \delta$.

$$simD(u, v) = (\alpha * simG(u, v) + \beta * simN(u, v) + \chi * simE(u, v) + \delta * simA(u, v)) /4 \quad (9)$$

Notice that a machine learning approach could be used to find the best parameter values. The relevance value of a course *cs* is defined as shown in equation (10), where *simD*(*u*, *v*) is the demographic similarity between users *u* and *v*.

$$rv(cs) = simD(u, v) \quad (10)$$

Considering that more than one user of $N_I(u)$ can enroll in the same candidate course, in *L* there may be repeated courses. To process them, a repetition coefficient is calculated for each course *cs* of the list as shown in equation (11), where *occurs*(*cs*, *L*) is the number of

occurrences of the course *cs* in *L*, and *maxOccurs*(*L*) is the maximum number of repeated occurrences in *L*.

$$rc(cs, L) = (occurs(cs, L) / maxOccurs(L)) \qquad (11)$$

Then, the relevance value of each course of *L* is adjusted, multiplying the current relevance value by the repetition coefficient. After that, the list is reordered by the adjusted relevance value. The repeated courses are eliminated as going through the list in descending order by the adjusted relevance value. Finally, the list *L* is returned. Analogously, L_2 and L_3 are obtained by calling the function previously described, but using the sets of users $N_2(u)$ and $N_3(u)$ respectively. L_4 is obtained by calling the function *getCrowdsourcingCS*, which uses a crowdsourcing technique. The function consists in taking the most popular candidate courses, based on the statistics of the network, which users enrolled in, from the same country and with the same profession and/or medical specialization as those of the current user, and adding them to the list ordered by the relevance value, which is equal to the percentage of students regarding the population of the country. The ordered set *R* is defined as the set which contains the recommended courses for the current user. The candidate courses are added to *R* taking one course at a time from L_1, L_2 and L_3, in descending order by the relevance value and without repeating, until reaching *n* courses or until L_1, L_2 and L_3 are empty. Then, a course of L_4 is taken and added in descending order by the relevance value and without repeating to *R*, until reaching *m* courses or until L_4 is empty. Finally, the ordered set *R* is returned.

5.4 Tests and User Feedback

Once the recommendation algorithms of resources/activities and comments were implemented and put into production, an initial testing phase of ten days was defined. The parameter values suggested to use in the testing phase were: $\alpha = 0.1$, $\beta = 0.15$, $\chi = 0.25$, $\delta = 0.5$, $\lambda = 3.0$, $\sigma = 0$, $\varphi = 0$, $\theta = 0$. A total of 538 users received recommendations of resources and activities. From the implicit feedback it was found that 14% of the recommendations were of interest to users by viewing the recommended resources and activities. These low results could be probably due to sparsity issues. From the explicit feedback given by 3% of the users, it was determined that 94% of them evaluated positively the recommendations, which means the users answered that the recommended resources and activities were useful to them. Notice that most of the recommendations were generated with crowdsourcing and this is probably due to the cold-start problem mentioned earlier.

Table 5.1 Origin of the recommendations of resources/activities and comments.

Origin	Resources/Activities (%)	Comments (%)
Friendsourcing N_1	17.3	3.4
Friendsourcing N_2	8.0	11.9
Friendsourcing N_3	1.5	0.4
Crowdsourcing	73.2	84.3

A total of 2649 users received recommendations of comments and there was a total of 2635 published comments. From the implicit feedback it was found that 26% of the recommendations were of interest to the users by viewing the recommended comments. From the explicit feedback given by 1% of the users, it was determined that 100% of them evaluated positively the recommendations. As in the previous results, most of the recommendations were generated with crowdsourcing and this is also probably due to the cold-start problem. Table 5.1 shows the origin of the recommendations of resources/activities and comments, i.e., which of the three levels of relevance in user relationships determined the recommendations.

5.5 Results and Conclusions

Although users are not commonly inclined to evaluate and give feedback, in the case of redEMC for CME, students were explicitly motivated to collaborate in order to produce interesting recommendations. It was possible to assess that students really participated actively and collaboratively by creating and maintaining their academic and social network, evaluating items, and giving implicit and explicit feedback. As a result of this process of co-creation among users in the virtual learning platform, it was possible to generate meaningful recommendations. Regarding the short period of testing and the percentages of users that gave positive feedback, it is possible to conclude that personalized recommendations are useful to students improving their user experience, learning processes and stimulating further collaboration. Future research will be dedicated to adjusting the parameters of the algorithms in order to improve the recommendation process. An interesting line of future work is to make more extensive tests, specially analyzing interactions among users.

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CHAPTER 6

Soft skills promoted by participatory processes: a case study in Italian high schools

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This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Abstract. This paper explores how the soft skills included in the European framework of key competences for lifelong learning can be promoted by a participatory approach involving high school students in the co-creation/development of their Physical Education and Sport (PES) curriculum. The first results of a research conducted within the European Erasmus Plus project DIYPES in 3 Italian high schools, including the use of focus group methodology in 9 classes, are presented as a case study. It is shown that the activation of various kinds of soft skills included in the European framework of key competences for lifelong learning – in particular "Personal, social and learning competence", "Civic competence", "Entrepreneurship competence" – not only was fostered by the participatory process in itself, but emerged as an implicit central issue in the proposals developed by the students to improve their PES classes.

Keywords: *Physical education; sport; soft skills; focus group; co-creation*

6.1 Introduction

This research was conducted within the "Do It Yourself! A participative approach to increase participation and engagement of high school students in Physical Education and Sport classes

project" (DIYPES)[10]. The project – involving Italy, Romania, Albania, Malta, Slovakia and Denmark as internal evaluator – proposes an innovative approach to PES classes planning and development at high school level in Europe, which focuses on needs and interests expressed by students, involving them in the co-creation of their PES curriculum. Indeed, DIYPES considers the school curriculum in a wide perspective, not limiting to the official, formal curriculum level – generally described in norms, guidelines or policy papers – but also referring to the UNESCO concept of "curriculum system" and "curriculum framework" (International Bureau Education-UNESCO 2013; Valente *et al*. 2018), which allows to take into account other relevant elements like practices realized locally and stakeholders' views.

Specifically, within DIYPES the students are encouraged to propose changes in their PES classes by means of participatory methodologies, with the aim of developing an intervention consisting in designing and implementing innovations in PES classes, that allows the students to contribute to their PES curriculum at local level and to express the potentials of "student choices" (Landrum TJ and Landrum KM 2016; Chen-Chung *et al*. 2017; Quin 2016; Smucny *et al.* 2016). In this way the project is meant to empower students and to offer them a higher level of autonomy, considering that perceived autonomy and feeling of competence and self-management have been proven to have positive effects on students' participation and engagement in PES (Goudas *et al*. 1994). Indeed DIYPES' approach is also guided by the self-determination theory (Ryan and Deci 2000), which identifies 3 universal psychological needs involved in human motivation: 1) competence (we assume that an increased perception of competence and potential for mastery of the activities result in higher motivation to actively participate in PES classes); 2) relatedness, described as the universal need to interact (we assume that the students feel more related to the aims of the classes, listened-to and thus more motivated to actively participate in PES classes); 3) autonomy, described as the universal urge to be causal agent of own life and act in harmony with own integrated self (we assume that the opportunity to be engaged in the way the PES classes are being planned and developed builds in the students feeling of ownership of their own actions and thus increases their engagement in the activities and responsibility for the outcomes).

As a consequence, competences represent one of the central issues that matter throughout the whole DIYPES project, in particular fostering the activation of soft skills in both the

[10] Do it yourself! A participative approach to increase participation and engagement of high school students in physical education and sport classes project" (DIYPES) is a two-year project funded by European Commission under Erasmus+ Sport programme and started in January 2017.

students and the teachers (and researchers) involved. In this paper we focus on the promotion of soft skills in the students by means of DIYPES' participatory process and present the first results related to the intervention in Italy.

At European level, the reflection on competences has undergone to an evolution from the early 2000s to now, as shown in the next section, which aimed to replace the traditional organization of teaching based on subjects to another one more centred on competences.

6.2 The key competences for lifelong learning European framework

In 2006 the European Parliament and the Council adopted a document about "Recommendations on key competences for lifelong learning", aimed at identifying and defining a common set of key competences all individuals need for "personal fulfilment, active citizenship, social cohesion and employability in a knowledge society" (Borrell Fontelles and Enestam 2006). The 8 key competences identified, recognizing the need for and value of a lifelong learning perspective to ensure that Europe's citizens can adapt flexibly in a rapidly changing globalized society, had to represent a reference for the Member states and led to the implementation of related reforms in a majority of them.

In recent years a process of revision of the 2006 Recommendations was promoted by the European Commission with the aim of updating the Key competences and further support their development across Europe.

Based on the conclusions of the review, the Commission adopted a new official document entitled "Proposal for a new Council Recommendation on Key Competences for Lifelong learning" on 17 January 2018 (European Commission 2018a) replacing the previous one. This revision was fostered by the awareness that since 2006 some factors like "greater use of technology, enhanced distance learning and the increase of informal learning through the use of digital devices" have been impacting on the opportunities to acquire competences, and it aims to "develop a shared and updated understanding of key competences, to foster their introduction in education and training curricula and to provide support for better developing and assessing them" (European Commission 2016). The revision was based on several sources including reports and studies on the impact of 2006 Recommendation, related reforms in Member States and EU funded projects, plus stakeholder consultations (European Commission 2018b).

The 2018 Recommendations state that the key competences aim "to lay the foundation for achieving more equal and democratic societies", responding to the need for inclusive and

sustainable growth, social cohesion and further development of democratic culture (European Council 2018). Among the main objectives of this document there are: "supporting the implementation of the first principle of the European Pillar of Social Rights" (2017), underlining that "everyone has the right to quality and inclusive education, training and life-long learning in order to maintain and acquire skills that enable them to participate fully in society and manage successful transitions in the labour market" (European Commission 2017) and recognizing that not having the necessary competences to successfully participate in society and in the labour market increases the risk of unemployment, poverty and social exclusion; supporting the promotion of entrepreneurial competences "to develop essential skills and attitudes including creativity, initiative taking, teamwork, understanding of risk and a sense of responsibility"; highlighting "the role of active citizenship, shared values and fundamental rights".

All the 8 competences listed in the 2018 Recommendations – which are basically the same as 2006, but slightly different in their formulation/structure – are composed by the 3 elements "knowledge, skills and attitude"[11] and go beyond the notion of only knowledge: 1. Literacy competence; 2. Languages competence; 3. Mathematical competence and competence in science, technology, engineering; 4. Digital competence; 5. Personal, social and learning competence; 6. Civic competence; 7. Entrepreneurship competence; 8. Cultural awareness and expression competence.

In this paper we make mainly reference to the soft skills related to the latter 4 key competences, while describing our results. The issue of soft skills was highlighted in the 2018 recommendations, considering that improving basic skills in literacy, numeracy and digital competences is strongly related to personal development, the development of learning competences and civic competences (OECD 2015). At the same time, it was realized that since 2006 "progress has been seen in relation to key competences that easily relate to traditional school subjects, such as communication in mother tongue and foreign languages or mathematical competence, rather than to competences that cut across the boundaries of traditional subjects such as learning to learn, entrepreneurship or social and civic competence" (European Commission 2018b). Indeed moving from a rather static conception of curricular content to a dynamic definition of the knowledge, skills and attitudes a learner needs to

[11] Knowledge is composed of the facts and figures, concepts, ideas and theories which are already established and support the understanding of a certain area of subject; skills are defined as the ability and capacity to carry out processes and use the existing knowledge to achieve results; attitudes describe the disposition and mind-sets to act or react to ideas, persons or situations (European Commission 2018a).

develop throughout the learning process requires a paradigm shift in education, affecting the way it is organized and assessed (European Commission 2018b): competences definition is not rigid, competences overlap and interlock – aspects that are essential to one domain will support competence in another (Borrell Fontelles and Enestam 2006) –, and soft skills in particular – like critical thinking, creativity, initiative, problem solving, risk assessment, decision taking and constructive management of feelings – play a role within the 8 key competences as a whole and are difficult to be defined and objectively assessed. As a consequence, these changes were absolutely not trivial to be implemented.

6.3 Methods

The participatory process of DIYPES project – following a preliminary research phase focused on the PES curriculum assessment aimed at identifying PES core educational objectives and practices at high-school in Albania, Italy, Malta, Romania and Slovakia (Valente *et al*. 2018) – involved 15 schools (3 per country) with the aim of enhancing the students active role in the definition of the PES curriculum as co-producers of knowledge and in the improvement of PES practices, making them contribute to the PES classes design. The 5 countries followed a common methodology, including: choosing 3 high schools per country in various areas (city-center, neighborhood and peri-urban/rural); conducting focus groups in 3 classes per school from grades 9, 10 and 11 to gather from the students proposals inspired by their needs and preferences to improve their PES classes; developing an "intervention plan" per class based on these proposals negotiated with the PES teachers and PES experts; pilot testing/implementation of the intervention, introducing changes in the PES within a period of 3 months. Finally, a project meeting involving representatives of students and teachers from all countries, to be held in Malta in June 2018, was planned in order to foster inter-country exchanges and contribute to develop recommendations about participatory approaches related to PES at European level.

In Italy the focus groups were conducted in 3 schools of different areas of Rome (Liceo Cavour in the city-center, Liceo Orazio in the neighborhood and Istituto di Istruzione Superiore Domizia Lucilla-Sezione Agraria in a rural area) involving 3 classes per school, for a total of 9 classes. Due to the high number of students per class (from a minimum of 15 to a maximum of 28) and the limited time (just one hour), we decided to integrate the focus group methodology with the metaplan methodology (Mayer and Valente 2009), strengthening the

focus group capability to elicit tacit knowledge[12] (Nonaka and Takeuchi 1995; Polanyi 2009): at the beginning students had to silently reflect on 4 questions – "n. 1 What aspects of your ordinary PES classes you like at most?", "n. 2 What aspects of your ordinary PES classes you dislike at most?", "n. 3 How could your PES teacher improve your PES classes?" and "n. 4 What activities would you like to do, do more, or in a different way?" – conceived to gradually focus their attention on the objective of the participatory experience, which was to let proposals to improve PES classes emerge. The students were let 20 minutes to write their answers on post-its (one per question), then the post-it were distributed among 4 posters displaying the 4 questions and we facilitated a short debate on each group of answers; in particular we tried to reach consensus by the class about the answers of the latter 2 questions, inviting the students to rate the proposals by a show of hands and fostering further reflections on possible solutions for their implementation.

Summaries of classes' results were presented to the respective teachers and evaluated by them during an interview, which led to the development of class-specific "intervention plans" including each several possibilities for introducing changes in PES classes, as guidelines for the teachers during the considered 3 months. The implementation of the plans in terms of number of hours within their PES program was let to the responsibility of the teachers.

6.4 Results 1: soft skills promoted by the participatory process

The participatory approach of the DIYPES project in itself, besides strengthening aspects/skills specifically related to PES, implies the promotion of soft skills in the participating students. Inviting the students to elaborate changes to improve their PES classes, so involving them in a process of co-production of their PES curriculum, has the potentiality of fostering awareness of their learning process and stimulating the desire to apply prior learning and life experiences and the curiosity to look for opportunities to learn (European Council 2018).

More specifically, in our experience, the participation of the students to the focus groups fostered the activation of several soft skills embedded throughout the EU key competences (European Council 2018).

In particular in the first phase of the focus group the students had to silently answer 4 questions, expliciting their tacit knowledge (Nonaka and Takeuchi 1995; Polanyi 2009). The

[12] With 'tacit knowledge' we mean implicit and intuitive knowledge that is difficult to communicate, e. g. know-how acquired during practical experience.

first 2 questions, requiring them to reflect on what aspects of their ordinary PES classes they liked and disliked at most, fostered the activation of the EU key competence n. 5 "Personal, social and learning competence" (including "knowledge of the components of a healthy mind, body and lifestyle", more PES-specific) in the sense that the students had to reflect upon themselves, effectively manage time and information and work autonomously. While answering the other 2 questions, where they had to reflect on how the PES teacher could improve PES classes and on what activities they "would like to do, do more, or in a different way", the students were induced to activate also EU key competence n. 7 "Entrepreneurship competence", in particular taking initiative and creativity, which includes imagination, critical and constructive reflection (European Council 2018).

In the second phase of the focus group, where the students had to share their answers and collectively debate supported by facilitators in order to reach consensus on feasible concrete proposals to improve their PES classes – taking into account the needs of their PES teachers, the available school PES equipment and infrastructures, possible bureaucratic limits – key competences n. 5 and n. 7 were further stimulated, fostering the students to communicate and work with others in a constructive way, planning "projects" taking into account both processes and resources; to motivate the others and value their ideas, to manage conflict, to critically reflect and make decisions, cope with complexity, negotiate and solve problems, effectively manage time and information, take initiative and think about how to turn ideas into action and mobilize resources (people and things). The students had also to consider actual "financial" aspects, since the project had a budget available to provide the school with PES equipment that could be used to meet the preferences of the students, based on students' proposals and teachers evaluation.

In addition, some of the students in each class were involved as co-facilitators – at least 4, one per question, usually volunteers – having the task of collecting the post-its where their companions had answered, of putting them under the corresponding questions, reading them to the group and collecting comments from the companions (they were given written instructions about their role). In some cases, they also helped – spontaneously or invited by us – to keep the companions' attention and reach consensus. For these students, skills related to taking initiative, managing time and ability to communicate and work with others in a constructive way were further fostered.

Summarizing, the focus group process implied showing tolerance, expressing and understanding different viewpoints, as well as the ability to create confidence and feel

empathy; it included respecting the others and being prepared (both to overcome prejudice and) to compromise and accepting responsibility; at the same time it gave the students the opportunity of reflecting on themselves, on their attitudes and preferences and increasing awareness of their learning path and of the fact that understanding and implementing own desires, taking into account reality, is not easy and requires engagement.

6.5 Results 2: Soft skills emerged from the students' proposals

The proposals emerged from the focus groups were presented to the 3 PES teachers, also including some suggestions for implementation added by us, and were negotiated with them in order to develop 9 class-specific "intervention plans" as reference documents to be used for introducing changes in their PES classes in order to meet the preferences of the students.

The proposals of the Italian students resulted as very heterogeneous: they included both proposals specifically related to PES (e. g. the introduction of new kinds of sports) and "transversal" proposals (e. g. related to organizational aspects of the class), potentially be applicable also to other subjects.

Looking at the results as a whole, we identified some educational objectives emerged from the students' proposals:

A. To optimize times in order to take the maximum benefit from the practical part of PES classes.
B. To optimize spaces in order to take the maximum benefit from the practical part of PES classes.
C. To meet the individual preferences of the students with reference to performing specific kinds of sports.
D. To give more organizational autonomy and responsibilities to the students.
E. To promote the active involvement also of the least capable in matches.
F. To meet the individual preferences of the students with reference to integrating usual PES activities with artistic physical activities such as dance and other artistic elements such as music.
G. To link PES practice and theory.
H. To increase awareness about the evaluation criteria adopted by the teacher.

Some of the objectives emerged from most of the classes of all the 3 schools: not only C) – related to the main focus of the project – but also A), B), and D), concerning organizational aspects and increasing responsibility of the students. The content of these latter objectives implies recognizing the value and the activation of soft skills embedded, again, in the key competences n. 5 and n. 7, namely effectively managing time, working with others in a constructive way, making decisions, collaboration, problem-solving, capacity to act upon opportunities and ideas, mobilizing resources (people and things), creativity, planning and managing projects, turning ideas into action, having self-awareness on their own strengths and weaknesses, evolving creative processes and innovation, accepting responsibility. Among the most interesting concrete proposals of the students to implement these objectives – and activate, in this way, the soft skills embedded – there are: organizing the teams before the class starts and performing simultaneously different activities in small groups so that no one has to wait for his/her turn.

The objectives F) and G), concerning integrating PES with artistic aspects like dancing and music and integrating PES theory with practice, emerged in 2/3 classes; they meet EU key competence n. 8 "Cultural awareness and expression competence" and at the same time can be related to some of the learning approaches and contexts mentioned in the European documents (European Council 2018), namely cross-discipline learning, complementing academic learning with social and emotional learning, including arts.

The objectives E) and H) – each of them emerged only in 1 class – are related to values/ethical principles like inclusiveness, empathy, respecting others and increasing awareness, taking responsibility, related to key competence n. 5, and can be also linked to key competence n. 6. "Civic competence".

The implementation of the intervention plan will be object of future research papers. However, we can anticipate an aspect that is related to the development of soft skills: the fact that, in some cases, barriers impeded to use the DIYPES budget available to make purchases that could satisfy some of the students' proposals agreed by the teachers. In particular, it was not possible to buy a mower to solve the problem of maintenance of the grass in the external space of one of the schools, which impeded to use it properly for PES, or to improve the pavement of the external space of another school – with the same aim – because exceeding the available budget. Even if this aspect was not directly managed by the students, it represented another opportunity for them – but also for us and the teachers – to realize that to implement what one desires is not easy and depends also on factors we cannot control.

As a consequence, not only soft skills were stimulated by the focus group process, but they also emerged in the content of the proposals advanced by the classes and as prerequisite for their implementation.

6.6 Next steps

To complete this path, 2 students, as representatives of their companions, and 1 teacher per school – a total of 6 Italian students and 3 teachers – took part to the international project meeting held in Malta in June 2018, where they had the opportunity of meeting students and other social actors – e.g. researchers, policy makers, scholars and practitioners in PES-related fields – from the other countries involved in the project and exchanging with them experiences, visions and sensitivities by means of informal approaches based on "appreciation of local knowledge" (Goudas *et al.* 1994), policy game methodology (Spitters *et al.* 2017), fostering collaborative learning (Tan and Brown 2005).

In this case, besides the key competences n. 5, n. 8 "Cultural awareness and expression competence" seemed to be the most stimulated, which includes having an understanding of and respect for how ideas and meaning are creatively expressed and communicated in different cultures, implying curiosity about the world, an openness to imagine new possibilities and a willingness to participate in cultural experiences (European Council 2018). Finally, also the development in the students and teachers of n. 6 "Civic competence", including the awareness of diversity and cultural identities in Europe and in the world, seemed to be fostered.

6.7 Conclusion and perspectives

The participatory approach embedded in the DIYPES project, with the aim of involving high school students in the co-production of their PES curriculum, has proven to allow the promotion of soft skills included in the EU key competences for lifelong learning in the Italian case. This aspect emerged not only in the methodology adopted – including the integration of focus group and metaplan – but also in the results obtained from the students in terms of proposals to improve their PES classes and solutions to implement them. The students had the chance to reflect on the need of developing and applying soft skills in order to realize what they desire and on the fact that even understanding what one desires is not a trivial, gathering awareness.

Next research papers will focus on the analysis of the DIYPES results achieved in the other 4 project countries related to the development and implementation of the interventions in view

of an international comparison, taking into account also the recommendations related to soft skills included in the national PES official curricula of the various countries, with the final aim of providing scenarios and examples of best practices applicable at European level in regards to models for building innovative participatory approaches to PES classes.

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