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RESPONSIBLE HIGHER EDUCATION:
Principles for Educational Design and
Pedagogy

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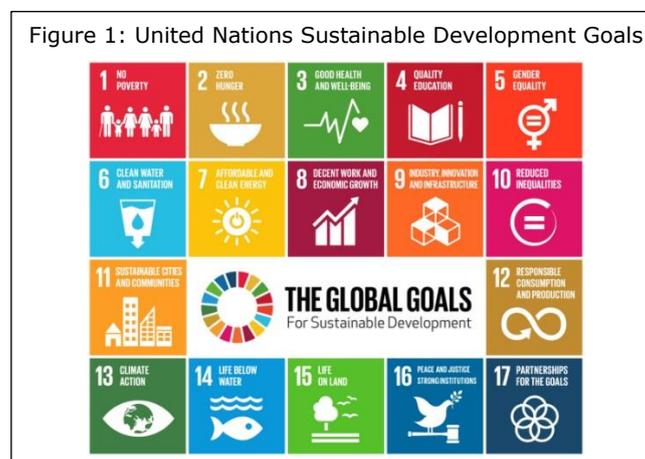
RESPONSIBLE HIGHER EDUCATION: Principles for Educational Design and Pedagogy

Higher education has a pivotal role in equipping students to responsibly tackle the grand sustainability challenges of our time and to contribute to the development of responsible societies. For this, suited educational design and pedagogical practices are needed. This paper provides guidance towards the development of educational design and pedagogy that equips students as responsible actors of the future.

Engaging Students in Responsible Research and Innovation

How to best equip students, through higher education curricula design and pedagogy, to be and to become responsible researchers and innovators in a complex world? This is one crucial question addressed by the Enhancing Responsible Research and Innovation through Curricula in Higher Education (EnRRICH) project. Overall, a Responsible Research and Innovation (RRI) approach encourages research and innovation efforts that respond in a responsible manner to complex grand sustainability challenges, as for example challenges related to climate change, resource scarcity, social inequalities and others. See Figure 1 presenting global challenges and goals for sustainable development. RRI encourages researchers and societal actors to work together and to align research and innovation outcomes with societal needs (e.g. European Commission, 2012; von Schomberg, 2013; Stilgoe et al, 2013). In turn this implies making research efforts more open and democratic, while enhancing public engagement in research and innovation activities. Those efforts are intended to foster the development of more responsible societies.

Consequently, a main implication when considering an RRI aligned higher education is that students need to be equipped as responsible actors, to respond to grand challenges and to participate in RRI collaborative processes. During the past two years, and with a focus on a European higher education context, the EnRRICH partners have addressed this need. Through a collaborative journey of reflection and action, they have piloted approaches to responsible educational design and pedagogy that engage students in RRI endeavours within programme and modules, at Bachelor, Master and PhD levels. The educational fields engaged include technical sciences and engineering, social sciences and humanities, and the interactions among those fields. This paper is designed to share some EnRRICH findings and experiences. It introduces a set of principles that can revitalize education and pedagogies from a RRI standpoint, it provides guidance for implementing those principles, and it highlights key lessons learned through formative evaluation activities based on EnRRICH pilots (Vargiu, in press). Overall, this paper is an educational brief especially targeted to educators interested in fostering a culture of responsibility in their higher educational practices.



Implementing EnRRICH Principles

The EnRRICH principles can guide educators to revitalize educational practices, within programmes and modules, from an RRI standpoint. Figure 2 presents those principles and introduces prompts that can engage educators in reflecting about the relevance and possible implementation of each principle within their educational practices. Those principles are grounded in the following working definition of RRI-oriented higher education (Tassone et al., 2017):

"Fostering RRI in higher education curricula is about equipping learners to care for the future by means of responsive stewardship of scientific and innovation practices that address the grand challenges of our time in a collaborative, ethical and sustainable way".

The principles can support the development of learning environments conducive to RRI learning. What follows is a description of the meaning of each principle and suggestions for their implementation based on the EnRRICH experience and pilots.

Principle 1 "Education for society". It is about engaging students in real life challenges by designing education, curricula and modules, around complex real challenges faced nowadays by society. *Problem-based learning* (e.g. Savin-Baden, 2000) is one typical pedagogical model that can serve as inspiration for educators that want to implement this principle. Through this pedagogical model, the curricular content is organized around problem scenarios. Students work towards understanding, critically reflecting about, and addressing societal problems and dilemmas, rooted in the previously mentioned sustainable development goals. A guidance and examples of resources for prompting understanding and debates about societal issues and dilemmas is provided by Hally et al., 2017. Given the complex and interconnected nature of those problems, it is crucial to engage students in cross-cutting forms of inquiry. While disciplinary specialism remains relevant, providing gateways in the curriculum for inter- and trans-disciplinary inquiry can enable students to work towards cross-fertilization of disciplinary and also practical knowledge to address complex current challenges.

Figure 2: EnRRICH principles and prompts for educators

THE EnRRICH PRINCIPLES

Four Principles to Revitalize Education from a Responsible Research and Innovation (RRI) Perspective

PRINCIPLE 1: "Education for society"

Engaging students with societal challenges



- ✓ What are the societal challenges that your programme/module is addressing or can address (e.g. food security, climate action)?
- ✓ How does your programme/module engage students with those challenges?

PRINCIPLE 2: "Education with society"

Connecting students to societal actors



- ✓ Does or can your institution facilitate an interplay between academia and society? And in what way (e.g. Science Shop methodology)?
- ✓ Does or can your programme/module equip students to address societal challenges academically and collaboratively with societal actors?

PRINCIPLE 3: "Whole persons education"

Fostering students learning in terms of knowing, being and doing



- ✓ Does your programme/module allow for learning across various learning domains of knowing (e.g. understanding), being (e.g. collaborating) and doing (e.g. communicating)? And how?
- ✓ What do you consider to be a possible added value of fostering learning across learning domains, in the context of your programme/module?

PRINCIPLE 4: "RRI competencies proficiency"

Fostering students competencies for participating in RRI processes



- Future-studies abilities
- Future-oriented ethical abilities
- Pro-activity
- Multi-perspective & inter-cultural communication
- Trans-disciplinary collaboration
- Openness & Transparency
- Navigating complexity or wicked problems
- Adaptability
- Agency
- Self-awareness
- Situational awareness
- Social awareness & Empathy
- Ethical thinking
- Disruptive thinking

- ✓ What RRI competencies are relevant in the context of your programme/module?
- ✓ How could you facilitate the development of the RRI competencies in students?
- ✓ What challenges do you foresee in seeking to foster the development of RRI competencies? And how could you tackle those challenges?

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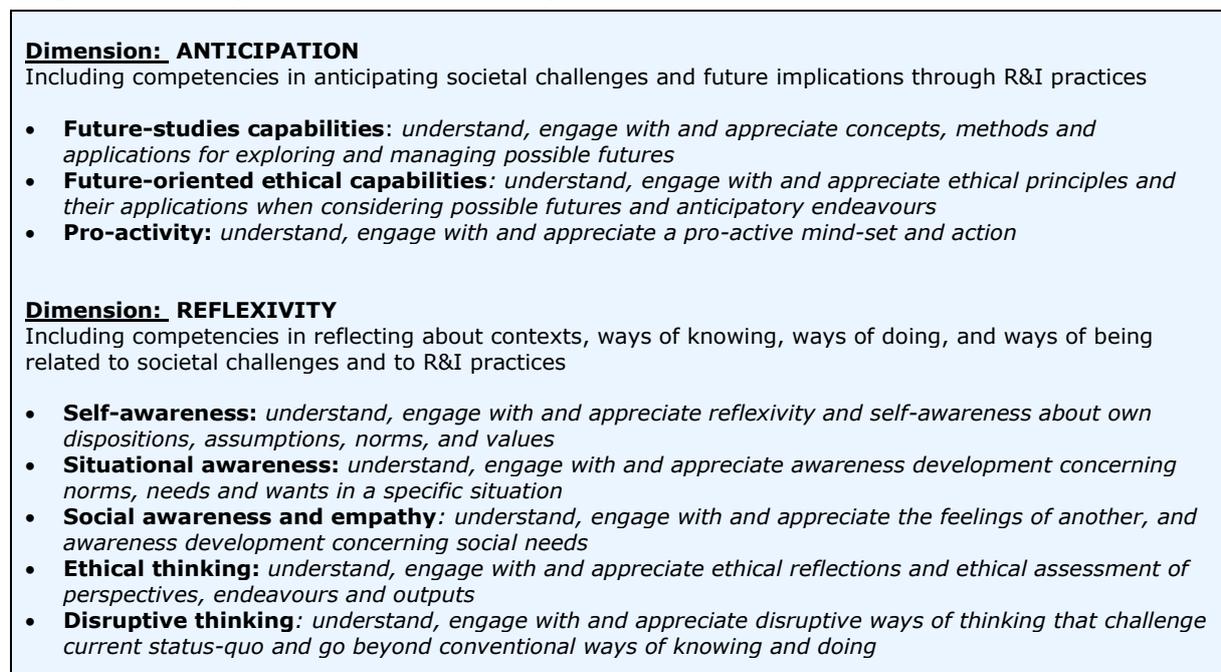

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Principle 2 “Education with society”. It is about creating space, within curricula or modules, for critical and constructive dialogue between students and societal actors. In this process, transmissive forms of education with the teacher being the instructor can become less prominent, while more room can be given to emancipatory forms of learning fostering collaboration among students and stakeholders. The engagement of students into real challenges should take place in a context of reciprocal interaction between students and other actors. Educators can consider two main pedagogical approaches, namely a light and a deep approach. The *light approach* focuses on exposing students, often within the classroom, to societal actors challenges, perspectives and viewpoints. For example, by means of case studies, through role plays or by inviting stakeholders to discuss a certain topic. The *deep approach* focuses on engaging students in authentic learning processes at the cross-road between the classroom and society. Students collaborate with societal actors in order to address specific challenges faced by those actors. In contrast to the light approach, students here are engaged in collaborative real-time and real-life applications in-between academia and the rest of the world.

Principle 3 “Whole persons education”. It is about fostering learning within the domains of knowing, being and doing. *Learning to know*, is fostered by generating critical understanding and reflection concerning the emergent complex issues of our time, and by making use of knowledge to address those complex issues. *Learning to be* is fostered by enhancing collaborations and cultivation of social attitudes, and by nurturing a sense of care towards ourselves, others and the planet. *Learning to do* is fostered by promoting tangible expression of our capacities, by trying out new behaviours and also by engaging into actions that bring about changes into current state of affairs. Those three learning domains need to be interwoven and challenged simultaneously throughout the learning process. In order to foster this process, educators can consider the application of experiential pedagogies and project work. For example, by engaging students into concrete collaborative research projects, they can understand current issues (learn to know), can learn to operate within collaborative environments (learn to be), and can experiment with multi-perspective communication (learning to do).

Principle 4 “RRI competence proficiency”. It is about equipping students with competencies that enable them to participate in RRI processes. Figure 3 articulates relevant RRI competencies or capabilities across four dimensions, namely anticipation, reflexivity, inclusiveness and responsiveness.

Figure 3: Description of RRI relevant competencies within each dimension



Dimension: INCLUSIVENESS

Including competencies in involving, communicating and, collaborating with diverse stakeholders and the wider public to address societal challenges through R&I practices

- **Multi-perspective & inter-cultural communication:** *understand, engage with and appreciate communication strategies that include multiple perspectives, frames of reference and cultures*
- **Participatory ability:** *understand, engage with and appreciate participatory decision-making processes that include voices of diverse stakeholders, also the wider public and silent voices*
- **Trans-disciplinary collaboration:** *understand, engage with and appreciate collaborative and bridge-making efforts across disciplines, actors and contexts*
- **Openness & transparency:** *understand, engage with and appreciate the process of sharing information about findings, processes and practices while being mindful of possible restrictions in sharing information (e.g. intellectual property rights, considerations around sensitive data)*

Dimension: RESPONSIVENESS

Including competencies in coping with and responding to societal challenges and to emergent (social) needs, values, norms, perspectives and knowledge through R&I practices

- **Navigating complexity or wicked problems:** *understand, engage with and appreciate complexities, uncertainties and ambiguities and manage a possible sense of paralysis or of being overwhelmed*
- **Adaptability:** *understand, engage with and appreciate flexible and adaptable design and practices to cope with emergent challenges and changes in society, revise views and adjust the course of action*
- **Agency:** *understand, engage with and appreciate purposive actions through which one can initiate or contribute to change while being mindful of supportive or less supportive factors*

Each of those competencies represents a dynamic interplay between knowing, doing and being (principle 3 “Whole Person Education”). Those competencies emerge in interaction with others and the context in which activities take place. While each competence stands within a certain dimension, the competencies and dimensions are interlinked. Hence, the lines between them are blurred. The set of various competencies is presented here as a heuristic. It is thus not exhaustive, nor prescriptive. Rather, it aims to inspire educators to further think about the design of the programs and modules they are engaged in. For example, one relevant competence can inform the development of one module within a program, while a combination of a few competencies can guide the development of another module within the same program; or, while conveying basic disciplinary knowledge and research skills in the first phase of a study program, the framework proposed here could inform the second phase of the program; or, the framework can inspire the development of modules that provide the conditions for engaging with multiple RRI competencies which students themselves can choose based on their learning needs, thereby fostering self-directed learning.

An example

To make the four EnRRICH principles more tangible, an example of the implementation of all those principles within a specific case is provided here:

An example on how to embed EnRRICH principles at the level of MSc modules

(Supporting and Understanding Sustainability Transitions & project-based modules at Wageningen University)

Students enrolled on this double module are contributing, for a total of 12 ECTS, to real life sustainability transition projects. Those students with diverse disciplinary backgrounds, collaboratively work in teams in a consultative advisory capacity for a societal organization facing a sustainability challenge. Through a real life problem-based learning approach, each team explores and advises sustainability transition projects related to, for example, energy, water, land use, well-being, etc. (*education for society* principle). Learning spaces in-between the scientific and the societal spheres are constituted (*education with society* principle, deep approach) by engaging students to collaborate with each other, with scientists, and with the societal organizations commissioning their project). Additionally, the course allows students to learn within multiple learning domains (*whole persons education* principle): the teams develop and use multiple forms of knowledge in order to address the challenge at hand (learning to know); they practice collaboration and engage their social attitudes (learning to be); they exercise facilitation and communication skills and undertake actions to advance the project (learning to do). Students further reflect on their work by taking into account the four RRI dimensions. Namely, they develop forward thinking and attempt to anticipate implications and impact of the project (anticipation), reflect on their responsibilities in the context of their project (reflexivity), identify stakeholders and the relevance of including their voice throughout project development (inclusiveness), identify ways to respond to emergent challenges throughout project development (responsiveness). Additionally, students select one or more RRI competencies they find interesting, they experiment with the selected competence, develop a trajectory based on their learning needs and practice of that competence.

Lessons learned: key successful and challenging factors

Based on the EnRRICH project experience and through the evaluation of the EnRRICH pilots (Vargiu, 2017), key factors that play a role in facilitating responsible education and learning through the EnRRICH principles, are distilled. Hereby the three most valuable factors contributing to RRI students' learning are reported, together with the key challenge students struggled with. Additionally, it is reported the most significant reflection of educators involved in developing responsible higher education through those principles. Those few lessons learned can inform educators interested in fostering responsible research and innovation through higher education practices.

Students value:

- **Engaging in cross-boundary learning experiences.** Students perceive they have learned the most through their engagement in-between disciplines, in-between academic and societal perspectives, and in-between cultures. They were positively challenged by the diversity in viewpoints and perspectives when discussing issues and dilemmas. Listening to other perspectives especially enabled students to enlarge their own perspective and to get a more comprehensive understanding of the issues they were working on.
- **Working on real life issues and ethical dilemmas.** Students positively perceive their involvement in challenges and dilemmas that have a real relevance in society. Applying knowledge and ethical considerations into real cases, conducting research activities in a real context, and engaging in real tasks has made the students learning process tangible, rather than abstract, and supported the concrete development of students personal, professional and ethical capacities.
- **Collaborating with others.** Students appreciate working with others towards a common objective, for example by collaboratively addressing a specific challenge in society through a research project. Though this, they learned to cultivate social attitudes and develop relational skills. In some cases they learned to conciliate different interests, while in others they learned how complex is to handle a conflict or divergence in viewpoints.

Students struggle with:

- **Actively participating in the learning process and activities.** Implementing the EnRRICH principles requires a shift, on the student side, from being a receiver of knowledge by for example "sitting down and reading a power point" (as indicated by one student), to being a participant in a real context, with real challenges and with real actors. Although active participation in the learning process was highly appreciated by the majority of the students, some other felt disoriented, intimidated or even overwhelmed. Those students felt pushed beyond their comfort zone, and did not know how to handle the learning process, because this active way of learning was new to them. It is crucial in those cases to offer support to those students so that they can learn how to navigate more complex and engaged learning environments. For example, it can be helpful to organize curricula in such a way that students can receive guidance when needed, and gradually develop a sense of stewardship and build their capacities to handle more emancipatory and collaborative learning processes.

Educators highlight the relevance of:

- **Dedicated teachers & supportive organizational arrangements.** While the success in implementing responsible educational design and pedagogies depends on various factors, it is the combination of committed teachers on one side, and conducive organizational factors on the other that appears very powerful. Embedding the EnRRICH principles in higher education would not be possible without committed teachers that are willing and capable to initiate, experiment with and embed cross-boundary, reflexive and responsive learning environments and pedagogies, beyond conventional and mono-disciplinary classroom approaches. At the same time, the development of institutional policies that allow for flexibility and experimentation within curricula, and of rewards that acknowledge the relevance of more responsible forms of education, play a major role in encouraging a culture of responsibility through higher education. Especially, the development of institutional arrangements that translates societal needs into research projects and creates a link between students, academia and society is of crucial importance. An example of a successful model is the Science Shops. An explanatory note about the role of Science Shops in fostering the EnRRICH principles is provided in the next page.

Science Shops as an example of organizational arrangements conducive to Responsible Higher Education

Science Shops are units providing independent, participatory research support in response to concerns experienced by civil society organisations (<http://www.livingknowledge.org/>) the majority of cases Science Shops are part of a university, in other cases they can also be independent Non-Governmental Organisations (NGOs). Research is usually provided free of charge, normally by assigning it to students who undertake the research as part of their degree programmes with the support of academics. By bringing current societal issues to the attention of university students and by letting the students address the issues at hands, Science Shops can help embed an *education for society* principle in higher education. Through their participatory working ethos, and by engaging students in collaborative research efforts with academics and communities or organizations in societies, Science Shops can also support the embedding of an *education with society* principle. While Science Shops are not directly engaged in shaping pedagogical aspects and the learning process of the students within curricula, they can indirectly support a *whole persons education*. Students participating in Science Shop projects are offered the opportunity to learn to apply scientific knowledge and can engage in transdisciplinary problem solving (*learning to know*), they can learn to collaborate with others and develop social attitudes (*learning to be*), they can learn to communicate and present their findings within academic and societal contexts (*learning to do*). This in turn could provide the conditions for fostering the cultivation of appropriate *RRI competencies*.

Acknowledgments

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