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NEW PERSPECTIVES in SCIENCE EDUCATION


Science Education as a Trigger to Attain Responsible Research and Innovation (RRI) in Biosciences

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Abstract

STARBIOS 2 (Structural Transformation to Attain Responsible BioSciences) is an European project in the program HORIZON 2020, coordinated by the University Tor Vergata at Rome (Italy). The project wants to contribute to the advancement of the European Responsible Research and Innovation (RRI) strategy by promoting Action Plans (APs) in six European Universities ohented to attain a RRI structural change in research institutions and developing 3 further APs in non-european entities, all active in the field of biosciences.

The Institute of Science Education at the University of Bremen is one of the Partners in this four-years-lasting project. It triggers the structural change process in respect to RRI at the Faculty Biology and Chemistry. Therefore, the science educators developed a complex Action Plan (AP) aiming in the promotion of sensitiveness, awareness and structural change regarding the five RRI keys "Societal Engagement", "Education", "Gender", "Open Access", and "Ethics".

One of the major hubs in this change process is the Graduate School NanoCompetence which links researchers and students of natural sciences and social sciences with the goal to support research, application and communication in the field of nanoparticles and their effect on humans and the environment. A further hub to foster societal engagement through education is the public science educational lab Backstage Science (basci). Here the science educators offer an environment for inquiry-based teaching and learning (basci lab) and a discussion forum for researchers and the interested teachers and schools (basci talks).

The science educators will closely cooperate with the faculty-intern Quality Management and Control Group to integrate subject- specific RRI content in the broader institutional structure. The goal is to negotiate and to implement a RRI mission statement at the Faculty Biology.

The complex Action Plan of the Science Education Institute of the University Bremen and its first steps of implementation will be presented and discussed at the NPSE Conference in Florence.

1. The European project STARBIOS 2

STARBIOS 2 (Structural Transformation to Attain Responsible BioSciences) is a European project funded from the Framework Programme for Research and Innovation HORIZON 2020 under Grant Agreement No 709517.

The project aims at activating structural processes in six European and three non European research institutions in a holistic manner with five key issues:

- Societal Engagement: Promoting the engagement of all the societal actors in the Research and Innovation process.
- Education: Providing future researchers with new capacities for attracting children and youth to maths, science, and technology.
- Gender: Favouring gender equality within research institutions as well as Research and Innovation content.
- Open Access: Making research and innovation transparent and accessible through making Open Access a reality.
- Ethics: Ensuring high quality research results using fundamental rights and ethical standards.

The STARBIOS 2 project (http://www.starbios2.eu) contributes to the advancement of the Responsible Research and Innovation (RRI) strategy by fostering structural change in research institutions to cope

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with one of the main risks for European research: its inadequate connection with society. Therefore, it is important to identify multiple RRI strategies tailored to each research sector as each disciplinary community is characterised by its own features, culture, languages, networks and associations, communication means and power dynamics. In the context of the EC policies, structural change refers to profound modifications of universities and research organisations and is characterised by the main features irreversibility, comprehensiveness, inclusiveness and contextualisation. [1]
The STARBIOS 2 project emphases three interconnected objectives to promote RRI structural change in biosciences research institutions [2]:

1) **Design and implement Action Plans** (APs) to attain RRI structural change in the participating institutions. The APs form the base to generate new practical knowledge.
2) **Learning process** to facilitate RRI implementation.
3) **Guidelines RRI models** to provide Biosciences Departments with formalised orientations and practical knowledge

In the **Starbios2 Core Team** six partner institutes from European countries (Italy; University Bremen, Germany; Bulgaria; UK; Slovenia; Poland) and three partner institutes from non-European countries (Brazil; South Africa; USA) work together. They are supported by three further European partner institutions for monitoring and assessment (Aarhus University, Denmark), technical assistance for APs (Labaratorio di Scienze della Cittadinanza, Italy), and for communication and dissemination (Sparks & Co, France). The coordinator of the STARBIOS 2 project is the Universita di Roma Tor Vergata, Italy. The University Bremen is one of the Partners.

2. RRI Action Plan of the University Bremen, Germany

The Action Plan (AP) of the University Bremen focuses on the structural change concerning RRI in the Faculty 2 -Biology and Chemistry. Therefore, the main focus will be the negotiation of RRI issues at the faculty level (stakeholders, researchers, students) to promote sensitiveness, awareness and structural change regarding the RRI keys Societal Engagement, Education, Gender, Open Access and Ethics.
One of the major hubs will be the Graduate School NanoCompetence which links researchers and students of natural sciences and social sciences with the goal to support research, application and communication in the field of nanoparticles and their effect on humans and the environment. Societal engagement and technology transfer is one of the key issues of the Graduate School NanoCompetence.
Education as an instrument for raising awareness is our main line in order to initiate practicing and training RRI issues. We promote RRI issues as a common shared frame for PhD theses. A further important hub to foster societal engagement through education is the public science educational lab Backstage Science (basci). Here we offer an environment for inquiry-based teaching and learning (within the basci lab) and a discussion forum for researchers and the public (the so-called basci talks).
We will closely cooperate with the faculty-intern Quality Management and Control Group to integrate subject- specific RRI content in the broader institutional structure. Our goal is to negotiate and to implement a RRI mission statement at the Faculty 2. In this context we focus on gender sensitiveness by offering mentoring and a female career friendly research environment. Open access to research findings by offering websites and events such as poster awards for different communities, and raising awareness for ethics by updating and reconstructing ethical research guidelines are our further goals.

2.1 Underlying considerations for the Development of the Streams of Actions (SoAs)

Streams of Actions (SoA) are main thematic elements of the AP. They describe the premise based on the needs of the Faculty, the specific function within the project, the planned actions (design actions, implementation actions, reporting and follow up actions), and the expected outcomes in terms of structural change.
To put our AP into practice we developed eight Streams of Actions (SoAs)

A. Setting up criteria for successful societal engagement and technology transfer
B. Promoting societal engagement through socio-scientific contextualization
C. Education to raise the awareness of RRI Keys
D. Raising awareness of gender issues
E. Raising awareness of ethical issues
F. Promotion of open access
H. Making a RRI Mission Statement at faculty level possible
G. RRI AP management and periodic revision

2.2 The key-specific Streams of Actions A, B, C, D, E, F

The SoAs A (societal engagement and technology transfer), B (societal engagement and contextualization), D (gender issues), E (ethical issues), and F (open access) are RRI key specific SoAs. Our underlying considerations for the development of these SoAs are summarized in Figure 1.

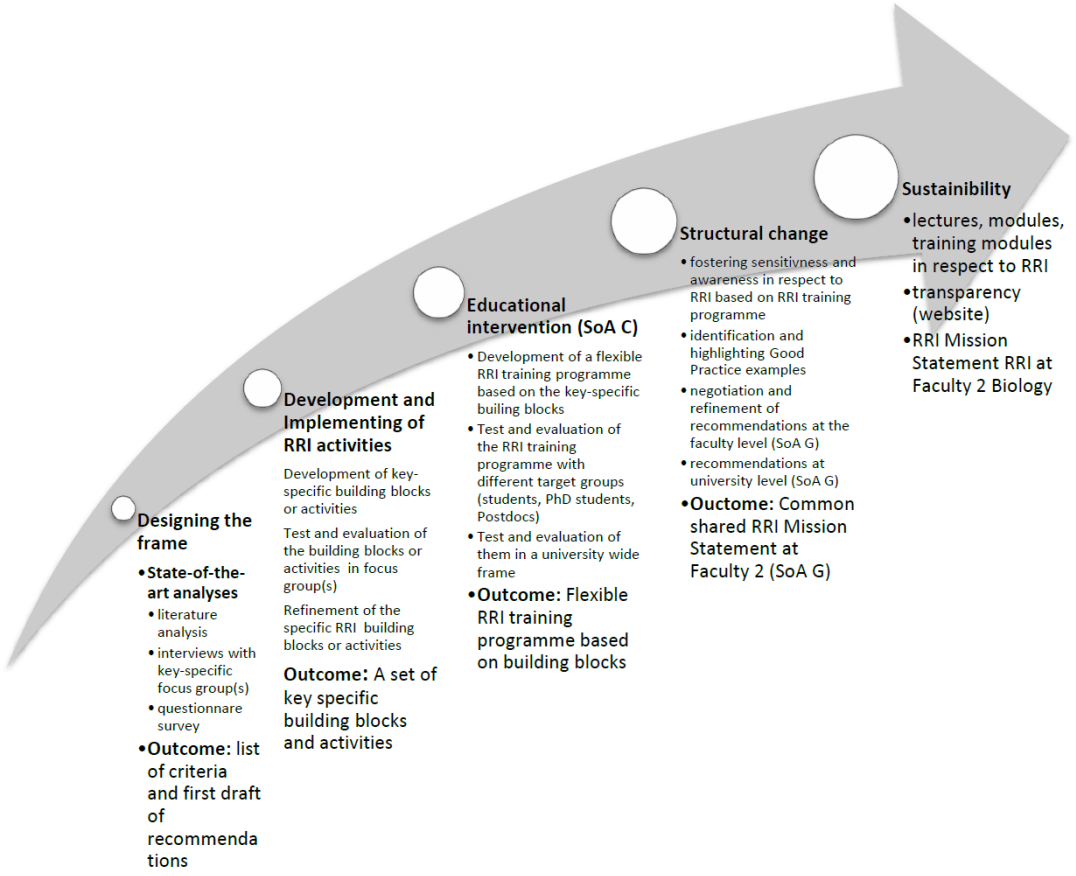

Figure 2. Scheme of the development of the Streams of Actions (SoAs) A, B, D, E, F and the training elements of SoA C (Education)

- **Step 1.** We start each SoA with a comprehensive **state-of-the-art analysis**. This comprises a complex literature analysis of research programmes. The findings of the analysis build the basis for the development of theoretical framework to analyse research projects (SoA A) or to develop interview guidelines (SoA B, D, E, F). The interviews are conducted with different focus group(s) (PhD students, Postdocs, students, researchers, and/or educators). The interview results form the basis for the development of questionnaires. Target groups for the questionnaire survey are students, PhD students, Postdocs and researchers.
  Outcome: From the findings of the interviews and the questionnaires we deduce key-specific lists of criteria for the successful promotion of the specific RRI issue. These lists form the basis for a first draft of recommendations (see SoA G – Mission Statement) and for step 2.

- **Step 2.** The **RRI implementation** comprises the development of RRI building blocks and activities for the keys Societal Engagement, Technology Transfer, Gender, Ethics, and Open Access. These building blocks and activities will be tested and evaluated within different focus groups in dependence of the specific goal of the SoA.
  Outcome: A set of RRI key-specific building blocks. They form the basis for the educational intervention at step 3.

- **Step 3.** The goal of the **educational intervention** (SoA C Education) is the connection of the key-specific building blocks to an academic RRI training programme (see Figure 2). The RRI programme will be offered at Faculty 2 for students, PhD students and Postdocs, and (in the second project period) university-wide at the promotion centre. The RRI programme will be evaluated, the results will contribute to a further development of the RRI recommendations and the RRI Mission Statement of the Faculty (SoA G – Mission Statement)
  Outcome: Flexible academic RRI training programme for different target groups.

- **Step 4.** The evaluation of the RRI buildings blocks are the basis for the actions for **structural change**. We will foster sensitiveness and awareness in respect to RRI through dialog with important stakeholder, offer academic lectures and round tables, highlight transparency and offer an user-friendly website, good practice examples, and recommendations at the faculty level and at the university level.
  Outcome: Mission Statement at Faculty 2

- **Step 5.** For the **sustainability** of STARBIOS2 outcome we will implement RRI training modules and building blocks in the study programme and will continue our work in the up-dating of the RRI Mission Statement at Faculty 2 Biology/Chemistry (SoA H).

2.3 The transversal Stream of Actions C (Education)

SoA C "Education to raise the awareness of RRI" is transversal to the key-specific SoAs A, B, D, E, and F. It comprises the following goals:

- **Academic educational training programme on RRI:** Capacities improvement on RRI-related issues by developing an RRI educational training programme based on the building blocks (societal engagement and technology transfer, gender, ethics and open access) which are developed in the SoAs A, B, D, E, F. Figure 2 gives an overview about these educational building blocks which form the basis for the RRI educational training programme.

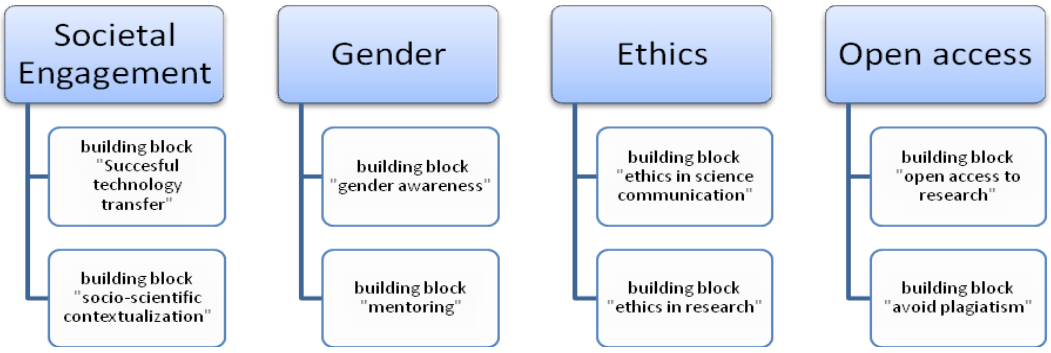

Figure 3. Key-specific building blocks that form the RRI educational training program (SoA C – Education)

2.4 The transversal Stream of Actions G (Mission Statement)

SoA G (Making a RRI Mission Statement at faculty level possible) is characterized by umbrella activities which comprises all other key-specific SoAs. It aims at the development of a RRI Mission Statement at Faculty 2 by involving all important stakeholders. SoA G comprises the following tasks:

- Setting up criteria for a RRI Mission Statement based on experiences and findings of the key-specific SoAs
- Negotiation of these criteria with different target groups (work group leaders and professors, researchers, PhD-students and students)

- Defining recommendations based on the RRI keys and periodic negotiation with the members of the deanery
- Summarizing the RRI recommendations in a RRI Mission statement (draft)
- Negotiation with representatives of the rectorate
- Refinement and revision of the Mission Statement
- RRI Mission statement for Faculty 2 (final)
- RRI Mission Statement gets part of the Sustainability Plan

3. Next steps

In November 2016 we started to put our Action Plan into practice. Our first steps were the development of RRI specific interview guidelines. The interviews will be conducted with students, PhD students and young researchers, and researchers and group leaders in spring 2017.

References

[1] European Commission (2012). *Responsible Research and Innovation. Europe´s Ability to respond to societal challenges,* European Union, Bruessels
[2] STARBIOS 2 Consortium (2017). Flyer, Paris: Sparks & Co.
[3] Elster, D. (2016). Deliverable 5.1. - *Action Plan Partner University Bremen*, EC.