Training Programmes Design (WP3)

D3.2 Training Programmes

HEIRRI

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Abbreviations

AU	Aarhus University
DOW	Description of Work
ECTS	European Credit Transfer System
HEI	higher education institution
IBL	inquiry-based learning
IHS	Institute for Advanced Studies, Vienna
ILDE	Integrated Learning Design Environment
LO	learning outcome
MOOC	Massive Open Online Courses
OA	Open Access
PBL	problem-based learning
R&D&I	research, development, and innovation
R&I	research and innovation
RRI	Responsible Research and Innovation
UiB	University of Bergen
UNIST	University of Split
UPF	Pompeu Fabra University
WP	work package

HEIRRI

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Deliverable 3.2
Training Programmes

Authored by Alexander Lang, Marlene Altenhofer, Milena Wuketich, Erich Griessler and the HEIRRI consortium

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0. About HEIRRI

Responsible Research and Innovation (RRI) is a transformative emerging principle of research and innovation policy. The RRI concept emerges from scholarly research that is critical of the status quo of the science-society interface. The aim of the HEIRRI project (Higher Education Institutions and Responsible Research and Innovation) is to start the integration of RRI into the formal and informal education of future scientists, engineers, and other professionals involved in the research, development, and innovation (R&D&I) process.

HEIRRI wants to stress the potential of RRI as a transformative, critical, and radical concept. However, the project also takes into account the six RRI "key aspects" identified by the European Commission (public engagement, gender equality, open access, science education, ethics, and governance in research and innovation). HEIRRI has created and shared a stock-taking inventory constituted by a State of the Art Review and a Data Base on an open access (OA) basis. The inventory gathers results of other EU funded RRI projects, good cases, and practices of RRI and RRI learning. Also, different stakeholders involved and/or affected by R&I have participate in a debate and reflection process on RRI learning through online and offline Forum actions.

Results from the inventory represent the basis for RRI Training programs and formative materials, offering students knowledge and skills to develop viable solutions to specific problems related to R&I, integrating theory and practice. They are designed for different HEI educational levels (undergraduate, Master and PhD, summer courses, and Massive Open Online Courses (MOOC)), mainly based on Problem Based Learning methodology, and supported by multimedia materials (videos and microvideos, 2.0 materials, etc.). All results and products elaborated by HEIRRI will be uploaded in open access at the RRI Tools platform [1].

An internationalisation plan guarantees the spreading and future use of the HEIRRI materials by HEIs from Europe and beyond. A global scope and expertise on RRI is provided by the HEIRRI consortium consisting of Pompeu Fabra University (UPF), University of Bergen (UiB), Aarhus University (AU), University of Split (UNIST), the Institute for Advanced Studies (IHS), the European network of science centres and museums (AEESTI/Ecsite), "la Caixa" Foundation (FBLC), a network of universities (Catalan Association of Public Universities, ACUP, who chairs the Global University Network for Innovation, GUNi), and a private company specialised in R&I (Innovatec).

[1] https://www.rri-tools.eu

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1. About HEIRRI Deliverable 3.2 Training Programmes

This deliverable outlines the development process of the HEIRRI training programmes in detail. If you are mainly interested in using the HEIRRI training programmes for teaching RRI in your own higher education institution (HEI) you can find the training programmes and a practical guidance on how to use them in the last part of the deliverable. The latest version of the training programmes as well as training materials to be used in the programmes can also be found in the HEIRRI section of the RRI Tools website (https://www.rri-tools.eu) and the HEIRRI website (http://heirri.eu).

HEIRRI Deliverable 3.2 "Training Programmes" describes the implementation and findings of the process of developing the HEIRRI training programmes as well as the training programmes themselves as final output. The development process was implemented based on the "Training Program Design Guide of Work" (Lang et al., 2016); however, some modifications have been necessary. In the following deliberations, the reasons and impacts of these adaptations will be described. In another report available, HEIRRI Deliverable 3.3 "Accreditation and Qualification System Report", the process of adapting the training programmes to European and other qualification systems are described in depth.

The deliverable at hand will

- first, give an overview of HEIRRI's approach to designing training programmes for teaching and learning RRI in higher education and outline the different steps of the development process consisting of four closely interrelated steps in detail;
- second, present key findings from the HEIRRI development process, and especially the insights from consulted higher education stakeholders as well as the main conclusions for the final design of the training programmes;
- and third, give an overview of the ten final training programmes for teaching RRI, of further accompanying documents, and then presents each individual training programme.

Since it is possible that individual training programmes undergo some modification after submission of the deliverable at hand (February 2017), e.g. in the process of testing and evaluating them through the HEIRRI pilot experiences, it is advised to visit the HEIRRI section on the RRI Tools website for information on updates and revisions of training materials in case you want to use them.

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2. Developing the HEIRRI Training Programmes

The HEIRRI project started with the objective of developing RRI training programmes suitable for different HEIs, different national contexts, different audiences including bachelor's, master's, and PhD students as well as other actors related to R&I. In the HEIRRI project, higher education training programmes for RRI are understood as courses in typical formats for higher education contexts, aiming to support the course participants acquiring knowledge and developing skills with regards to RRI. They should know about the relevance, concepts, and ideas of RRI, and should be trained to critically reflect R&I developments and systems as well as to incorporate ideas of RRI into their own practice. The HEIRRI training programmes are design outlines for different types of courses to be conducted in various higher education settings. They provide the information necessary to integrate such a course into higher education study programmes, as for example learning outcomes, teaching and learning methods, course content, assessment methods, and ECTS credits awarded on completion. Furthermore, each training programme outlines the structure and implementation in more detail giving information on how the course could be conducted. They are intended to be used as an inspiration for higher education teachers or others who want to set up and conduct a course or training on RRI in higher education contexts or elsewhere.

One initial assumption in developing RRI training programmes was that although RRI as a concept might not have been taught at universities yet, other theories, concepts, and practices that are addressing certain aspects of RRI, are closely related to the idea of RRI, or such that have preceded RRI have been taught to students for decades.[2] HEIRRI wanted to draw on these experiences and empirically identify how RRI-related topics and issues can be taught in a meaningful way that promotes the ideas of RRI. The development process should also consider and put into practice one key aspect of RRI, the active and significant involvement of societal actors in research, innovation, and development processes. Actors potentially affected and/or using the HEIRRI training programmes thus had the opportunity to actively express their needs, demands, and wishes regarding the design of the programmes.

Furthermore, it was important to identify potential challenges and barriers for integrating RRI into different higher education contexts and to find ways how to practically deal with them. If the HEIRRI training programmes would not "speak" to the conditions in which they should be used, then the probability for them to be implemented would decrease. Or, if implemented, course instructors and students might get frustrated because the design would produce troubling interferences with the given institutional conditions. Through including stakeholders from different HEIs, these contextual factors should be considered in the first place, thus already when designing the training programmes.

[2] This assumptions was later underpinned by the findings of HEIRRI WP2 as well as first consultation with stakeholders in WP3.

One aspect of this compatibility was that the training programmes did not only have to be adapted to the needs of individual HEIs and contexts, but also to that of different accreditation and qualification systems. Therefore, the structure and content of the training programmes were also designed and further revised according to the requirements of official higher education accreditation systems.

Considering these aspects, the development of the HEIRRI training programmes was designed and conducted in four closely interrelated phases:

- First, the findings of HEIRRI WP2, the "stock taking and inventorying" of existing practices of teaching and learning RRI, were reviewed. The insights of this work laid one basis for subsequent stakeholder interviews and workshops. Furthermore, approaches and practices selected for the HEIRRI database, an inventory of new and existing practices of teaching and learning RRI, were also used as an inspiration for designing the HEIRRI training programmes, especially regarding their teaching and learning methods.
- Second, interviews and then two workshops with Austrian-based higher education stakeholders were conducted by the HEIRRI team from the Institute for Advanced Studies in Vienna (IHS). The participating stakeholders gave insights into their experiences in teaching RRI or similar topics in higher education, discussed these experiences, and worked together with the HEIRRI team to identify appropriate and meaningful ways of teaching RRI in higher education. In the time between the two workshops, the HEIRRI team developed first drafts of the HEIRRI training programmes, shared and discussed them within the HEIRRI consortium, and then put them up for discussion and further refinement in the second stakeholder workshop in Austria. After the second workshop, the drafts were again modified, further developed, and new ones produced.
- Third, the draft training programmes were reviewed and discussed in an international consolidation phase. Pompeu Fabra University (UPF), University of Bergen (UiB), Aarhus University (AU), and University of Split (UNIST) organised and conducted stakeholder workshops to discuss these draft training programmes with HEI stakeholders from their own institutions and countries. These workshops provided further valuable insights and proposals on how to further modify the training programmes in order to make them align with different higher education contexts. Furthermore, the draft training programmes were shared with the three HEIRRI Advisory Boards and the HEIRRI Forum Online. The members of these groups were asked to give feedback on the training programmes as a whole and on different aspects of individual training programmes. The comments and feedback from the international consolidation phase were systematically collected and used in the last phase of the development process.
- Fourth, the draft training programmes were again revisited by the IHS team in light of results of the international consolidation and with specific focus on the requirements of different accreditation and qualification systems.

The designs and implementations of these steps will be described in detail in the following sections of this deliverable. The insights and findings of all of these different steps contributed to and guided the development of the HEIRRI training programmes.

In parallel, work to guarantee that the HEIRRI training programmes are in line with the quality and accreditation standards according to the European Credit Transfer System (ECTS) and similar international accreditation frameworks had been conducted (for more information see HEIRRI Deliverable 3.3).

2.1 Use of WP2 stock taking

The development of the HEIRRI training programmes started with making use of the findings of HEIRRI WP2's efforts to identify existing good practices with regards to teaching RRI in higher education. The key findings of this task were used as an initial input for the further co-construction process, the stakeholder workshops and the development of the draft training programmes.

The findings of WP2 are based on an extensive literature review (policy documents, academic papers, results from EU projects on RRI), expert interviews, consultation of the Advisory Boards and the broader communities, as well as input from the 1st HEIRRI Conference[3]; more information on the review process and the data collected, produced, and analysed can be found in HEIRRI Deliverable D2.2 (Mejlgaard et al., 2016a). The HEIRRI database provides a purposeful selection and analysis of useful and appropriate documents and articles on teaching and learning RRI and related aspects (Mejlgaard et al., 2016b). These did not only inspire the further development process (e.g. as input for stakeholder workshops), but also the final HEIRRI training programmes.

Mejlgaard et al. emphasise that although it is important to know some basic facts about RRI as a concept, it is even more important to "enhance students' understanding and ability for continuous critical questioning of what constitutes good practices *within* their respective disciplines or fields of research" (Mejlgaard et al., 2016a, p. 19). Thus, the HEIRRI training programmes should enable and encourage "critical reflection".

In line with the above described insight that teaching RRI can have different meanings, the objectives of RRI training programmes and their respective learning outcomes differ. RRI training programmes thus could aim to convey different things:

- Teaching the concept(s) of and policies related to RRI. The learning outcome in this context would be awareness of and knowledge about the existence of different definitions of and policies related to RRI as well as their relevance.

[3] http://heirri.eu/1st-heirri-conference/

- Teaching the theoretical and empirical basis of RRI through presenting and discussing "critical theories and studies about the interface between science and society" (Mejlgaard et al., 2016a, p. 38). This approach goes beyond the notion of RRI and conveys a "deeper understanding of the interdependencies of science and society" (Mejlgaard et al., 2016a, p. 38).
- Teaching ways how to influence R&I processes and trajectories towards being more responsible.
- Teaching ways how students could practice RRI themselves.

Central learning outcome identified – irrespective of the different above outlined aims of RRI training programmes – are that students should learn

- to "critically examine their own academic domain, its relation to other areas of research and innovation, and its position and role to society at large" (Mejlgaard et al., 2016a, p. 39);
- reflection skills and critical thinking;
- and to "combine insights from different domains in order to understand the interrelatedness of science and society" (Mejlgaard et al., 2016a, p. 39).

2.2 Stakeholder interviews and workshops in Austria

Initially, the design of HEIRRI WP3 (Lang et al., 2016) envisaged a series of four workshops on teaching and learning RRI with various HEI stakeholders. However, because of scheduling conflicts, it was decided that instead of four half-day workshops, qualitative interviews with all participants, one full-day workshop as well as one half-day workshop would be conducted (see Table 1).

Table 1: Adaptation of work plan

Initial work plan	Adapted work plan
1. Workshop (1/2 day): mid-May 2016 – Experiences with teaching RRI	Interviews with workshop participants: May and June 2016 – Experiences with teaching RRI
2. Workshop (1/2 day): early June 2016 – Conditions of teaching RRI in HEIs	1. Workshop (full day): 15 June 2016 – Experiences with teaching RRI and development of RRI training programmes
3. Workshop (1/2 day): late June 2016 – Drafting RRI training programmes I	
4. Workshop (1/2 day): early September 2016 – Drafting RRI training programmes II	2. Workshop (1/2 day): 8 September 2016 – Drafting RRI training programmes II

Key criterion for the selection of participants was that they had experience with teaching or learning RRI or related aspects (ethics, gender equality, open access, public engagement, science communication, etc.) in higher education. Furthermore, participants should cover a broad range of disciplines, positions, and aspects of RRI. The organising team recruited a total of 15 participants for

the stakeholder workshop series. Stakeholders included teachers with experience in teaching RRI-related subjects to different audiences in higher education and other contexts, study programme coordinators, students, members of committees dealing with RRI-related issues, and researchers of RRI. They had different disciplinary and professional backgrounds and worked in a variety of different HEIs in Austria.

2.2.1 Stakeholder interviews

The stakeholder interviews were conducted in order to collect experiences of different stakeholders regarding RRI teaching and learning. They were asked about their own experiences in teaching and designing courses, and about possibilities and challenges regarding teaching RRI and implementing it in HEIs.

The interviews were designed as semi-structured interviews, thus a set of questions revolving around certain topics was predefined, but at the same time the questions were open enough to allow the stakeholders to freely talk about their experiences and ideas with teaching RRI (see Table 2).

Table 2: Interview topics

1. Experiences with teaching RRI in higher education: goals and learning outcomes, target audiences, content, teaching methods, and course design.
2. Possibilities, limitations and barriers considering teaching RRI:
    a. Teaching: What works, what does not? Goal attainment, impact on students, feedback from students.
    b. Structural and institutional context: integration into study programme/curriculum, institutional resources and limitations, possibilities for desired implementation.
3. Ideas and suggestions for meaningfully teaching RRI: ideal ways of teaching RRI in higher education, necessary resources and support to improve teaching RRI.

In late May and early June 2016, 13 interviews with workshop participants were conducted; in two cases, it was not possible to schedule an interview with later workshop participants. The interviews took place either at the offices of the interviewees or at the IHS and they lasted between 30 and 60 minutes each. Interviews were recorded (audio) and protocols covering the key aspects were produced.

The semi-structured qualitative approach of the interviews gave the stakeholders the opportunity to freely talk about their experiences with teaching RRI in higher education, to make aware of challenges in this regard as well as to think about future possibilities to improve teaching RRI and the necessary resources to do so. Several good practice examples of teaching and learning RRI-related issues could be identified. Furthermore, information on possible barriers and challenges in teaching RRI in higher education were gathered and analysed. The findings of the interviews were then presented in the first

stakeholder workshop and provided the basis for further discussion and the development of the first drafts of training programmes.

The interviewed stakeholders reported on a variety of higher education courses dealing with RRI issues they have given in the last years or even decades. Some of these courses have taken place on a regular basis, some have been discontinued after a while, and some were only given once. Concepts of RRI have not been subject of any course yet. However, there have been courses dealing with different aspects of RRI (gender, open access, etc.) or the science–society relationship in general. The interviewees identified appropriate teaching and learning methods for dealing with issues of RRI, often in line with inquiry-based or problem-based learning approaches. They deliberated on their experiences in teaching RRI-related issues to different higher education audiences, and how they dealt with certain challenges they had to face with regards to students, but also regarding their higher education institution.

2.2.2 Stakeholder workshops in Austria

The first stakeholder workshop, which took place at the IHS on 15 June 2016 from 09:00–16:00, started with a short introduction to the HEIRRI project. The HEIRRI team and the overall objective and approach of the project were described as well as the co-development process and the role of the stakeholder workshops. After a round of introduction of all participants, the insights from the preliminary interviews were presented and discussed in the plenary.

In the following two sessions, the workshop participants were asked to gather in small groups and develop ideas and approaches on how to teach RRI. They had to think about objectives, teaching methods, course designs, and how these could be linked with individual prerequisites of different audiences. Participants were asked to write down their ideas and concepts on flip charts. After each session, their findings were presented and discussed in the plenary. In the final session, there were two rounds of discussion: First, participants debated on the draft programmes. Then, before closing the workshop, participants identified the most central aspects and findings upon which the HEIRRI project should further investigate.

After the first stakeholder workshop, an internal report describing the organisation and main findings of the stakeholder interviews as well as the workshop was produced and sent to the HEIRRI consortium as well as the workshop participants. Based on the insights from WP2, the stakeholder interviews, and the first workshop, the first six preliminary HEIRRI training programmes were drafted. These drafts were aligned with the HEIRRI training programme template developed previously (see HEIRRI D3.3 for details) and included first designs of training programmes for different audiences. The first drafts were shared with the consortium and provided the main input for the second stakeholder workshop.

The second stakeholder workshop took place at the IHS on 8 September 2016 from 12:45–17:00. In advance of the workshop, the participants received the draft training programmes. The workshop started with a short recap of the objective of the HEIRRI project and its progress. Then, the first six draft training programmes were briefly presented. In the following sessions, the workshop participants discussed the training programmes' approaches in the plenary. In the last session, participants were asked to highlight the most important aspects they have heard throughout the workshop.

The discussions and work in the second stakeholder workshop laid the basis for the next development step: the six existing drafts were revised according to the feedback received from the stakeholder participants, and four further training programmes were produced. In early October 2016, the drafts were sent out to the HEIRRI consortium to be used in the next phase of development, the international consolidation. Furthermore, the training programme drafts were shared with the stakeholder participants as well as the three HEIRRI Advisory Boards, asking for comments and feedback.

2.3 International consolidation

Given the dissimilarities of national higher education systems, institutions, cultures, etc. it was important to further develop the preliminary training programmes. As outlined above, the programmes were drafted based on the state of the art review of WP2 and the findings from the Austrian co-construction stakeholder workshops and interviews, and thus might have neglected needs from other institutional and national contexts. The international consolidation phase aimed to make the training programmes better compatible with these needs.

Four international consolidation workshops or other formats to consult with HEI stakeholders were organised in different countries and settings. UPF, UiB, UNIST, and AU invited HEI stakeholders from their respective national contexts to comment and give feedback on the draft training programmes.

Table 3: International consolidation workshops

Organiser of consultation	Date of consultation	Number of participants
Aarhus University	12 December 2016	6 (+1 written feedback)
University of Split	November and December 2016	7
University of Bergen	16 December 2016	5
Pompeu Fabra University	16 December 2016	12

Beyond these face-to-face consultation activities, the draft HEIRRI training programmes were sent out to the three HEIRRI Advisory Boards, the Multidisciplinary Contents Council (MCC), the Business & Entrepreneurship Advisory Board (BEAB), and the Science Communication & Internationalization Advisory Board (SCIAB). Thus, the draft programmes were shared with another 18 experts from

different national and professional contexts. From this consultation we received valuable and diverse feedback for the further development and finalisation of the training programmes.

For the different international consolidation activities, a common feedback template was developed to systematically gather the comments by different experts and stakeholders. This template provided guiding questions on the training programmes as a whole as well as on individual training programmes (see Table 4 for guiding questions). The feedback from the international consolidation process was gathered until January 2017.

Table 4: International consolidation feedback template

Training programmes as a whole • Are there any types of training programmes missing? If yes: which ones? • Does the programme template comprise all information necessary to implement the programmes? If not: what kind of information is missing? • Other comments. **Individual training programmes** • Is the overall design comprehensive and coherent? If no: why? • Is the design suitable for teaching RRI-related issues? If no: why? • Are there any important topics or aspects of RRI missing? If yes: which ones? • Are the teaching methods appropriate for teaching and learning RRI? If no: why? • Are there better/other teaching and learning methods you would recommend? If yes: which ones? • Are there any specific elements that need further elaboration? If yes: which ones and in what respect? • Are there any factors regarding the design of the training programmes that could hinder the implementation/integration into HEIs? If yes: which ones?

2.4 Finalisation of the training programmes

The HEIRRI training programme drafts were revisited, adapted, and further developed in January and February 2017. In this last step of the development process, the input from the international consolidation process was used to finalise the draft training programmes.

At the end of the international consolidation phase, the comments and feedback from the various international HEI stakeholders were categorised and systematised in a working document: it was regrouped in feedback on individual training programmes and in more general comments concerning multiple/all of the programmes. This working document was shared and discussed within the team responsible for finalising the training programmes. Revised drafts were shared with other HEIRRI consortium members who provided again feedback and minor corrections to the programmes.

In the finalisation phase, the different draft training programmes were modified to various extents. While the designs of some training programmes were maintained in principle and only slightly changed (e.g. adding of some additional elements and better explanation of certain steps), other training

programmes were altered more comprehensively. The biggest change was to drop a training programme, a standalone lecture on RRI with bachelor's students as key audience. Possible end users of these programmes indicated, that a lecture on RRI of this scope would not be possible to implement in existing curricula. Instead of the standalone lecture, another training programme for bachelor students consisting of four independent modules dealing with RRI from different perspectives was further developed. The changes of the latter mentioned training programme includes a more detailed description of how it could also be used in form of a single course. Rather than a lecture for bachelor's students, stakeholders wanted to have an interactive training programme specifically designed for (future) secondary school teachers in order to enable them to initiate reflection and discussion on the relationships between science and society already in school[4].

Further reasons for the appearance and designs of the final HEIRRI training programmes and for specific design decisions are outlined in section 3 on the key insights from the co-construction process.

[4] The decision for a specific training programme for secondary school teachers was made in a late stage of the development process of the HEIRRI training programmes. Thus, it has not been possible to finish this programme in time and to include it in this report submitted end of February 2017. Once the training programme is ready, you can find it in the HEIRRI section of the RRI Tools website (https://www.rri-tools.eu).

3. Key insights from the co-construction process

The co-construction process described above brought forward a multitude of insights into the status quo of teaching RRI and related issues in higher education, into its possibilities and limitations as well as its desired future directions.

The findings and feedback gathered and used in the development process concerned the question how to teach RRI and related issues in a meaningful way. That means: how to set up and implement the learning process so that students understand what is at stake when dealing with RRI, that independent and critical thinking is promoted, and that they are trained to apply what they have learned in different R&I contexts. Thereby, the discussions and reflections in the interviews and workshops went beyond concrete designs for the means of teaching RRI in higher education. Stakeholders often addressed systemic and/or institutionalised challenges, barriers, and possibilities for teaching and learning RRI, e.g. the lack of institutional incentives for teaching and conducting RRI. Although these insights are valuable, it is out of the scope of the HEIRRI project to directly deal with them. Rather, HEIRRI built upon the experiences and wishes of the involved stakeholders to develop RRI training programmes that are useful for introducing RRI into higher education teaching and initiate a change on this level. With their design, they answer to the institutional and other requirements and limitations. Thus, they are better compatible and therefore might be easier implemented in different higher education contexts. HEIRRI did not aim to develop the perfect or ideal way to teach and learn RRI, but the best way possible given the existing resources and structures in higher education.

Below, selected key insights from the co-construction process as well as their implications for the HEIRRI training programmes will be outlined very briefly, before presenting the individual training programmes. The description is by no means exhaustive, but focuses on the main findings and feedback from the development process, which initiated the development of certain designs or significantly modified preliminary HEIRRI training programme proposals.

3.1 Training programmes: presentation and overall design

One specific challenge and opportunity in the co-development process proved to be the diversity of feedback: for example, some aspects highlighted by one consulted stakeholder were contradicted by the comment of another one. To deal with this heterogeneity, the final training programmes have rather flexible and open designs, proposing adaptation possibilities that might or might not be used depending on the available resources and existing requirements.

One common feedback from HEI stakeholders was that in the given situation, topics such as RRI do not have top priority in most study programmes. Although our informants stated that they would like to see that RRI is assessed as an important teaching and learning subject, they took up a pragmatic

stance. Most of them stated that it would not be possible to implement a very comprehensive course on RRI, e.g. awarding five or even ten ECTS credits. Rather, they needed to have compact and adaptable (e.g. a one-day workshop) that could be included in study programmes or individual courses more easily. Otherwise, they could not use it at all. Thus, the HEIRRI training programmes provide quite efficient designs to teach, learn, and reflect RRI in different higher education contexts. The final training programmes require relatively few in-class hours, have a limited workload, and award a smaller number of ECTS (between 0.5 and 2) compared to other courses in higher education. To especially account for already tense bachelor's study programmes, the HEIRRI training programme for bachelor's students features four separate and compact modules, which can be integrated into an existing course or into different lectures, seminars, workshops, etc. of a curriculum.

At the same time, consulted stakeholders highlighted that teaching and learning RRI might be more meaningful if students dealt with it more comprehensively and interactively. In some context and in the future, also longer and more demanding course designs might be possible. Therefore, adaptation possibilities were developed and added to the training programmes that would enhance them, but also be more demanding in terms of resources. An example for such adaptation possibilities is the suggestion to integrate a public engagement activity or more stakeholder involvement into the course.

Several of the consulted experts and stakeholders in the international consolidation phase demanded more comprehensive explanations of how the training programmes in general are supposed to be used and also more detailed descriptions of the different parts of the course as well as of individual teaching activities. Others wanted to have even shorter descriptions than in the initial drafts to highlight the freedom of those implementing the course to modify and adapt the training programme to their own needs. To meet both demands, the HEIRRI training programmes now give more precise instructions to give support for those who need them, and at the same time continuously encourage users to consider the training programmes as inspiration for their own programmes and not as a strict prescription. While at the beginning of developing the HEIRRI training programmes the programme template envisaged a brief introduction, a rather short description of the course design and implementation as well as of the syllabus, the final HEIRRI training programmes elaborate more on the course designs and describe different implementation steps and adaptation possibilities in more detail.

One further contribution to the magnitude of the training programmes was that consulted experts called for a more transparent alignment of learning outcomes, teaching and learning methods, and assessment methods. Responding to this demand, each HEIRRI training programme indicates the relationship between different parts/activities of the course and the learning outcomes identified in the introduction to the course and the syllabus. Furthermore, the assessment methods are highlighted.

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3.2 Audience

The HEIRRI project initially aimed to develop training programmes on RRI for different higher education levels, for bachelor's, master's, and PhD students as well as other actors and stakeholders with relation to R&I. The HEIRRI training programmes succeeded in doing this, but also went beyond that.

Through the literature review and stakeholder consultations it became clear that RRI is not a well-known concept among researchers and higher education teachers yet. Higher education teachers need training themselves on how to teach RRI. Different stakeholders also made a strong case for developing train-the-trainer programmes: Teachers would have to become aware of RRI first in order to start thinking about conducting an RRI training programme themselves. For this purpose, we developed two train-the-trainer programmes (an online course and a one-day workshop) on teaching RRI, which are adapted to the needs of people working and teaching within HEIs.

Several of the invited stakeholders also highlighted another important issue: the reflection on the science–society relationship, the embedding of R&I as well as the responsibility of R&I should not only start in higher education. Already in secondary school (or even earlier), pupils should learn what research and innovation are and how they can affect society. Thus, in order to better enable secondary school teachers to promote reflection on RRI in school, one training programme was developed which especially addresses future secondary school teachers.

The consulted stakeholders and experts advised to teach and learn about RRI in inter- and transdisciplinary courses. Students from different fields as well as societal stakeholders should come together to learn about and reflect on RRI and concrete cases of R&I processes. This would allow that students experience first-hand fruitful and cooperative engagement with other actors from different fields. Keeping in mind that interdisciplinary courses are not always possible to be conducted in given institutional contexts, in our introductory guidelines to the training programmes, we recommend pursuing an interdisciplinary group of course participants. Furthermore, there are several courses and possible adaptation possibilities that support the engagement with other societal groups.

3.3 Learning outcomes

Through participating in the HEIRRI training programmes, students should acquire knowledge and skills they need in order to be able to integrate RRI into their (future) professional practices. The development process worked towards embedding this objective into the designs of the training programmes.

Throughout the development process, the notion of "knowing about RRI" was under debate. Although stakeholders acknowledged that knowing about the existence and relevance of concepts of RRI is relevant and provides a basis for further activities, they emphasised that students should rather be

enabled to critically reflect on the organisation and broader context of science, research, and innovation. They should learn to think about, question, and discuss the manifold relationships between science, research, innovation, and society. Concepts of RRI, including concepts putting forward certain key dimensions, were seen as one vehicle to initiate and promote these reflection processes. However, they should not been taught in isolation, but should be seen in the broader picture of a more open and responsible science. The HEIRRI training programmes considered this issue: Although students deal with concepts of RRI and get familiar with their relevance, basic ideas, and linked practical approaches, the training programmes' main learning outcomes are about being able to think about and reflect on research and innovation processes. In these deliberation processes, RRI concepts are used as means to promote critical reflections and constructive dialogues on issues of responsibility with regards to R&I.

However, the training programmes should not only aim to promote reflection, but should also enable participants to put RRI into practice and become more responsible in doing R&I. While at an undergraduate level this might be an unreasonably high ambition, master's or PhD students as well as other stakeholders have already (first) experiences in and/or conduct R&I. As a stakeholder pointed out, the training programme participants should learn how to put RRI into practice also by critically examining their own day-to-day working practices and thinking about how to make them more responsible. An important learning outcome of many training programmes is thus to be able to apply concepts of RRI in analysing R&I processes and developments and then to identify other ways to organise and conduct those in order to make them more responsible. Therefore, the participants are often asked to bring in their own research experiences and projects for the analysis and incorporation of RRI aspects.

3.4 Teaching and learning methods

Right from the start, HEIRRI aimed to design training programmes that allow learning about RRI in a meaningful way, e.g. using problem-based (PBL) or inquiry-based learning (IBL) approaches. Students should be encouraged and supported to think and reflect on RRI on their own, to form an opinion, and then to be able to apply their acquired knowledge and skills to deal with RRI issues in research and innovation processes. This position was supported and even pushed further by the consulted experts and stakeholders, who demanded ever more interactive and problem-oriented teaching activities. Thus, the final HEIRRI training programmes especially put forward teaching and learning activities that promote the reflection and active work of participants. Students have to work on challenges and problems with regards to the organisation and impacts of R&I processes and thereby find orientation in concepts of RRI.

Many of those consulted in the co-development process highlighted the importance of involving different societal stakeholders and actors and of considering their unique perspectives in students' deliberations on R&I and RRI. In line with their view on the concept of RRI, they underlined that

students should learn to engage with researchers from other disciplines, with different R&I stakeholders from industry or civil society, and with other groups and members of the society. The HEIRRI training programmes support this objective whenever possible by identifying specific teaching and learning activities that open up the course to external actors or takes the students outside of class to engage in a dialogue with different people.

However, in some cases the demand for interactive and innovative teaching and learning activities as well as stakeholder involvement stood in contrast to the requirement to have very compact and efficient courses with a short overall duration and workload. Such activities often would have been more time demanding and would have had a higher workload, both for the participating students and for the course instructor to prepare and implement the activity. To deal with this matter, activities of this type (e.g. public engagement activities or other forms of stakeholder involvement) were often included in the training programmes as adaptation possibilities which would additionally contribute to the courses' learning objectives or even extend them. However, the defined learning outcomes can also be successfully reached by the students if these activities are not implemented.

3.5 Content

The HEIRRI training programmes aim to support more responsible R&I practices and outcomes and thereby draw on concepts of RRI. Therefore, necessary content to be taught are different concepts of RRI, practical approaches and methods to promote RRI, case examples for R&I processes that are more or less responsible, as well as other field or audience-specific topics.

The consulted participants were in principle positive towards the basic idea of RRI, to rethink the relationships between science and society and to make R&I more responsible. However, many were critical of more narrower approaches towards RRI, which only focus on certain key dimensions (e.g. open access, gender equality, public engagement, and ethics), thus omitting other important aspects and leading away from seeing the "bigger picture". Others assessed the key dimensions as rather practical and nonetheless useful starting points to think about how to make R&I more responsible. The HEIRRI training programmes focus on initiating and supporting a process of dealing with different perspectives on RRI, of considering various aspect of R&I that are often not at the core of higher education, and of reflecting the relationships between science, research, innovation, and society. For that purpose, different concepts of and aspects of RRI give guidance and orientation, thus they are part of the content of the different courses. Students have to know and deal with them, but not for their own sake. The HEIRRI training programmes do not identify one RRI concept, but rather a variety of different (complementary) concepts of RRI.

In line with their demand for problem-based teaching approaches, the consulted stakeholders identified well elaborated and illustrative case examples for R&I processes imposing specific societal

challenges, and showcases for RRI and non-RRI processes as important content for the students to work on. The HEIRRI project will develop a series of such case examples and provide them as part of the HEIRRI training materials (HEIRRI work package 4). Furthermore, in many training programmes students have to identify R&I developments themselves, bring in their own experiences or research projects, which then are content to be discussed and worked upon in class.

3.6 Assessment methods

The above outlined learning outcomes as well as teaching and learning methods have an effect on the assessment methods suggested in the HEIRRI training programmes. Standardised exam formats, e.g. multiple-choice tests to assess the knowledge on the subject of RRI, are not appropriate in courses that are highly interactive and facilitate students' deliberation and reflection on RRI. This was also brought forward by many of the consulted stakeholders and experts, who wanted to focus on teaching students that actively participate and come up with ideas on their own rather than learning towards tick-box exercises.

The assessment methods proposed in the HEIRRI training programmes promote students to comprehensively reflect on issues of responsibility in R&I contexts. They are rather open and do not favour any type of predefined answer. Students have to for example write essays reflecting on their insights from deliberation activities in the course, they have to come up with own designs for research projects incorporating aspects of RRI, or they have to outline how they could consider RRI in their final theses. The quality of these different types of elaborations then can be assessed (in line with institutional requirements for the assessment of such type of output) by the course instructor and grades can be awarded accordingly.

4. Ten training programmes for teaching RRI

Before finally presenting the ten HEIRRI training programmes for teaching and learning RRI in different higher education contexts, this section gives an overview of all the training programmes, their structure, and presents the introductory text which gives guidance on the aim and rationale, the key actors for using and implementing the programmes as well as some general guidance on how the programmes are proposed to be used.

Table 5 provides an overview of all HEIRRI training programmes; a similar overview is also part of the introductory text to the training programmes and is supposed to give interested higher education teachers and other end users a quick idea of which training programme might suit their needs. The characteristics of the training programmes outlined in this table are by no means prescriptive; they present our ideas of how the individual programmes should be named, for which audience they might be most appropriate, how they structured, and how many ECTS credits should be awarded on completion of the course. ECTS credits should be understood as a means to quickly assess the scope and workload of the course. Thereby, one ECTS credit is equivalent to 25 to 30 working hours on behalf of the student.

Most of the courses are designed for a specific audience, considering the particular knowledge, needs, and resources the potential participants have. These key audiences are identified in the programmes and in the overview table. However, it is possible and desirable to also address other audiences with a certain training programme. It rests with the host of the course to identify if a certain training programme design is appropriate for a specific audience or not.

The table indicates the “default” (Def) number of credits awarded if the course is implemented as outlined in the document without any modification. In the training programme descriptions, “adaptation possibilities” are outlined which make the course more comprehensive, provide suggestions on how to shorten them, or show how they could be implemented differently; the ECTS credits if extensions (Ext) of these adaptation possibilities are used are also indicated. However, despite of the number of ECTS credits indicated here: Please feel free to modify the course to your own needs and re-calculate the ECTS credits accordingly (see HEIRRI Deliverable 3.3 for guidance).

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Table 5: HEIRRI training programmes overview

Name	Audience	Design	ECTS credits	
			Def	Ext
Studying Responsibility: A Module-Based Integration of RRI into Bachelor's Programmes	Bachelor's students	This training programme for bachelor's students is composed of four modules, which can either be implemented together or included in already existing courses. In the adaptable modules, students (1) learn what research, innovation, and RRI mean in their field of study, (2) deal with concrete cases of RRI, (3) get to know practical approaches to promote RRI, and 4) to reflect on the responsibility of R&I in their scientific field.	0.5	2.5
Doing and Experiencing Dialogical Reflection on Research and Innovation	Master's students	In this interactive course students get to know and discuss different approaches of how to facilitate dialogues on issues of R&I. Then they have to develop dialogue activities in groups and implement these in "dialogue experiments" with their colleagues as participants.	3.0	5.0
Enhance your Thesis	Master's students	In this course for master's students starting their final thesis, participants get to know concepts of RRI and discuss case examples, and then identify, investigate, and reflect on RRI aspects of their own theses.	2.0	4.0
Responsible PhD: RRI and PhD Research Projects	PhD students	This seminar will introduce PhD students to the concept and idea of RRI, discuss its role in (academic) research by case examples, and further shows how PhD students can apply RRI in their own research.	1.0	2.0
Supporting RRI: Developing RRI Guidelines for PhD Candidates	PhD students	In this five- to six-hours workshop for PhD candidates, students develop RRI guidelines specific for the position of a PhD researcher. They identify their own possibilities to promote change towards more responsible research within their research context, and then set up guidelines that consider different concepts of RRI.	1.0	2.0
Teaching Responsible Research and Innovation in Higher Education	Academic and non-academic HEI members	This train-the-trainer online course is based on the participants' independent study of provided texts, video material, and literature in combination with writing assignments and discussions in an online forum and chat. Participants deal in three parts with (1) concepts and the relevance of RRI, (2) practical approaches towards RRI, and (3) teaching RRI in higher education.	–	1.0
Facilitating Reflection on Responsible Research and Innovation	Academic and non-academic HEI members	In this train-the-trainer one-day workshop participants will experience a reflection exercise on issues of Responsible Research and Innovation and related aspects. They will learn how to initiate and facilitate such reflection in their own field and particularly in teaching.	–	1.0

Considering Responsible Research and Innovation by Design	Master's and PhD students, R&I actors and other stakeholders	This interactive five-day summer school brings together participants with different scientific and professional background to get to know RRI and work on concrete research proposals that consider RRI in organising a research process.	2.0	–
Concepts and Practice of Responsible Research and Innovation	Students, researchers, HEI actors, stakeholders, and other interested actors	This massive open online course (MOOC) is directed at a broader audience, from students and other stakeholders and actors of HEIs (e.g. researcher, librarians, administrative staff) to other interested people. An overview of existing concepts and practices of responsible and sustainable research and development is given.	2.0	–
TBA[5]	Secondary school teachers in training	This training programme supports future secondary school teachers to deal with and discuss issues of responsibility with regards to science, research, and innovation with their own students.	TBA	TBA

Def = Default number of ECTS credits awarded if the course is implemented as outlined in the training programme without any modification.
Ext = Number of ECTS credits awarded if extensions of outlined adaptation possibilities of the training programme are used.

4.1 Guide to the HEIRRI training programmes

The HEIRRI training programmes are accompanied by a short introductory text, the "Guide to the HEIRRI Training Programmes". This text provides an overview of the HEIRRI programmes and guidance on how to use them. It is directly addressed to potential users and gives a very short presentation of the HEIRRI project, its rationale and design as well as information on the envisaged audiences and the implementation of the training programmes.

This introductory guide answers to demands of consulted stakeholders and experts to get a better overview of all of the training programmes (including their audience, design, scope, etc.) as well as to have some orientation on how the programmes ought to be used. Furthermore, the introduction should make the training programmes more appealing to possible users through reasoning the importance of teaching RRI in higher education contexts.

4.2 Structure of the training programmes

Although some of the programmes exhibit peculiarities because of their specific design, the HEIRRI training programmes have a common structure. In an introduction the specific rationale of the course, a short overview of its structure, of used teaching methods, intended learning outcomes, and

[5] The decision for a specific training programme for secondary school teachers was made in a late stage of the development process of the HEIRRI training programmes. Thus, it has not been possible to finish this programme in time and to include it in this report. Once the training programme is ready, you can find it in the HEIRRI section of the RRI Tools website (https://www.rri-tools.eu).

assessment methods are given. This one- to two-page introduction gives the reader a quick idea of the training programme's design and if it is feasible to be used in a certain context. The introduction is followed by a section giving an in-depth description of the structure and practical implementation of the training programme, including possible adaptations.

Every training programme also provides a course syllabus which complies with the standards of the Bologna process and the ECTS guidelines, indicating the title of the course, the higher education cycle as well as the year of study in which it should be implemented, the number of ECTS credits awarded on completion of the course, learning outcomes, mode of delivery, prerequisites and co-requisites to attend the course, the course content, recommended or required reading, teaching and learning activities to be conducted in the course, as well as assessment methods. Some elements identified in the ECTS guidelines are omitted because they entirely depend on the institutional context and the situation in which the training programmes are implemented (e.g. the name of the course instructor or the code of the course). Each syllabus represents the default course design without using some of the proposed adaptation possibilities. If the course design is modified or adaptation possibilities are used, the syllabus has to be changed accordingly. The boxes in which the adaptation possibilities are presented also highlight necessary changes to the syllabus, if the adaptation proposal is used.

In a further reading section, each training programme provides the literature referenced throughout the outline of the design and some further useful documents and texts for planning and implementing the course, e.g. guidelines for specific teaching methods.

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6. The HEIRRI training programmes

In the following you will find first the "Guide to the HEIRRI training programmes" and then the HEIRRI training programmes for teaching and learning RRI in higher education. The latest version of the training programmes as well as the HEIRRI training materials to be used in the programmes can be found in the HEIRRI section of the RRI Tools website (http://www.rri-tools.eu).

Acknowledgement

The HEIRRI training programmes are the results of the collaborative work of the HEIRRI consortium partners, the HEIRRI Advisory Boards, and different higher education stakeholders and experts. The HEIRRI consortium wants to thank all experts and stakeholders who gave us insights into their teaching experiences, shared their visions of teaching Responsible Research and Innovation, and constructively commented on earlier versions of the training programmes.

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Teaching RRI in Higher Education – a Guide to the HEIRRI Training Programmes

The importance of teaching RRI

Science, research, and innovation are important forces in our societies that can yield very positive impacts and improve the quality of life in our societies. However, research and innovation (R&I) developments can also have adverse and unintended effects and their wider impacts can be unclear or ambiguous. The same holds true for their assessment and acceptance: R&I can be societally praised and contested by different actors at the same time. Technological innovations developed with best intentions and care might be met by society with hostility and disappear from the scene.

R&I have always dealt with the question of how responsible R&I practices look like, and actors and stakeholders have taken care of acting in the "right" way. Scholarly discussions on the responsibility of R&I have a long tradition. In recent years, the discourse on Responsible Research and Innovation (RRI) emerged, continues and interweaves many strands of discourses on the "responsible" way to organise R&I processes. Different overlapping, complimentary, and competing concepts of RRI have been put forward (Ribeiro et al., 2017). In general, RRI emphasises the necessity to rethink the way R&I is organised and calls for more reflexive, open, and inclusive ways of doing R&I, considering societal implications and societal perspectives. The European Commission (n.d.) promotes the concept of RRI as a cross-cutting issue in its funding programmes, identifying specific elements to be considered in R&I processes (public engagement, open access, gender equality, ethics, and science education).

Scientists, researcher, engineers, and others involved in or guiding R&I processes learn about the right and responsible way to organise and conduct R&I through their training in higher education institutions (HEIs). As students they learn what it means to do research, to develop new technologies, and in general to be a scientist. However, broader reflection on the implications of one's own work on society and the environment, of the societal role of R&I, and other aspects highlighted by concepts of RRI are often marginalised in study curricula. However, it would be important to include such broader reflection and to learn how to proactively deal with risks, uncertainty, unintended side effects, different societal perspectives and interests, and in general with the societal embedding of R&I. Students should become familiar with these and other issues and acquire skills to cope with them. The concepts of RRI provide a good starting point for this purpose. They highlight a variety of issues important across scientific disciplines and aim to make a difference in improving R&I processes. R&I as well as society might benefit from considering RRI aspects in research. For example, scientific knowledge and R&I output might become more socially robust and better aligned with societal needs,

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different actors could engage in mutual dialogue and learn from each other, and unintended impacts might be identified earlier in the research and innovation processes.

The HEIRRI project

HEIRRI wants to promote and support this integration of RRI into HEIs by developing training programmes for teaching RRI in higher education. These are based on a review of existing practices of teaching RRI in higher education and a co-construction process involving higher education stakeholders throughout Europe (Lang et al., 2017a). The programmes have been aligned with accreditation and qualification system requirements (Lang et al., 2017b).

The HEIRRI training programmes are designs for courses or modules that can be adapted to different higher education contexts and audiences. They are meant to be used as inspiration for the integration of teaching and learning on RRI into higher education curricula. HEIRRI also offers training materials, including videos or RRI case examples, to be used for implementing the programmes.

Each HEIRRI training programme first gives an overview of its aim, rationale, key audience, structure, and some further basic information. Then, the course design is outlined in detail on a more practical level including a schedule of different parts, teaching and learning as well as assessment methods. These in-depth descriptions also indicate how the learning outcomes, teaching and learning methods as well as the assessment are linked to each other. Throughout the training programmes, you will find boxes with adaptation possibilities, e.g. an additional learning activity or assessment. We encourage you to consider these proposals; they make a deeper reflection on RRI possible. At the end of each programme, you will find a syllabus that is in line with the ECTS and Bologna system guidelines.

Who can use the programmes?

The HEIRRI training programmes are intended to be used by actors responsible for setting up and/or conducting individual lessons or classes, modules, or even whole curricula in higher education contexts. Examples for user groups are higher education teachers who want to offer a course on RRI to their students or study programme coordinators who want to integrate a module or course on RRI into a curriculum and need inspiration for this purpose. Those and others can use these training programmes and materials as support to prepare and conduct a whole course on RRI or modify existing ones. Nevertheless, we do not want to limit the use to these specific contexts or user groups. We would be happy to see how you make meaningful use of our training programmes in any other context.

With our HEIRRI training programmes we want to reach a broad range of possible end users from different scientific fields, institutional structures, and national contexts. Thus, the designs of the training programmes are generic to a certain extent and offer flexibility in order to be easily adaptable

to different circumstances. Existing curricula are already packed, teaching resources are often scarce, and RRI and related aspects often do not have top priority in HEIs. The HEIRRI training programmes consider these conditions: most of them provide basic approaches to teach RRI to different higher education audiences without being too demanding in terms of resources.

How should the programmes be used?

The HEIRRI training programmes should inspire and help you to design a course on your own or adapt existing courses. With your teaching experience and knowledge of your institution, students, and scientific field, you are the expert in what might work and what not. It is possible to use them as they are presented and we are happy if our designs perfectly suit your needs. However, please feel free to adapt the programmes:

- Give the training programme a specific focus by e.g. addressing a certain societal challenge or a specific R&I development.
- Leave out parts if your students already have sufficient knowledge on the subject, add further parts if you want to emphasise a certain topic, replace recommended material with others, etc.
- Combine whole programmes, re-combine individual elements of different programmes, or introduce single activities described in a training programme to a course of your own.
- Use our proposed adaptation possibilities, which we see as meaningful additions to the core programmes, but make them more comprehensive and demanding.

For all programmes, we recommend pursuing a heterogeneous, interdisciplinary group of participants and inviting external stakeholders and societal actors to participate in one way or another (as discussants, co-participants, etc.).

In our training programme elaborations, we give different parameters of the courses, including the number of in-class units, the length of parts of the courses, etc. These are not prescriptive but should convey a better idea of the course design and give some practical guidance. However, if you change parameters you might have to re-calculate the ECTS credits awarded on completion of the course. You can find more on how to calculate the ECTS credits in HEIRRI D3.3 (Lang et al., 2017b). In this document, you will also find guidance on how to make the programmes suitable for other accreditation systems.

All HEIRRI training programmes are intended to be used together with HEIRRI training materials which you can find in the HEIRRI section on the RRI Tools website (https://www.rri-tools.eu).

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Overview of the HEIRRI training programmes

Course	Audience	Design	ECTS credits
Studying Responsibility: A Module-Based Integration of RRI into Bachelor's Programmes	Bachelor's students	Four modules to be implemented in existing courses or together	0.5–2.5
Doing and Experiencing Dialogical Reflection on Research and Innovation	Master's students	Workshop (eight units)	3.0–5.0
Enhance your Thesis	Master's students	Workshop (six units)	2.0–4.0
Responsible PhD: RRI and PhD Research Projects	PhD students	One-day workshop	1.0–2.0
Supporting RRI: Developing RRI Guidelines for PhD Candidates	PhD students	One-day workshop	1.0–2.0
Teaching Responsible Research and Innovation in Higher Education	Academic and non-academic HEI members	Train-the-trainer online course	0.0–1.0
Facilitating Reflection on Responsible Research and Innovation	Academic and non-academic HEI members	Train-the-trainer one-day workshop	0.0–1.0
Considering Responsible Research and Innovation by Design	Master's and PhD students, R&I actors, other stakeholders	Summer school (five days)	2.0
Concepts and Practice of Responsible Research and Innovation	Students, researchers, HEI actors, other stakeholders	Massive Open Online Course (six to eight weeks)	1.0–2.0
TBA*	Secondary school teachers in training	Workshop	TBA

* The decision for a specific training programme for secondary school teachers was made in a late stage of the development process of the HEIRRI training programmes. Thus, it has not been possible to finish this programme in time to include it in this report. Once the training programme is ready, you can find it in the HEIRRI section of the RRI Tools website (https://www.rri-tools.eu).

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Studying Responsibility: A Module-Based Integration of RRI into Bachelor's Programmes

Overview

Audience	Bachelor's students
Year of study	From the second semester or third trimester (≙ second half/final third of the first year) onwards until the final year of the studies.
Number of ECTS credits	2.0 ECTS credits (0.5 ECTS credits per module, 4 modules in total; workload of altogether 50 to 60 hours)

Introduction

Responsible Research and Innovation (RRI) is considered being able to better focus on and approach societal challenges and is supposed to make science and research more efficient and valuable. Thus it is important to bring responsibility in science, research, and innovation closer to future researchers at various stages in their educational path, thus also already at the beginning of their higher education career. This training programme wants to tackle this necessity by offering four modules that can be embedded in existing courses of bachelor's curricula and thus offers an effortless way to address RRI without fundamentally amending courses or study programmes.

The overall aim of this training programme is to introduce students of different bachelor's studies to the various concepts, ideas, rationales, and aims of Responsible Research and Innovation (RRI). By integrating different modules covering RRI into different compulsory courses of bachelor's curricula, students will get to know and deliberate on RRI throughout their bachelor's degree programme. This will allow students to learn different facets of RRI, get to know how RRI is interrelated with their own field of study, and will be gradually introduced to and repeatedly reminded of the topic of RRI.

The target audience of this programme are undergraduate students of all disciplines and fields of study. At best, students should start with courses containing such RRI modules in the final part of their first year (thus the second semester, second/third trimester): Students will already be familiar with main topics and issues in their field of study and should thus have a solid basis for learning how concepts of RRI and their studies are interconnected. Ideally, all of the four suggested modules of this programme will be integrated into a curriculum and evenly distributed over all semesters/trimesters.

The different modules are designed in a way that they can be embedded in existing courses of undergraduate studies of different study fields. To allow a successful integration, the modules are held fairly open in terms of their design (learning activities, teaching methods, assessment methods, and

their concrete implementation) and course instructors are strongly encouraged to adapt them according their needs. However, this programme guide offers several suggestions on how each of the modules can be implemented.

On completion of this course students will be able to (learning outcomes – LO)

1. explain what research and innovation means in their respective field of study;
2. explain different concepts, ideas, relevance, and aims of Responsible Research and Innovation (RRI);
3. relate research and innovation processes in their own field and the role of responsibility in these processes;
4. and to discuss the relationship between science, research, innovation, and society. They will be able to identify the potential impact of science/research/innovation on individuals, groups, or society as a whole.

The programme is divided into four small modules, which are not too extensive and can thus be more easily integrated into existing courses. It is expected that each module has a workload of 0.5 ECTS credits (workload of 12.5 to 15 hours, expected teaching time 2 to 4 hours per module).

Structure of the course and implementation

In order to achieve the overall goal of this training programme – to gradually make undergraduate students familiar with RRI – it is suggested that all four modules are integrated into a curriculum. The modules do not need to follow the suggested order, except for Module 1, which should be completed first. Each subsequent module should have a short introductory part on RRI, its basic ideas, definitions, aims, key dimensions, etc. The repetition of this introduction in all modules is considered crucial to make sure that students attending a course with an RRI module for the first time and students already knowing RRI should both be able to understand the idea of RRI. The four modules are:

1. What is research and innovation? What is responsible research and innovation?
2. Cases of RRI
3. Practical approaches towards RRI
4. Challenging research processes

There is no general suggestion on the time span of each module (e.g. blocked course vs. span of one semester). Instead, the time span can be adapted according to the courses the modules are embedded in. This flexibility is necessary in order to allow a successful integration into existing courses of different bachelor's programmes.

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Recommended learning activities, teaching methods, and their assessment

As outlined in the introduction of this programme guide, the four modules of this training programme allow flexibility and openness in terms of learning activities, teaching methods, and assessment methods. However, this guide will offer several of such methods and activities, and it will provide suggestions in each module description how they could be implemented in order to fulfil the desired learning outcomes as well as serve the thematic focus of the respective module.

Below, the basics of learning activities, teaching methods, and their assessment, which are recommended for the modules, will be explained.

Learning Activity/Teaching Method 1: Lecturing/presentation by course instructor

Short description of learning activity/teaching method:	The course instructor will present specific content to participating students. As students will have a rather passive role in this method (listening, taking notes), it is suggested to only use this method if necessary and combine it with other teaching methods. Presented content should thus rather serve as input for further activities, e.g. discussions, role-play activities, etc.
Assessment methods and criteria:	Examples for assessment of contents delivered with this teaching method: • Tests, exams (open questions are highly recommended); assessment of the quality of given answers and their relation to the given input. • Short essays on the given input; assessment of the quality of the essays and their relation to the given input. • Subsequent discussions on the given input; assessment of the quality of students' input and its relation to the given input.
Relation to learning outcomes:	This method can be used in the context of learning outcomes with the aim that participants can demonstrate knowledge, are able to understand learned content, or are able to explain learned input. In context of this training programme, this applies particularly to learning outcomes LO1, LO2, and LO4.

Learning Activity/Teaching Method 2: In-class discussions based on Inverted/Flipped Classroom

Short description of learning activity/teaching method:	The method of the Inverted/Flipped Classroom suggests that activities usually taking place in the classroom are conducted outside the classroom and the other way round (see e.g. Lage, Platt & Treglia, 2000; Schell, 2013). In the context of this training programme, students will have to develop questions and thoughts on input received by the course instructor (see e.g. Learning Activity/Teaching Method 1) as well as on reading material outside the classroom. The course instructor will provide guiding questions for the students' task to develop own questions and thoughts. Depending on the number of participating students in the course, students will either discuss their questions and thoughts among all participants or in small groups. In case of the latter, students will prepare and present the key points of their group discussions to all of their colleagues after the work in the small groups.

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Assessment methods and criteria:	This learning activity could be assessed based on: • Quality of the questions and thoughts on the given input/reading material. • Active participation in the in-class discussions.
Relation to learning outcomes:	This learning activity is useful for learning outcomes with the aim that participants are able to explain and analyse learned content. It particularly corresponds to learning outcomes LO1 and LO3.

Learning Activity/Teaching Method 3: Card-based engagement exercise

Short description of learning activity/teaching method:	This learning activity is roughly based on a card-based public engagement method developed for debating emerging technologies (Felt, Schumann, Schwarz & Strassnig, 2014). The idea of this method is that cards providing a short statement (e.g. by a real or fictional researcher) can stimulate group discussions. In the context of this training programme, cases on research processes, decisions in research, etc. of both the respective field of study and other disciplines will be provided in form of cards and/or other means (e.g. articles, videos, blog entries, etc.). In small groups of four to eight participants, students will read/watch these cases and based on what they have already learnt about RRI, they will start a light discussion on the cases. In a next step, so-called issue cards (Felt et al., 2014, pp. 238–239) will be added to the initial input. These issue cards will pose specific questions related to RRI, which should be debated in a further discussion. Questions include, but are not limited to (Please note that the questions need to be chosen and adapted according to the selected case): • Which factors of responsibility as pointed out in the concepts of RRI can you detect in this case? • Can you detect any implications (e.g. ethical) in this case? How would you describe these implications? Why are they implications and for whom? • Who should be held responsible for applications resulting from the described process? • Who should be responsible if the described process goes wrong? • Which (other) stakeholders could be involved in the described process/case? • How can a broader public be involved in the described process/case? • Which societal actors could be directly affected by the described case? How could they be affected? • Which societal domains could be directly affected by the described case? How could they be affected? • How could the described process/case be made more responsible? In this learning activity, the course instructor will have a rather passive role and will function as a moderator if necessary.
Assessment methods and criteria:	This learning activity could be assessed based on: • Active participation in the learning activity. • Quality of participants' input in the learning activity.

Relation to learning outcomes:	This learning activity is useful for learning outcomes with the aim that participants analyse content and comprehend this content. It particularly corresponds to learning outcomes LO2, LO3, and LO4.

Learning Activity/Teaching Method 4: Problem-based learning activity

Short description of learning activity/teaching method:	This activity starts with the presentation of an example case illustrating a research process of the respective field of study that is in some way problematic, challenging, brings up a dilemma, or has the potential to have impacts on specific areas (e.g. society, economy, politics, etc.). The case should be strongly related to the respective field of study and to the contents of the hosting course of the module. The example case will be presented by the course instructor either in form of a talk (see Learning Activity/Teaching Method 1) or via other means, as for example a video clip. The course instructor will further provide guiding questions for a subsequent discussion of the case. Questions include, but are not limited to (Please note that the questions need to be chosen and adapted according to the selected case): • What is "responsible" in the given context? • Which societal actors could be affected by the described process(es)? How could they be affected? • Which societal domains could be affected by the described process(es)? How could they be affected? • Which potential implications and impacts on various areas (e.g. society, economy, politics, etc.) can you detect? • Who should be held responsible for applications resulting from the described process(es)? • Who should be responsible if the described process(es) go(es) wrong? • How could the described process(es) be made more responsible? Participants should note their findings in an appropriate manner (poster, flip chart, smart board, etc.). They will shortly present the key points to their colleagues.
Assessment methods and criteria:	This learning activity could be assessed based on: • Active participation in the learning activity. • Quality of participants' input in the learning activity.
Relation to learning outcomes:	This learning activity is related to learning outcomes with the aim that participants understand and are able to analyse learned content. It will also provide an understanding of the relationship between research processes and society as well as the wider societal impacts of science/research/innovation. It thus particularly corresponds to learning outcomes LO3 and LO4.

Learning Activity/Teaching Method 5: Role-play exercise

Short description of learning activity/teaching method:	This activity starts with the outline of a scenario in form of a case illustrating a planned research process in the respective field of study. The case should be in some way problematic, challenging, bring up a dilemma, or could have the potential to have impacts on specific areas (e.g. society, economy, politics, etc.). At best, this case should be strongly related to the respective field of study. The

outline of the case could happen in form of a talk (see Learning Activity/Teaching Method 1), a written description (e.g. a research proposal), or via other means, as for example a video clip.

Students will then be divided into small groups, one of them representing the researchers aiming to conduct the presented case/process, and the other groups representing different actors of society, economics, politics, etc. Depending on the selected case, these could be for example a group of citizens, representatives of an NGO, ethicists, entrepreneurs, gender equality commissioners, policy makers, etc. In these groups, students will discuss the presented case from the point of view of their stakeholder group. Guiding questions for this discussion could be, but are not limited to:

- What is our* interest in this case/process?
- Are our* interests represented in the case/process?
- What are problematic factors in this case/process from our* point of view?
- What is needed in order to address our* interests in this case/process?
- Which other stakeholders should be included in the case/process?
- What does it need, from our* point of view, that this case/process becomes more responsible?
- How is responsibility (or concepts of responsibility/RRI) addressed in this case/process? How could it be addressed, keeping in mind our* own interests and points of view?

During this task, students should take notes on their thoughts, viewpoints, etc. These notes will be used as a basis for the next steps of the learning activity. After this initial group work, students will form an overall discussion board in the class. Depending on the available room and furniture (i.e. if tables and chairs are mobile) as well as the number of participants, this could for example happen in form of a large table where all of the students have a seat. Another possibility is the formation of a semicircle (with chairs and potentially also tables) in front of a table where the group of researchers sits. In this next task of the role-play exercise, the group of researchers shortly re-introduces the project they aim to conduct. The other groups – in the role of their respective actor group – will then address their interests, expectations, concerns, etc. in a plenary discussion. The groups are encouraged to not only engage with the researcher group, but also debate with the other stakeholder groups and take into account their viewpoints. In this task, the course instructor will not directly engage in the role-play, but rather function as a supervisor or moderator, if necessary.

The final task of this exercise is an evaluation and reflection phase: Participants will turn back to their role as students and discuss both their experiences in the role-play but also the discussed content. Guiding questions for this reflective discussion could be, but are not limited to:

- Which aspects of responsibility have been addressed in the role-play discussion? Which aspects were missing?
- Did all of the groups get a chance to speak? If not, why?
- Did you learn any new aspects, viewpoints, etc. that could make the described case/process more responsible?

	• Do you have a different view on the case/process after this role-play? Why? Why not? • From your point of view, which of the discussed interests, aspects, etc. should eventually be considered in the case/process? Which ones should not be addressed? Why? • How could considering the addressed interests, aspects, etc. change the case/process? * The chosen stakeholder group, group of actors, representatives, etc.
Assessment methods and criteria:	This learning activity could be assessed based on: • Active participation in the learning activity. • Quality of participants' input in the learning activity.
Relation to learning outcomes:	This learning activity is related to learning outcomes with the aim that participants analyse a specific case/processes, take into account different actors, and relate science/research/innovation and society. This particularly corresponds to learning outcomes LO3 and LO4.

Module 1: What is research and innovation? What is *responsible* research and innovation?

Overview

The main aims of Module 1 are (1) to address what research and innovation mean in the respective field of study; (2) to introduce participating students to RRI by addressing the concepts, related ideas, rationales, and aims of RRI; and (3) to draw first connections between RRI and the field of study when explaining both what research and innovation means in the respective field of study and when introducing RRI.

These three main aims of Module 1 particularly correspond to the learning outcomes LO1, aiming that students are able to "explain what research and innovation means in their respective field of study", and LO2, that students will know and are able to "explain different concepts, ideas, relevance, and aims of Responsible Research and Innovation (RRI)". Through the first connections between RRI and the field of study, LO4 will also be touched, but not yet fully achieved.

Integration into curriculum

Module 1 can be included in courses with either compulsory or non-compulsory attendance (e.g. lectures). It is suggested that this module is integrated into a second semester or second/third trimester course, thus after students have finished the introductory courses of their studies. The hosting course should not be too highly specialised in a small aspect of the respective field of study. Ideally, the chosen course addresses the societal relevance of the field. Examples would be social science courses that are part of several engineering or natural science courses in European universities or an advanced introductory course to the field of study. Other potential courses include classes on the historical development of the field and their current status quo, on research ethics, on research practices, etc.

Learning activities and teaching methods
Learning activities and teaching methods of this module strongly depend on those of the hosting course and should be in accordance with these. This programme guide suggests the following process:

1. *Input by the course instructor* (Learning Activity/Teaching Method 1): The course instructor explains what research and innovation means in the field of study and further introduces concepts of RRI, related ideas, and the concepts' rationales and aims. Students should have the possibility to pose questions and discuss the given input.
2. *In-class discussions based on Inverted/Flipped Classroom* (Learning Activity/Teaching Method 2): Based on guiding questions, students will have to read introductory texts on RRI and prepare questions and thoughts on the reading material and input received by the teacher. The guiding questions for this task are as follows (Note: This list is not complete. Course instructors are strongly encouraged to add and adapt the questions according to the content of the course, field of study, etc.):

    - What does responsible research and responsible innovation mean in your opinion?
    - What is irresponsible research or irresponsible innovation?
    - What do you think of the presented concepts and ideas of RRI?
    - How do the presented concepts and ideas of RRI relate to your own understanding of responsibility in research and innovation?
    - What could responsible research and innovation mean in your field of study?
    - What could responsible research and innovation mean for your own studies?

    The prepared questions and thoughts of the students will be discussed in class.

Recommended or required reading and other learning resources/tools
Participants will have to read introductory material on RRI. Articles and literature dealing with concepts of RRI are given below in the syllabus of this programme guide. Additional literature, learning and teaching material can be found in the HEIRRI training materials on the HEIRRI website (http://heirri.eu) and in the HEIRRI section of the RRI Tools website (https://www.rri-tools.eu).

Module 2: Cases of RRI

Overview
The main aim of Module 2 is to discuss exemplary cases of doing RRI including their wider societal implications and impacts. In the best case, examples are given both from the respective field of study and from other scientific fields.

Module 2 allows students to get a more in-depth idea of RRI, which particularly supports LO2. Through the work with exemplary cases of doing RRI, participants will learn to "relate research and innovation

processes in their own field and the role of responsibility in these processes" (LO3). They will further be able to "discuss the relationship between science, research, innovation, and society. They will be able to identify the potential impact of science/research/innovation on individuals, groups, or society as a whole" (LO4).

Integration into curriculum
It is suggested that Module 2 is integrated into a course with compulsory attendance. However, course formats without compulsory attendance are also a viable way of presenting the selected cases of doing RRI. Module 2 should be embedded in courses in the second or third (or fourth, if applicable) year of study as participants should already have a more comprehensive insight into their field of study and research processes.

Learning activities and teaching methods
Learning activities and teaching methods of this module strongly depend on those of the hosting course and should be in accordance with these. This programme guide suggests the following process:

1. *Input by the course instructor* (Learning Activity/Teaching Method 1): The course instructor provides a brief overview of concepts of RRI, related ideas, and the concepts' rationales and aims. This allows all participating students to have a similar knowledge level. Students should have the possibility to pose questions and discuss the given input.
2. *Card-based engagement exercise* (Learning Activity/Teaching Method 3): Students will work in groups with the given cases in form of a card-based engagement exercise. Some groups will discuss cases from their own field of study, and other groups from other scientific disciplines. This should allow reflection and insight into other disciplines and their societal relevance.

Recommended or required reading and other learning resources/tools
Literature giving an overview of RRI concepts will be provided as reading material. Students will also work with material (e.g. articles, videos, blog entries, etc.) on concrete case examples. Additionally, it is suggested to provide case examples that do not necessarily have a direct connection to conceptualisations of RRI, but deal for example with individual aspects (e.g. ethical questions, gender equality, etc.). More literature, learning and teaching material can be found in the HEIRRI training materials.

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Adaptation Possibility 1: Longer module (+0.5 ECTS credits)

Module 2 can be extended by 0.5 ECTS credits to a 1.0 ECTS credit module. This extension allows students to engage more in-depth with the given cases. For this adaptation possibility, more time will be spent on the card-based engagement exercise and students should write down the discussion points they consider most important. They should particularly note down contradictions, dilemmas, disagreements, etc. After the card-based engagement exercise, students will have to synthesise their group discussions and formulate their key points on flip charts, smart boards, or equivalent. It is suggested that students work with different material (e.g. pictures, articles, drawings, etc.) creating their poster or equivalent.

Depending on the number of participants in the course, they will then present their key discussion points to either another discussion group (and vice-versa) or all of the participants. The listening students should critically scrutinise the findings of the presenting students. Therefore, enough time for discussions of the short presentations should be given. As both cases from the field of study of the participating students will be used as well as cases from other disciplines, students are encouraged to also draw comparisons between the different cases and disciplines. This activity should allow students to actively engage with input from colleagues and allow them to analyse different perspectives on the discussed cases.

Changes in syllabus

Number of ECTS credits:	1.0 ECTS credit
Learning outcomes (LO):	*Additional learning outcome (LO5):* • Students will be able to analyse different perspectives on exemplary research cases under debate.
Planned learning activities and teaching methods:	*Additional:* Students will synthesise their group discussions and formulate key points on flip charts or equivalent using different material (e.g. pictures, articles, drawings, etc.). They will present these key points to their colleagues who will critically discuss the presented results.
Assessment methods and criteria:	*Additional:* In general, assessment methods should correspond to the methods used in the hosting course of the module. The assessment of students' performance in the presenting exercise could be based on: • Active participation in the synthesis of key discussion points, formulation on flip charts or equivalent, presentation of the key discussion points to other students, and discussion with colleagues. • Quality of participants' synthesis of key discussion points, flip chart outputs (or equivalent), presentations, and discussions with colleagues.

Module 3: Practical approaches towards RRI

Overview

The main aim of Module 3 is to initiate an understanding how the consideration of RRI in practical research processes of the respective study field can change these processes. Participants should further be equipped with basic approaches that support an application of RRI.

Module 3 provides a more in-depth understanding of RRI, which is mirrored in LO2. The module particularly serves learning outcome LO3, which aims at students being able to "relate research and innovation processes in their own field and the role of responsibility in these processes". It further equips students with the ability to "discuss the relationship between science, research, innovation, and

society. They will be able to identify the potential impact of science/research/innovation on individuals, groups, or society as a whole" (LO4).

Integration into curriculum
It is suggested that Module 3 is integrated into a course with compulsory attendance. It is recommended to embed the module into courses on research practices (i.e. a practical/application-oriented course) in the respective field of study. In most cases, such a course will be held in the second or third (or fourth, if applicable) year of study. Participating students should already know the basics of how research processes unfold and how research is conducted in their field.

Learning activities and teaching methods
Learning activities and teaching methods of this module strongly depend on those of the hosting course and should be in accordance with these. This programme guide suggests the following process:

1. *Problem-based learning activity I* (Learning Activity/Teaching Method 4): Students will work with presented research processes of the respective study field based on a problem-based learning activity as described above.
2. *Input by the course instructor* (Learning Activity/Teaching Method 1): The course instructor provides a brief overview of concepts of RRI, related ideas, and the concepts' rationales and aims. Students should have the possibility to pose questions and discuss the given input.
3. *Problem-based learning activity II* (Learning Activity/Teaching Method 4): Based on the given input on concepts of RRI, students will go back in small groups and re-discuss the presented case on research processes. They should relate their own initial findings with the conceptualisations of RRI and should again formulate their findings on flip charts, posters, smart boards or the like. Finally, they will present the key points to their colleagues.

Recommended or required reading and other learning resources/tools
Literature giving an overview of RRI concepts will be provided as reading material. Students receive input on research processes in form of an example case either in form of a talk by the course instructor or other means, as for example a video clip. Additional literature, learning and teaching material can be found in the HEIRRI training materials.

Module 4: Challenging research processes

Overview
The main aim of Module 4 is to initiate further reflection and discussion on how concepts of RRI can be considered in research processes. More precisely, students will directly challenge research processes of their field of study through a role-play exercise.

Module 4 mainly corresponds to learning outcome LO3, which wants to achieve that students are able to "relate research and innovation processes in their own field and the role of responsibility in these

processes". It also supports LO4, which aims at students being able to "discuss the relationship between science, research, innovation, and society. They will be able to identify the potential impact of science/research/innovation on individuals, groups, or society as a whole".

Integration into curriculum
It is suggested that Module 4 is integrated into a course with compulsory attendance. There is no general suggestion on the particular focus of the embedding course. An example, however, could be a course on the writing of a bachelor's thesis or a course requiring a paper to be handed in, as learned content and the activities could be reflected in the students' own work. At best, the hosting course takes place in the final year of study. Participating students should already know the basics of how research processes unfold and how research is conducted in their field.

Learning activities and teaching methods
Learning activities and teaching methods of this module strongly depend on those of the hosting course and should be in accordance with these. This programme guide suggests the following process:

1. *Input by the course instructor* (Learning Activity/Teaching Method 1): The course instructor provides a brief overview of concepts of RRI, related ideas, and the concepts' rationales and aims. This allows all participating students to have a similar knowledge level. Students should have the possibility to pose questions and discuss the given input.
2. *Role-play exercise* (Learning Activity/Teaching Method 5): Students will conduct a role-play exercise on a case/process related to their own field of study.

Recommended or required reading and other learning resources/tools
Literature giving an overview of RRI concepts will be provided as reading material. Students receive input on research processes in form of an example case either in form of a talk by the course instructor, as a text (e.g. research proposal), or via other means, as for example a video clip. Additional literature, learning and teaching material can be found in the HEIRRI training materials.

Combining modules to a single course

Adaptation Possibility 2: Combining modules to a single course

This training programme was particularly designed for curricula that do not allow an integration of an entire course. However, it is possible to combine the modules to a single course. For doing so, adaptations of the suggested content, course format, teaching methods, and material are necessary. Similar to the individual modules, the course format of a single course can be either a course with or without compulsory attendance (e.g. lecture). The first-mentioned, however, is highly recommended.
Changes in syllabus
Year of study: — From the final semester/trimester of the second year onwards
Number of ECTS credits: — 2.0 ECTS credits (instead of 0.5 ECTS credits for each module)

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Learning outcomes (LO):	No adaptations necessary.
Mode of delivery:	*Discard* repetitions of modes of delivery used in more than one module, if necessary. A combination of different modes of delivery as suggested in the individual modules is suggested.
Course content:	*Discard* repetitions of the introductory part on RRI, which are only recommended if the modules are integrated into separate courses. *Modify:* The course could start with the problem-based learning activity as outlined in Module 3 and then turn to a general introduction to concepts of RRI as suggested in Module 1. *Modify/Additional:* Cases used in Module 2, 3, and 4 could focus on a specific aspect of an RRI concept or a specific RRI dimension and thus address this in more detail. *Additional:* Units of this course could be used to address specific aspects of an RRI concept or a specific RRI dimension in more detail.
Recommended or required reading and learning resources/tools:	*Discard* repetitions of obligatory literature and other learning material that might be used in more than one module. *Additional:* Course instructors are encouraged to include other reading and learning material than suggested in this syllabus (see "Recommended or required reading and other learning resources/tools").
Planned learning activities and teaching methods:	*Discard* repetitions of learning activities that are used in more than one module. *Additional:* Course instructors are encouraged to make use of Adaptation Possibility 1, and make use of other not mentioned activities.
Assessment methods and criteria:	*Modify:* Originally, assessment methods should correspond to the methods used in the hosting course of the module. If the modules are combined to a single course, students' performance will be based on the criteria outlined in the descriptions of recommended learning activities and teaching methods.

Syllabus

Element	Description
Title	Studying Responsibility: A Module-Based Integration of RRI into Bachelor's Programmes
Cycle	EHEA: First cycle EQF level: 6 Degree level: Bachelor
Year of study	We suggest integrating the modules into courses from the second semester or third trimester (≙ second half/final third of the first year) onwards until the final year of the studies.
Number of ECTS credits	2.0 ECTS credits (0.5 ECTS credits per module, 4 modules in total; workload of altogether 50 to 60 hours)
Learning outcomes (LO)	On completion of this course students will be able to 1. explain what research and innovation means in their respective field of study;

	2. explain different concepts, ideas, relevance, and aims of Responsible Research and Innovation (RRI); 3. relate research and innovation processes in their own field and the role of responsibility in these processes; 4. and to discuss the relationship between science, research, innovation, and society. They will be able to identify the potential impact of science/research/innovation on individuals, groups, or society as a whole.
Mode of delivery	In general, the modes of delivery of the four modules of this programme should be in accordance with the embedding courses. This training programme combines different modes of delivery: talks/presentations by the course instructor, problem-based learning activities, role-play exercises, a card-based engagement activity, an inverted/flipped classroom activity, in-class discussions, material to be read outside and in class, and optionally video clips. The modules of this programme are not limited to these modes of delivery; course instructors are strongly encouraged to adapt the presented means.
Prerequisites and co-requisites	Before attending any of the four modules, students should have a basic overview of their field of study, i.e. they should ideally have completed the introductory courses of their programme (in most curricula, this will be fulfilled after having completed the first semester/trimester). Students should be able to understand the contents of their subject in order to learn about its societal embedding and its relation to RRI. For Modules 3 and 4, students should have a basic understanding of research processes in their respective field of study.
Course content	This training programme gives an introduction to different concepts of Responsible Research and Innovation (RRI), and addresses related ideas, rationales, and aims. In the modules of this programme, different cases are presented, discussed, and engaged with through different problem-based learning activities. Additionally, practical approaches on how to address RRI will be provided.
Recommended or required reading and other learning resources/tools	A selection (or parts/quotes) of: • Angelaki, M. (2016, February 8). An Introduction to Responsible Research and Innovation. *PASTEUR4OA*. Retrieved 19 July 2016, from http://www.pasteur4oa.eu/sites/pasteur4oa/files/resource/RRI_POLICY%20BRIEF.pdf • Grunwald, A. (2011). Responsible Innovation: Bringing together Technology Assessment, Applied Ethics, and STS research. *Enterprise and Work Innovation Studies, 7*, 9–31. • Iatridis, K., & Schroeder, D. (2016). The Basics of Responsible Research and Innovation. In *Responsible Research and Innovation in Industry. The Case for Corporate Responsibility Tools* (pp. 5–30). Heidelberg/New York, NY/Dordrecht/London: Springer. DOI:10.1007/978-3-319-21693-5_2 • Owen, R., Macnaghten, P., & Stilgoe, J. (2012). Responsible research and innovation: From science in society to science for society, with society. *Science and Public Policy, 39*(6), 751–760. DOI:10.1093/scipol/scs093 • Ribeiro, B. E., Smith, R. D. J., & Millar, K. (2016). A Mobilising Concept? Unpacking Academic Representations of Responsible Research and Innovation. *Science and Engineering Ethics*, 1–23. DOI:10.1007/s11948-016-9761-6 • Rip, A. (2014). The past and future of RRI. *Life Sciences, Society and Policy, 10*(17). DOI:10.1186/s40504-014-0017-4

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	• Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. *Research Policy, 42*(9), 1568–1580. DOI:10.1016/j.respol.2013.05.008
	• Taebi, B., Correljé, A., Cuppen, E., Dignum, M., & Pesch, U. (2014). Responsible innovation as an endorsement of public values: the need for interdisciplinary research. *Journal of Responsible Innovation, 1*(1), 118–124. DOI:10.1080/23299460.2014.882072
	• Van der Burg, S. (2010). Shaping the societal impacts of engineering sciences: a reflection on the role of public funding agencies. *Innovation: The European Journal of Social Science Research, 23*(1), 25–36. DOI:10.1080/13511611003791158
	• Von Schomberg, R. (2013). A vision of responsible innovation. In R. Owen, J. Bessant & M. Heintz (Eds.), *Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society* (pp. 51–74). West Sussex: John Wiley. DOI:10.1002/9781118551424.ch3
	
	Additional material:
	
	• Provision of (actual and relevant) cases from the respective field of study that should serve as practical examples for discussing RRI. Examples for such cases/advices how to identify such cases:
	  ○ Typical research processes of the respective field (Example 1: finding a research question, setting up a research plan around this research question, developing a theoretical model, applying the theoretical model in the field/laboratory; Example 2: design and development of an application for use in a broader society).
	  ○ An actual research project at the department/faculty.
	  ○ Students' own research projects (e.g. of their bachelor's theses).
	  ○ Products, applications, methods, etc. of the field that have already found their place in society.
	  ○ Examples of interdisciplinary teamwork at the department/faculty.
	
	Other helpful literature and material:
	
	• RRI Tools (web): RRI Toolkit. http://www.rri-tools.eu/search-engine

Planned learning activities and teaching methods	This training programme uses different learning activities and teaching methods. A detailed description of these activities can be found at the beginning of this guide. The addressed learning activities and teaching methods are as follows: • Lecturing/presentation by course instructor • In-class discussions based on Inverted/Flipped Classroom • Card-based engagement exercise • Problem-based learning activity • Role-play exercise Course instructors are strongly encouraged to add further learning activities and teaching methods when using this training programme.
Assessment methods and	Assessment methods and criteria depend on the respective course the modules are

criteria	embedded in and should be in accordance with them. Based on the learning activities and teaching methods suggested in this guide, assessment could be based on: • Active participation in learning activities. • Quality of participants' input (oral, written, etc.) in learning activities. • Tests, exams, etc. (open questions are highly recommended): Quality of given answers and their relation to the given input. • Short essays and other paper on given input: Quality of students' input and its relation to the given input.

References and further readings

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Lage, M. J., Platt, G. J., & Treglia, M. (2000). Inverting the Classroom: A Gateway to Creating an Inclusive Learning Environment. *The Journal of Economic Education, 31*(1), 30–43. DOI:10.1080/00220480009596759

Responsibility Observatory (web): http://observatory-rri.info/?q=obs-home

RRI Tools (web): RRI Toolkit. http://www.rri-tools.eu/search-engine

Schell, J. (2013). Quick Start Guide for Flipping your Classroom with Peer Instruction. Retrieved 8 February 2017, from http://cloud.julieschell.com/0g2J2k1T0W3c

- Text available in several other languages (Chinese, Czech, Dutch, French, German, Japanese, Korean, Norwegian, Portuguese, Spanish, Swedish): https://blog.peerinstruction.net/translated-quick-start-guides-to-flipping-your-class-with-peer-instruction/

Higher Education Institutions
& Responsible Research and Innovation

Doing and Experiencing Dialogical Reflection on Research and Innovation

Overview

Audience	Master's students
Year of study	Second year of master's studies
Number of ECTS credits	3.0 ECTS credits (workload of 75 to 90 hours)

Introduction

In the process of becoming professionals in their domain, students develop a specialist's view on the processes and output in their field. Students focus on certain topics and are supposed to become experts on them. Although this specialisation is indeed necessary to succeed as a professional in for example research and innovation, students run the risk of losing a critical view on their own work. They might get absorbed by "their" topic, by "their" specific field of interest, and might lose the anchorage in the wider society by moving in a bubble of journal articles and academic discourses. Thus, they might not only face challenges and unintended effects when their findings and developments are (not) taken up by society or certain groups, but they also might lose valuable input which could improve their own work in the first place.

To counter this possible effect, the interactive course "Doing and Experiencing Dialogical Reflection on Research and Innovation" encourages and empowers students to enter a mutual dialogue with others on research and innovation (R&I) activities and developments. In this course, students will train how to consider societal perspectives in R&I by the means of dialogue activities. It equips students with knowledge and skills to promote and facilitate such discussion and reflection processes and gives them the opportunity to be part of such activities. It is open for master's students with different disciplinary backgrounds.

Students will have the opportunity to experience both sides of deliberation activities. They will get to know and discuss different methods to facilitate dialogues on R&I and related developments. In groups they will prepare and conduct presentations on different related methods suggested by the course instructor. Groups of students supervised by the course instructor will design and implement a dialogue "experiment" in which their fellow students will participate. Thus, each student will be on both sides, on that of a facilitator and that of a participant. They will have to face and solve challenges such engagement entails but will also experience its great opportunities and insights. They will document the results in a written report and reflect on their own participation in a short essay.

On completion of this course students will be able to (learning outcomes – LO)

1. explain methods to facilitate dialogue and discussions on research and innovation (R&I) with different societal actors;
2. adapt a dialogue approach to facilitate dialogue on a specific R&I process or development;
3. carry out a dialogue activity to discuss a specific R&I process or development and analyse the participants' different perspectives on and assessment of the R&I issue under debate;
4. and to reflect on the quality of the dialogue and interaction facilitated through a dialogue activity.

The assessment of the students' performance will be based on the quality of

- the presentation of a participatory method;
- the dialogue activity design;
- and the implementation and documentation of a dialogue experiment in a final report.

The course should be implemented over the course of a whole semester in eight two-hour units in classes of up to 20 students with working groups of five students. 3.0 ECTS credits are awarded on completion (workload of 75 to 90 hours).

Structure of the course and implementation

The course consists of three main sequential parts, each consisting of several in-class units of about two hours as well as independent student group work:

1. How to facilitate dialogue on R&I: dialogue approaches (two in-class units)
2. Planning dialogue activities (two in-class units)
3. Doing and experiencing dialogical reflection (four in-class units)

Part 1: How to facilitate dialogue on R&I: dialogue approaches

In Part 1, students get to know different approaches to facilitate dialogues on R&I developments and related issues. It should be implemented in two units of about two hours each. The first unit serves as an introduction session. In the second unit, students give prepared presentations and discuss them with their colleagues and the course instructor. Through preparing presentations on selected dialogue approaches in working groups, they will show that they are able to "explain methods to facilitate dialogue and discussions on research and innovation (R&I) with different societal actors" (LO1). The presentations are part of their assessment.

In the first unit, the course instructor provides a general introduction on the subject and design of the course as well as a rough overview of dialogue approaches; Elliott et al. (2005) as well as Rowe and

Frewer (2005) outline different dialogue approaches. After this introduction, students form working groups of around five participants and choose a dialogue approach they will present in the second in-class unit. They can choose for example scenario workshops (Gnaiger & Schroffenegger, 2008), public Technology Assessment (Abels, 2007; Levidow, 2009), World Café, (Neo-)Socratic Dialogue (Birnbacher, 1999; Littig, 2004), Round Table (Felt et al., 2009; Science et Cité, n.d.), and other approaches (e.g. Decker & Fleischer, 2012).

Part 1 provides a basis for the students' development of a dialogue experiment: Students get to know a selection of approaches and are encouraged to read recommended literature and do additional desk research.

Part 2: Planning dialogue activities

In Part 2 of the course, students have to develop a dialogue activity themselves. Through their efforts, students will train how to "adapt a dialogue approach to facilitate dialogue on a specific R&I process or development" (LO2). They have to deliver a written design corresponding to the outlined aspects below. This design paper is part of students' overall assessment of the course.

Supported by the course instructor and in dialogue with other students, they first have to select an R&I development that is potentially controversial or gives rise to questions that could be dealt with in a deliberative setting. In the best case, they choose a topic they and/or some of the other participating students are already familiar with; otherwise, they have to gather information on the topic first in order to have some background knowledge, which might be necessary in moderating the dialogue.

Adaptation Possibility 1: Link to or embed in other thematic courses

Master's students attend a variety of seminars or lectures on specific topics from their field of study. However, in some courses, students might work or deal with R&I processes or developments in their scientific field, but are not encouraged to incorporate the perspective of others into their own work and thinking. "Doing and Experiencing Dialogical Reflection on Research and Innovation" could be used as a way to promote this kind of open and inclusive deliberation. Students can pick up topics or aspects they already dealt with (e.g. in a seminar paper or a presentation) and deepen and diversify their knowledge in this regard through the dialogue activity.

If possible and desired, the whole course can be linked to or embedded in another thematic course or module of a study programme.

After they have selected a topic and dialogue approach, students will outline a concrete design for a dialogue activity to promote discussion on the R&I development and linked societal, economic, cultural, etc. issues. They should describe the topic, potential target groups/participants, and the procedural design. By doing so, they have to reflect and identify the purpose and relevance of the activity as well as potential challenges if implemented in a real, non-experimental setting with different societal actors participating. They have to deliberate on the wider implications and impacts of facilitating a societal dialogue on controversial R&I issues, e.g. on the public discourse, political

decision-making processes, technological progress, etc. They also have to reflect the impact certain design decisions might have on the implementation, output, and outcome of a dialogue activity, e.g. the effect of certain selection criteria for participants (Who is a stakeholder?), external factors affecting the inclusion/exclusion of certain groups (education, financial means, etc.) and so forth.

Already in designing the dialogue activity, students should bear in mind the practical limitations they will encounter in implementing the activity within the course: They will have limited amount of time and resources (depending on the given institutional structure, local conditions, course size, etc.) and the participants will be their student colleagues. In their design, they have to reflect how they will modify their ideas to this context.

If the circumstances do not allow implementing a course of this scope, it is possible to shorten it by taking up Adaptation Possibility 2 and ending the course after Part 2. Then, another in-class unit should be added to Part 2 in which the students present and discuss their designs with their colleagues.

Adaptation Possibility 2: Shorter course (-1.0 ECTS credit)

The course can be held without implementing Part 3, the conduct of the dialogue experiment. The reflection on the participation/dialogue activity should then be included in Part 2: The different working groups should present their designs to their peers and receive/give feedback on the designs of other groups. The working groups should then revise their design incorporating the feedback.	
Changes in syllabus	
Number of ECTS credits:	2.0 ECTS credits
Learning outcomes (LO):	*Discard* learning outcome LO3: "carry out a dialogue activity to discuss a specific R&I process or development and analyse the participants' different perspectives on and assessment of the R&I issue under debate". *Modify* learning outcome LO4: "assess the appropriateness and stringency of a design for a dialogue activity on R&I processes and development".
Planned learning activities and teaching methods:	*Discard: "*Finally, they will implement the activity with their student colleagues as participants. This implementation is followed by discussion and reflection on the possibilities and challenges with regards to such participatory dialogue approaches."
Assessment methods and criteria:	*Discard:* • "implementation and documentation of a dialogue experiment; • and the reflection paper on their participation in the others' experiments."

Part 3: Doing and experiencing dialogical reflection: a dialogue experiment

In order to allow students enough time to design and organise their own dialogue experiments, sufficient time should be provided between the in-class units of Part 2 and Part 3 of this course. In Part 3, consisting of four units of about two hours each, students have to implement their activity with the

other students as participants. Thus, students do not only have the possibility to organise and conduct a dialogue experiment themselves, but also to actively participate in and experience such an activity. Part 3 is in line with learning outcome LO3, to "carry out a dialogue activity to discuss a specific R&I process or development and analyse the participants' different perspectives on and assessment of the R&I issue under debate". This learning outcome is assessed by evaluating students' final reports as well as their success in implementing the dialogue experiment.

If feasible, students could invite some external stakeholders or other relevant actors. If the circumstances allow an extension of the course, the design and implementation could also include inviting stakeholders or relevant societal actors more systematically (see Adaptation Possibility 3).

Adaptation Possibility 3: Inviting societal actors and relevant stakeholders to participate in the dialogue (+2.0 ECTS credits)

In the course design at hand, students learn about and try out organising and implementing a dialogue activity in the "safe" setting of a course at a higher education institution. They do not reach out to societal actors and groups, but "invite" their sympathetic peers to participate in their dialogue. Through this design, the course takes into account the often limited resources in higher education institutions and study programmes, or of the course instructor as well as the students.

However, if desired and possible in the given certain higher education setting, the course can be modified in order to become more realistic and challenging: The student groups should propose and implement a dialogue activity that brings together their student colleagues and other societal actors and allow them to discuss a defined R&I development or issue. In order to be able to do this, more support and time is needed for the students to organise their activity. In the organisation phase, they have to identify their target participants, e.g. societal stakeholders or groups affected by the R&I development under discussion, and have to adapt their dialogue approach accordingly. They have to get in contact with potential participants and convince them to participate in their dialogue experiment. They have to moderate a dialogue and discussion of a (possibly) more heterogeneous crowd and have to make sense of a larger amount of insights.

A material prerequisite for this adaptation possibility is the existence of available room and space to implement the dialogue activity with students and additional external participants. Furthermore, a high degree of flexibility, the possibility and willingness to adapt the plan (date and time) of the activity depending on the availability of the requested participants is necessary (e.g. late afternoon, evening, or on the weekend).

Changes in syllabus

Number of ECTS credits:	5.0 ECTS credits
Learning outcomes (LO):	*Additional learning outcomes (LO5 and LO6):* • "identify relevant stakeholders and societal actors regarding a R&I development or process; • and to include stakeholders and societal actors in dialogue activities on R&I developments or processes."
Planned learning activities and teaching methods:	*Additional:* "Students have to identify and contact stakeholders and societal actors relevant to the R&I development or process. They should invite them to participate in their dialogue activity." *Modify*: "Finally, they will implement the activity with their student colleagues, the stakeholders, and societal actors as participants."

At the end of each dialogue experiment, there should be an ad hoc round of feedback and discussion on the positive and negative aspects of the respective activity and the way of implementation. The comments should be collected by the student group implementing the activity and discussed in their final report.

Students complete the course by handing in a group report describing the implementation as well as the results of the activity. They should describe how their initial plan worked out, what challenges they had to face and how they dealt with them, but also reflect on the positive aspects of facilitating a dialogue. They should also deal with and address the feedback gathered from the participants in the dialogue experiment. This reflection task is in line with learning objective LO4, "to reflect on the quality of the dialogue and interaction facilitated through a dialogue activity".

Besides this reflection on procedural aspects, they should outline the major strands of discussions facilitated by the dialogue, analyse the different perspectives and assessments of the R&I issue as well as the broader insights they gained with respect to the chosen topic. They should then also think about how the output could affect the set up or further development of the considered R&I issue, how the involved institutions and scientists, but also policy makers or civil society, could use it in a meaningful way. In addition, they should reflect on the possible impact of their dialogue activity.

Syllabus

Element	Description
Title	Doing and Experiencing Dialogical Reflection on Research and Innovation
Cycle	EHEA: Second cycle EQF level: 7 Degree level: Master
Year of study	Second year of master's studies
Number of ECTS credits	3.0 ECTS credits (workload of 75 to 90 hours)
Learning outcomes (LO)	On completion of this course students will be able to 1. explain methods to facilitate dialogue and discussions on research and innovation (R&I) with different societal actors; 2. adapt a dialogue approach to facilitate dialogue on a specific R&I process or development; 3. carry out a dialogue activity to discuss a specific R&I process or development and analyse the participants' different perspectives on and assessment of the R&I issue under debate; 4. and to reflect on the quality of the dialogue and interaction facilitated through a dialogue activity.
Mode of delivery	The course combines different modes of delivery. The course instructor will give a short overview presentation in the first unit. In the remaining units, students themselves have to

	define the topics to be dealt with, namely the dialogue approaches and the topics to be discussed. Then students will have to prepare presentations in groups at home and present them in class. Supported by the course instructor, they will then have to identify an R&I-related topic and adapt a dialogue approach, both in class and independently at home. Furthermore, students have to actively participate in discussions and the dialogue experiments facilitated by their colleagues.
Prerequisites and co-requisites	Bachelor's degree. Participants should know about research and innovation developments in their respective field and possibly other areas.
Course content	The course focuses on different interactive approaches to facilitate dialogue on R&I developments, and their societal implications and impacts. These include but are not limited to scenario workshops, consensus conferences, public Technology Assessment, Round Table, (Neo-)Socratic Dialogue, or World Café. The respective R&I developments to be discussed in the course should be selected and outlined by the students themselves.
Recommended or required reading and other learning resources/tools	Overviews of participatory methods, which can be used to facilitate a dialogue between different stakeholders: • Elliott, J., Heesterbeek, S., Lukensmeyer, C., & Slocum, N. (2005). *Participatory Methods Toolkit. A practitioner's manual* (2nd ed.). Retrieved 30 January 2017, from http://cris.unu.edu/participatory-methods-toolkit-practitioners-manual-second-edition • Rowe, G., & Frewer, L. J. (2000). Public Participation Methods: A Framework for Evaluation. *Science, Technology, & Human Values, 25*(1), 3–29. DOI:10.1177/016224390002500101 • Rowe, G., Marsh, R., & Frewer, L. J. (2004). Evaluation of a Deliberative Conference. *Science, Technology, & Human Values, 29*(1), 88–121. DOI:10.1177/0162243903259194 Possible approaches to facilitate a dialogue on R&I developments: • Abels, G. (2007). Citizen Involvement in Public Policy-making: Does it Improve Democratic Legitimacy and Accountability? The Case of pTA. *Interdisciplinary Information Sciences, 13*(1), 103–116. DOI:10.4036/iis.2007.103 • Birnbacher, D. (1999). The Socratic method in teaching medical ethics: Potentials and limitations. *Medicine, Health Care and Philosophy, 99*(2), 219–224. DOI:10.1023/A:1009999523468 • Decker, M., & Fleischer, T. (2012). Participation in 'big style': first observations at the German citizens' dialogue on future technologies. *Poiesis & Praxis, 9*(1), 81–99. DOI:10.1007/s10202-012-0119-0 • Felt, U., Fochler, M., Müller, A., & Strassnig, M. (2009). Unruly ethics: on the difficulties of a bottom-up approach to ethics in the field of genomics. *Public Understanding of Science, 18*(3), 354–371. DOI:10.1177/0963662507079902 • Gnaiger, A., & Schroffenegger, G. (2008). *Tool-Kit Scenario Workshop. TRAMS – Training and Mentoring of Science Shops*. Retrieved 30 January 2017, from http://fbi.or.at/download/2008_Scenario_Workshop.pdf • Levidow, L. (2009). Democratizing Agri-Biotechnology? European Public Participation in Agbiotech Assessment. *Comparative Sociology, 8*(4), 541–564. DOI:10.1163/156913309X461633 • Littig, B. (2004). The neo-Socratic dialogue. A method of teaching the ethics of sustainable development. In C. Galea (Ed.), *Teaching Business Sustainability. Volume*

	1: From Theory to Practice (pp. 240–252). Sheffield: Greenfield Publishing. • Powell, M., & Colin, M. (2008). Meaningful Citizen Engagement in Science and Technology: What Would it Really Take? *Science Communication, 30*(1), 126–136. DOI:10.1177/1075547008320520 • Rowe, G., & Frewer, L. J. (2005). A Typology of Public Engagement Mechanisms. *Science, Technology, & Human Values, 30*(2), 251–290. DOI:10.1177/0162243904271724 • Science et Cité (n.d.). Dialogue science and society. Retrieved 30 January 2017, from http://www.science-et-cite.ch More methods and approaches can be found online: • Participedia (web): Participedia: Strengthen democracy through shared knowledge. http://participedia.net/ • RRI Tools (web): RRI Toolkit. https://www.rri-tools.eu/search-engine
Planned learning activities and teaching methods	At the beginning of the course, the instructor will give an introduction opening up issues of public participation in R&I, science communication, public understanding of science, etc. Then, students have to deliberate on and present different participatory dialogue approaches, e.g. consensus conferences, participatory Technology Assessment, or scenario workshops. These are followed by plenary discussions. In independent group work supported by course instructor (desk research, group deliberation), students will design a participatory dialogue activity. Finally, they will implement the activity with their student colleagues as participants. This implementation is followed by discussion and reflection on the possibilities and challenges with regards to such participatory dialogue approaches. The groups will write down and elaborate on their findings in a final report.
Assessment methods and criteria	The following activities and outputs of the students will be assessed: • Group presentation on a dialogue approach. • Written outline of dialogue experiment design. • Group report on the participatory experiment.

References and further readings

Elliott, J., Heesterbeek, S., Lukensmeyer, C., & Slocum, N. (2005). *Participatory Methods Toolkit. A practitioner's manual* (2nd ed.). Retrieved 30 January 2017, from http://cris.unu.edu/participatory-methods-toolkit-practitioners-manual-second-edition

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Higher Education Institutions
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Enhance your Thesis

Overview

Audience	Master's students
Year of study	Second year of master's studies
Number of ECTS credits	2.0 ECTS credits (workload of 50 to 60 hours)

Introduction

The master's thesis constitutes the central output of students' research efforts in many master's programmes of higher education institutions (HEI) in Europe. In working on their theses, students have to deal with tasks typically for a research project. They have to find interesting and appropriate topics, formulate research questions, set up a design for their empirical work or define their frame for theoretical deliberations, conduct the planned work, write down their findings, and present and defend their theses.

In this tight and demanding process, it is sometimes hard to hold on for a moment and reflect on aspects beyond the "core" scientific tasks and development steps. There is often lack of time and space or even lack of awareness for the importance of looking inward, talking to others, and reflecting on the significance and the wider implications of one's own work. To ask if and how the own work might be of importance, how others could benefit or how to prevent any potential harm deriving from it, how to conduct the project in line with societal and scientific norms and values, etc. often needs to be missed out. In short: While students learn how to do research "the proper" way in terms of correctly applying research methods, how to do it in a "responsible" way in general is often not addressed.

The training programme "Enhance your Thesis" aims to encourage students to engage in a reflection process on the implications of their own work going beyond the realm of their discipline in particular and of science in general. Its main target group are master's students of all disciplines who already have preliminary topics for their theses but have not yet started to work on them in depth. Students who already work on their thesis projects are eligible participants too, but the course then might not have the desired impact. Students participating in this course will develop a broader understanding of the societal embeddedness of research and innovation in different societal contexts and will be encouraged to apply such a perspective on the work for their own theses.

In this course, different concepts of Responsible Research and Innovation (RRI) will serve as reference points to question and reflect upon the thesis work of the students. Students will engage in discussions on and further investigate RRI aspects of their theses, present their findings to their colleagues, and

elaborate on them in a short paper. If the given institutional and programme context allows to do so, it is desirable that the work done in this course has an impact on the students' theses (e.g. on the research questions, the design, or the implementation). At least one contribution to the student's theses should be an added chapter outlining the insights gained from the reflection and discussion activities.

On completion of the course students will be able to (learning outcomes – LO)

1. apply concepts of RRI to discuss research and innovation (R&I) processes and their outputs;
2. assess possible societal implications and impacts of concrete research activities;
3. acknowledge and react constructively to suggestions from their peers regarding their own research work;
4. and to propose adaptations to better align a research project with societal needs, values, and expectations.

The course should be implemented over the course of a whole semester in six two-hour units in classes of about 10 students. 2.0 ECTS credits are awarded on completion (workload of 50 to 60 hours). It is possible to extend the course, doubling the workload, and to award a total of 4.0 ECTS credits (see Adaptation Possibility 2).

The assessment of the students' performance will be based on the quality of

- participation in discussions;
- lightning talk on the master's thesis;
- presentation of the results of their desk research;
- and the written final report at the end of the course.

Although this course primarily focuses master's students, this course is also suitable for prospective or active PhD students before starting with or at the beginning of their dissertation project.

Structure of the course and implementation

The course consists of four parts with different topics and teaching designs which are described below in detail:

1. What are "responsible" research and innovation? (two in-class units)
2. Present your thesis (two in-class units)
3. Investigate your thesis (individual work; no in-class units)
4. Enhance your thesis (two in-class units)

The parts build on each other and should be implemented in the given order. The role of the course instructor varies from part to part: While the instructor has a more active role in the second unit of Part 1 through giving a presentation and input on RRI, in other parts of the programme, they mainly responsible for moderating discussions and supervising and assessing students' independent investigations on RRI aspects of their research projects.

Part 1 and Part 2 should be conducted in close succession in order to ensure that participants can easily recall and translate their findings using them for the subsequent task. Then, students should have several weeks to autonomously work on Part 3 and investigate RRI aspects of their theses, which are then presented and committed to paper in Part 4.

Part 1: What are "responsible" research and innovation?

Part 1 aims to start a reflection on implications of R&I processes and related RRI aspects. It will contribute to enabling students to "apply concepts of RRI to discuss research and innovation (R&I) processes and their outputs" (LO1) and to "assess possible societal implications and impacts of concrete research activities" (LO2). Before turning to their own work, students should exercise such deliberation as a group by means of a "neutral" example, a case they do not have a personal interest in. Part 1 is divided into two units of about two hours each; if favoured, they can be implemented on the same day.

The course kicks off with a problem-based learning (PBL) activity: In the first unit, the course instructor presents an example case illustrating a research or innovation process that is in some way or another problematic, challenging, or has the potential to have unintended impacts in various areas (society, economy, politics, etc.). Some case examples can be found in the HEIRRI training materials on the HEIRRI website (http://heirri.eu) and in the HEIRRI section of the RRI Tools website (https://www.rri-tools.eu). However, it is suggested to find a real or produce a realistic made-up case example analogue to the HEIRRI materials, but more closely related to the field of the master's programme. Then, students should work in groups, identify and discuss different issues of "responsibility" related to the case example. They should discuss the process itself (What is "responsible" in the given context? Which societal domains are directly/indirectly affected by the process and how? How could the process be organised in a more "responsible" way?) as well as its output and impact (What intended and unintended impacts could the project have? How could different areas of society benefit from it and how could they be harmed?). Students should put down their findings in an appropriate manner (poster, flip chart, smart board, etc.) and present them to their colleagues.

In the second unit, the facilitator gives a presentation of RRI to facilitate a common knowledge basis for subsequent discussions. However, this does not mean to impart one definition of RRI, but to make clear that there are several – sometimes competing – understandings of what RRI is, and to elaborate on a range of concepts; an introductory presentation on RRI can be found among the HEIRRI training

materials. The short presentation is followed by a Q&A and a plenary discussion. In this discussion, the focus should be on linking students' own findings on the case example from the first unit with the presented concepts and elements of RRI. Furthermore, parallels and dissimilarities between different RRI approaches and how they can be seen as contradicting or complimentary to each other should be identified.

Adaptation Possibility 1: Students already know RRI concepts

If the participating students already know different concepts of RRI, it is possible to change the structure of Part 1: Students should then initially split in several groups, each choosing a different aspect of RRI or one specific concept of RRI, and discuss the case example against this very specific background. Then, their findings should be presented in the plenary and the students should discuss differences regarding their results by applying these various concepts (as well as complementarities, contradictions, etc.). The presentation of the course instructor thus can be omitted and replaced by this more in-depth discussion of different RRI aspects and/or RRI concepts.
No changes in syllabus necessary.

Part 2: Present your thesis

In Part 2, students have to give lightning talks ("Pecha Kucha"; see Klein Dytham Architecture, n.d.; Klentzin et al., 2010) of five minutes on their research projects for their theses, outlining the (preliminary) topic and research design, its rationale, and how they want to implement it.

After each presentation there will be a discussion on RRI aspects that may be of relevance to the project. Together with the thesis author, students should identify relevant starting points for further individual inquiry. By including the course participants in the decision-making process on the subject of further investigation, this part mirrors the RRI aspect of public engagement in a playful manner and contributes to LO3, to "acknowledge and react constructively to suggestions from their peers regarding their own research work". In their final report, students should make clear how they assessed and dealt with the contributions from their peers and why they considered them in one way or another.

For each thesis, 20 minutes should be estimated in total (presentation plus discussion). Thus, in a class of ten participants, about four hours (two units) of in-class time are necessary for Part 2 of this course. If the course has more participants, students can split in two groups and present and discuss their theses within these groups. In this case, an additional course instructor (e.g. tutor) might be necessary.

Part 3: Investigate your thesis

After having discussed and identified first possibly relevant RRI aspects of their theses, students have to conduct further inquiry on them. They will be assigned to independently search for and go through reports, guidelines, or articles dealing with these matters. They should investigate if and how others have dealt with similar problems within their area of research and how certain strategies of (not) addressing these issues played out. If available, students can also turn to dedicated organisational units

within their higher education institution that deal with relevant RRI matters (e.g. an office for gender equality, an ethics board, etc.).

Part 3 mainly builds on independent study of the course participants; however, the course instructor should be available via email or face-to-face consultation if students need support. A further supportive option is to offer an online forum on an e-learning platform where students can exchange, ask and answer questions, and start discussions on various topics.

If Adaptation Possibility 2 is considered, more in-class time and supervision is needed. The work done in Part 3 contributes to all four identified learning outcomes.

Adaptation Possibility 2: Adding stakeholder interviews (+2.0 ECTS credits)

Part 3 can be extended in order to deal with matters of RRI more in depth and to promote students' ability and openness to engage with other societal actors. Building on desk research and group discussions, each student will identify three to four relevant stakeholders from different societal areas or experts regarding certain aspects of RRI. For example, they can establish contact with civil society organisations dealing with relevant aspects (environmental groups, human rights groups, patient organisations, etc.), representatives from industry, or experts in certain domains related to RRI (foresight, gender equality, ethics, etc.). Then each student should organise and conduct qualitative interviews with these stakeholders/experts, presenting the thesis project, and talking about the stakeholders'/experts' perspective on the project in general and with respect to certain pre-identified RRI aspects. Students then should prepare documentation for each interview and incorporate their findings in their final reports. They should deliberate on the possibilities to adapt their research projects to consider suggestions of the interviewees.

In order to successfully implement this part, it is either necessary that the course instructor has some knowledge in planning, conducting, and analysing qualitative interviews to be able to support students in this task, or that an expert on these matters is invited to support the students. Three additional in-class sessions – (1) Basics of qualitative interviews, (2) Developing an interview guideline, (3) Analysing the interviews – and additional independent work by the students, i.e. the organisation and conduct of interviews, analysis of interviews, and the consideration of findings in the final report, are necessary.

Changes in syllabus

Number of ECTS credits:	4.0 ECTS credits
Learning outcomes (LO):	*Additional learning outcomes (LO5 and LO6):* • "actively and openly seek the input from different societal stakeholders and experts regarding their own research activities; • and to acknowledge and react constructively to suggestions from different societal stakeholders."
Course content:	*Additional*: "Students will learn the basics of organising and conducting qualitative interviews with societal stakeholders and experts. They will further learn how to integrate feedback from external stakeholders into their own work."
Planned learning activities and teaching methods:	*Additional*: "Students will have to identify and contact relevant stakeholders and experts and conduct three to four qualitative interviews on RRI-related aspects of their theses' work with them, and analyse and use their findings in their final report."

Assessment methods and criteria:	*Additional*: "The final report has to comprise an additional chapter on the process of organising, conducting, and analysing the stakeholder interviews. Students should show how their findings affect their further work and if not, argue why they do not consider them. The presentation of results then should also include a reflection on their experience with engaging with different actors on issues of RRI."

Part 4: Enhance your thesis

In Part 4 of this course, students have to present their findings on RRI aspects of their theses and discuss them in class with their colleagues (see Part 1 for implementation suggestions). In this task, they should also present and discuss ideas how to deal with the gained insights and what consequences these might have for their further work. The work done in Part 4 (presentation and discussion) and especially the presentation and reflection of results contribute to reaching learning outcomes LO2, LO3, and LO4. For this part of the course, two in-class units of two hours each should be estimated.

As a final assignment, students have to write a final report summarising and reflecting the findings and insights from their investigation and discussions with their colleagues. Students should also outline how they plan to make use of the various inputs, if and how they want to adapt their research projects, and also argue why they do not consider certain insights and suggestions in their further work.

It is open to the students and their supervisors if they consider the findings on the RRI aspects in the projects for their master's theses. While in some study programmes and disciplines the topic and design of the thesis is largely predetermined by various factors (e.g. by supervisors, industry partners, local conditions or institutional guidelines), in others there is more freedom of choice, the possibility to modify the subject and design of the thesis, and to really incorporate findings into the research activities. However, it is recommended that the findings, if not considered in the design and implementation of the research process, are at least included in an own chapter of the theses, reflecting on RRI aspects and the potential wider societal implications of the thesis.

Syllabus

Element	Description
Title	Enhance your Thesis
Cycle	EHEA: Second cycle EQF level: 7 Degree level: Master
Year of study	Second year of master's studies
Number of ECTS credits	2.0 ECTS credits (workload of 50 to 60 hours)
Learning outcomes (LO)	On completion of the course students will be able to

	1. apply concepts of RRI to discuss research and innovation (R&I) processes and their outputs; 2. assess possible societal implications and impacts of concrete research activities; 3. acknowledge and react constructively to suggestions from their peers regarding their own research work; 4. and to propose adaptations to better align a research project with societal needs, values, and expectations.
Mode of delivery	This course combines different modes of delivery. In class, students will participate in problem-based learning (PBL) activities, deliver prepared presentations, and actively participate in discussions. A short input lecture on RRI will be given by the course instructor. A significant part of the course consists of independent work of the students (desk research, preparation of presentations, and a final report).
Prerequisites and co-requisites	Students should already have a topic/research question for and at least a preliminary design of their master's thesis research.
Course content	The course provides room for investigating, reflecting, and discussing societal implications and possible impacts of research and innovation processes. As reference points for this deliberation, different concepts of Responsible Research and Innovation (RRI) will be used. Students will discuss a research or innovation case example ("What are 'responsible' research and innovation?") before turning to their own master's theses. Together with their colleagues, each student will identify and discuss RRI aspects of their thesis ("Present your thesis") and then individually further explore on them ("Investigate your thesis"). They will present and discuss their findings, and reflect how they could practically deal with them ("Enhance your thesis").
Recommended or required reading and other learning resources/tools	There is no required reading for this course. However, the following texts and tools might be helpful when reflecting upon and investigating RRI aspects of the master's theses: • Kuhlmann, S., Edler, J., Ordónez-Matamoros, G., Randles, S., Walhout, B., Gough, C., & Lindner, R. (2016). *Responsibility Navigator*. Karlsruhe: Fraunhofer ISI. Retrieved 9 February 2017, from http://responsibility-navigator.eu/ • RRI Tools (web): RRI Toolkit. https://www.rri-tools.eu/search-engine • RRI Tools (web): Self-reflection tool. https://www.rri-tools.eu/self-reflection-tool
Planned learning activities and teaching methods	At the beginning of the course, the course instructor will give a presentation of different concepts of RRI. Later on, the instructor mainly serves as moderator of discussions and supporter for the students in their independent inquiry. Students will have to • analyse a R&I case example in a group exercise; • present their master's theses in a lightning talk; • actively participate in discussions on RRI aspects of the theses of others; • do desk research on the wider implications of their research project; • and give an oral presentation and write a final report on their findings.
Assessment methods and criteria	The following activities and outputs of the students will be assessed: • Active and constructive participation in discussions. • Lightning talk on master's thesis. • Presentation of the results of their desk research.

	• Written final report on their findings regarding the RRI aspects of their thesis.

References and further readings

Klein Dytham Architecture (n.d.). Pecha Kucha. Retrieved 1 August 2016, from www.pechakucha.org

Klentzin, J. C., Paladino, E. B., Johnston, B., & Devine, C. (2010). Pecha Kucha: using "lightning talk" in university instruction. *Reference Services Review, 38*(1), 158–167. DOI:10.1108/00907321011020798

Higher Education Institutions
& Responsible Research and Innovation

Responsible PhD: RRI and PhD Research Projects

Overview

Audience	PhD students
Year of study	Beginning of PhD research project
Number of ECTS credits	1.0 ECTS credit (workload of 25 to 30 hours)

Introduction

PhD candidates are expected to do original research and contribute to the knowledge in their respective field. For most students, it is the first time to do research that extends the boundaries of knowledge and to produce new insights into a specific issue or further push a technological development. In this process, questions of how to organise a research process in the right or responsible way may arise. How to do research that does not harm? How to produce findings that are socially robust? To deliberate on these and further questions, concepts of Responsible Research and Innovation (RRI) provide a means to reflect on and analyse different aspects of research processes and show how to steer them towards being more responsible and open to societal needs, values, and demands.

This training programme introduces PhD students to Responsible Research and Innovation and facilitates reflection and discussion about how responsibility can be understood and practiced in academic research. Students will first discuss different concepts of and approaches towards RRI and apply them to a concrete research and innovation (R&I) case example. Then, participants will look at their own research project from an RRI perspective and will think about and propose how to practically consider and apply RRI in this context.

The target audience of this programme are PhD students at the beginning of their studies as well as other early career researchers. The course should be implemented with about fifteen participants. It demands a high level of active participation in all parts and preparatory work in advance of the course. Students have to actively engage in discussions and group exercises, complete reading assignments, hold a presentation, and write an essay. It is possible to also integrate a public engagement activity, which makes the course more interactive and comprehensive, but at the same time more demanding in terms of resources (see Adaptation Possibility 1).

On completion of this course students will be able to (learning outcomes – LO)

1. analyse and discuss the main characteristics of different concepts of Responsible Research and Innovation (RRI) and their implications for research practices;
2. apply different concepts of RRI to identify possible ways to make concrete R&I processes more responsible;
3. and to identify possibilities to make their own research projects both on the procedural and outcome level more responsible.

1.0 ECTS credit is awarded on completion of this course; it has a total workload of 25 to 30 hours with in-class time between six and eight hours. The different parts should be implemented in the given order; it is possible to realise the training programme as blocked course or in four individual sessions over a longer period of time. The course can be extended by implementing different adaptation possibilities described below; then, a total of 2.0 ECTS credits are awarded.

Structure of the course and implementation

This course is divided into four parts employing different teaching and learning methods and addressing the topic of RRI from various angles. The different parts build on each other and should be conducted in the given order:

1. Concepts of RRI
2. RRI concepts in practice: Inquiring cases of R&I
3. RRI in PhD students' research
4. Responsible PhD: Conclusions

The course can be implemented as a one-day workshop (six to eight hours) or in individual sessions of one and a half to two hours on separate days. However, in either case we strongly recommend implementing Part 1 and Part 2 together on one date. In the descriptions of Part 3 and Part 4 of this training programme, adaptation possibilities are identified which should enhance the course by implementing activities in line with basic ideas of RRI into the teaching and learning processes. Most of these adaptations make it necessary to have some time in-between different sessions to allow students enough time for preparations of specific activities.

In advance of the course, students have to complete a reading assignment (see description in Part 1) and should be prepared to shortly present their PhD project or their project proposal (see Part 3). Thus, the course instructor has to inform them of these tasks in time before the course takes place to allow enough time for preparation.

The course can be combined with the HEIRRI training programme "Supporting RRI: Developing RRI Guidelines for PhD Candidates", in which students develop practical guidelines based on concepts and ideas of RRI to be used by PhD students. In the course at hand, students could apply these guidelines to

their own projects and identify possibilities to make their own research processes more responsible. In case these two courses are combined, Part 1 of the training programme at hand can be omitted in favour of making Part 3 more comprehensive.

Part 1: Concepts of RRI

In the first part of the workshop students will "analyse and discuss the main characteristics of different concepts of Responsible Research and Innovation (RRI) and their implications for research practices" and thus show that they have achieved LO1. At the beginning of Part 1 the course instructor shows a more general introductory video on RRI to set the focus on the topic. Then participants will work in small groups on different concepts of RRI. The group works in Part 1 and Part 2 are loosely based on the Jigsaw method; you can find further information on this approach on the Jigsaw website (Jigsaw Classroom, n.d.).

In order to be able to do this in a meaningful way, each student has to prepare one article on RRI in advance of the course. Participants should prepare different texts so that there will be several "expert" groups on each text in the course. The course instructor should assign three to four selected text (depending on the total number of students) putting forward different concepts of RRI to different groups of about four students. We recommend a selection of the following texts representing different concepts of and approaches towards RRI. However, please feel free to identify other texts appropriate for your audience and scientific field. You can find further recommended literature on RRI on the HEIRRI website (http://heirri.eu) and in the HEIRRI section of the RRI Tools website (https://www.rri-tools.eu). For example, you could use the following texts (if you use other texts, you have to change the syllabus accordingly):

- Iatridis, K., & Schroeder, D. (2016). The Basics of Responsible Research and Innovation. In *Responsible Research and Innovation in Industry. The Case for Corporate Responsibility Tools* (pp. 5–30). Heidelberg/New York, NY/Dordrecht/London: Springer. DOI:10.1007/978-3-319-21693-5_2
- Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. *Research Policy, 42*(9), 1568–1580. DOI:10.1016/j.respol.2013.05.008
- Taebi, B., Correljé, A., Cuppen, E., Dignum, M., & Pesch, U. (2014). Responsible innovation as an endorsement of public values: the need for interdisciplinary research. *Journal of Responsible Innovation, 1*(1), 118–124. DOI:10.1080/23299460.2014.882072

In Part 1, students who have read the same texts in advance should gather in groups. Within these "expert" groups, students should clarify aspects they do not fully understand yet, identify the most relevant characteristics of the conceptualisation of RRI as well as possible practical approaches in line with the selected concept. They should identify and collect possible aspects that should be considered in research processes, and also start to deliberate on concrete measures to put the concepts into

practice. The main strands of the discussion and the insights on the RRI aspects to be considered in research processes should be systematically collected by the working group and written down on flip charts, whiteboards, or other means that make it possible to visibly display the findings in class.

Part 2: RRI concepts in practice: Inquiring cases of R&I

In the second part of the workshop, students will apply the different concepts they have discussed in the first part with regards to a concrete scenario of an R&I process. Based on the concepts of RRI they have dealt with, participants should identify RRI aspects of this scenario and then come up with first ideas of how to make the R&I process more responsible. By doing so, they are working towards achieving LO2.

You can find case scenarios to use for this purpose in the HEIRRI training materials. However, we suggest finding or developing case examples related to the field of study of the workshop participants. You can use the cases in the HEIRRI materials as blueprints for this task.

For Part 2, students should form groups again, but this time experts on different RRI concepts should assemble in new “mixed” groups. In these groups, students then have to analyse the case examples drawing on different concepts of RRI. Every group member should bring in the specific focus stemming from the RRI concepts they have worked with. Thus, participants do not only get to know different concepts of RRI, but also try to bring these together considering a concrete case of R&I. In dealing with the case example, students should identify aspects of the R&I case, which should be considered from an RRI perspective. Then, the groups have to come up with ideas of how the R&I example process could be organised and implemented in a different and more responsible way drawing on concepts of RRI.

At the end of this part, every student group briefly presents their key findings and first ideas of how to make the process described as case example more responsible. These should then be discussed in the plenary.

Part 3: RRI in PhD students’ research

Part 3 of this training programme aims to use the knowledge and experiences students acquired in the first two parts to analyse and deliberate on their own research projects. Students will “identify possibilities to make their own research projects both on the procedural and outcome level more responsible” (LO3).

Therefore, participants will again form “mixed” expert groups (see Part 2) in which they will very briefly present their own PhD research projects or project proposals at first. In advance of the course, students have to be informed of this task in order to be able to prepare for it. In less than five minutes, they have to present their own research topic, (preliminary) research questions as well as the research

design and methods to their group. After all students have presented their projects, they should – together in the group – identify key aspects regarding RRI that should be considered and addressed in organising and conducting the individual projects. In this task, they should also try to look for similarities across the various projects in terms of challenges and issues of RRI that might pervade projects which seem to be quite different from each other at the very first glance.

At the end of Part 3 (or in a break between Part 3 and 4) students need time to individually systematise and write down the insights they gained for their own research projects. They have to prepare a self-explanatory poster or flip chart to be used in Part 4 of the training programme. This poster should give a brief description of the project and outline the main ideas and insights with regards to RRI.

Adaptation Possibility 1: Public engagement activity (+1.0 ECTS credit)

One important idea of different RRI concepts is to engage with different societal stakeholders and actors in a constructive dialogue. Mutual learning between people having different knowledge, values, perspectives, or professional and socio-economic positions should be made possible in order to improve R&I processes. We suggest including such public engagement also within the limits of this PhD training programme. Students should learn to "actively and openly seek input from different societal stakeholders regarding their own research activities" (LO4) and then also to "acknowledge and react constructively" (LO5) to these suggestions.

An appropriate public engagement approach for this purpose is a Science Café. In such an activity, different societal groups come together in an informal, non-academic context like a coffeehouse and discuss R&I developments or other science issues (for more information see SciCafe, n.d.). In a first step of the Science Café, it is necessary to give a short introduction explaining the context of this course, its overall approach, and its participants. Then, students could alternate with hosting tables with five or six Science Café guests, with presenting them their research projects or preliminary proposals, and with engaging in discussions on their further plans. They should reach out and listen to the Science Café guests and try to understand their perspectives on the research projects. Students should take notes during the activity, which should help considering the Science Café's participants input in their final essays.

This public engagement activity needs thorough preparation in advance: An appropriate location has to be found, e.g. a science museum, a science shop, or a coffeehouse in which it is possible to host such an event. A sufficient number of guests should be invited in order to be able to promote meaningful discussions. Students have to be briefed on the Science Café activity: They have to think about how to explain their research proposal idea to people who (probably) are not researchers or scientists and who do not have in-depth knowledge on the discussed research subjects. After the activity, the course instructor should moderate a debriefing in which the students exchange their experiences and assessments with this public engagement format. They have to write a protocol as a basis for their further elaborations in their final essay.

Changes in syllabus

Number of ECTS credits:	2.0 ECTS credits
Learning outcomes (LO):	*Additional learning outcomes (LO4 and LO5):* • "actively and openly seek input from different societal stakeholders regarding their own research activities; • and to acknowledge and react constructively to suggestions from different societal stakeholders."
Course content:	*Additional*: "Students will engage with different societal stakeholders in a mutual dialogue on their research project. They will try to understand different perspectives on their research project and reflect on how to consider these

	different views and possible suggestions in their own work."
Planned learning activities and teaching methods:	*Additional*: "Students will host a table at a Science Café explaining their project and then discussing it with different societal actors. They have to collect the insights they get from the guests of the Science Café and deliberate on how they could consider it in their research projects."
Assessment methods and criteria:	*Additional*: "The essay has to report on the experience of hosting a table at the Science Café, on the insights from this public engagement activity, and how these could be considered in the research project."

Part 4: Responsible PhD: Conclusions

The fourth and last part of this training programme is devoted to presenting and discussing students' insights from the previous parts.

First, an in-class exhibition of the posters or flip charts on the students' individual projects should be conducted. Therefore, the posters should be arranged in the classroom or another appropriate venue so that students can walk around and approach all of them. Then, the students should have enough time to do so: They should walk around and read the others' elaborations and possibly engage in bilateral discussions on specific posters or aspects with the other "visitors" or the "producer" of the exhibition piece. Thus, they should also have the opportunity to get to know the projects of the other working groups and also learn from them.

Adaptation Possibility 2: Broadening the audience

The above described in-class poster exhibition is a basic means to discuss the students' insights and findings regarding RRI aspects of their PhD projects. However, students remain within their own peer group and do not open up to other stakeholders and actors. Thus, we suggest inviting other actors to the poster presentations who might be interested in the work of the students. Students then remain with their posters and engage in discussions with the invited guests. Different types of audiences are possible, but also bring forward specific challenges and opportunities:

- One viable option is to invite the PhD students' supervisors, research group colleagues, or other members of the students' higher education institution. In this social constellation, students could not only present their ideas with regards to their PhD project, but a broader discussion on the institutional embedding of RRI in research and innovation processes could be pursued.
- If the participating students work on similar topics or within a specific scientific field, it is fruitful to invite societal stakeholders bringing in different perspectives on the subject, for example politicians, civil society organisations, industry representatives, etc. who have experience in this domain. Students could then get to know various societal perspectives on their projects and their deliberations on how to conduct them in a more responsible way. Furthermore, they train presenting their ideas and findings to other audiences outside academia.
- Another option is to invite other societal groups and/or a broader public that are not familiar with the presented topic, might not have knowledge in the field of study, or are used to deal with scientific issues and research in general. In this case, students practice elaborating their projects and findings in a way that is easily comprehensible also for non-experts. Furthermore, they can experience how people outside their scientific field understand and react to their work.

We encourage you to think of any other possible guests and audiences to invite for this purpose.

This opening-up needs additional preparation and resources: Invited guests need to know well in advance of this event, the

room has to provide enough space for the additional guests, catering has to be organised, the course instructor or another invited speaker should prepare an introduction to RRI and the workshop, etc.	
Changes in syllabus	
Planned learning activities and teaching methods:	*Discard*: "Finally, students will create posters displaying their research projects and related RRI aspects and present them in an in-class poster exhibition." *Additional:* "Finally, students will create posters displaying their research projects and related RRI aspects and present them in a public poster exhibition to interested actors and stakeholders."

In a final plenary discussion round, participants are asked to identify their most important insights or "lessons learned" from the workshop as a whole, from the small group work on their own research project, or from the poster exhibition. As final assignment, students then have to write an essay outlining their projects' RRI aspects and how they could possibly deal with them. In this essay, they should draw on the RRI concepts they have dealt with in the course, but also on the insights from discussing their own and the others' projects in class and probably with other societal groups (if Adaptation Possibility 1 or Adaptation Possibility 2 is implemented). By successfully completing this task, the students will show that they have achieved LO2 and LO3.

Beyond the duration of the course, PhD students should be encouraged to share their insights with others students or their supervisors as well as to consider them in organising their PhD research projects, if possible in the given context.

Syllabus

Element	Description
Title	Responsible PhD: RRI and PhD Research Projects
Cycle	EHEA: Third cycle EQF level: 8 Degree level: PhD
Year of study	Beginning of PhD research project
Number of ECTS credits	1.0 ECTS credit (workload of 25 and 30 hours)
Learning outcomes (LO)	On completion of this course students will be able to 1. analyse and discuss the main characteristics of different concepts of Responsible Research and Innovation (RRI) and their implications for research practices; 2. apply different concepts of RRI to identify possible ways to make concrete R&I processes more responsible; 3. and to identify possibilities to make their own research projects both on the procedural and outcome level more responsible.
Mode of delivery	This course employs in-class plenary discussions and small group work. Independent

	preparation of literature as well as a presentation in advance of the course is necessary.
Prerequisites and co-requisites	Participating students need to meet all requirements to enrol in a doctoral or PhD programme. They should be at the beginning of their PhD project, but they should already know their (preliminary) research topics and designs.
Course content	This seminar will introduce PhD students to different concepts of Responsible Research and Innovation (RRI) and initiate deliberation on how to make a PhD research project more responsible. Students will read about and discuss several concepts of RRI in groups and then apply them to concrete case examples of R&I processes. Furthermore, participants will introduce their own PhD research projects or first project ideas and identify possibilities to make them more responsible by using various concepts of RRI.
Recommended or required reading and other learning resources/tools	The course instructor will assign one piece of literature to each workshop participant in order to prepare it in advance: • Iatridis, K., & Schroeder, D. (2016). The Basics of Responsible Research and Innovation. In *Responsible Research and Innovation in Industry. The Case for Corporate Responsibility Tools* (pp. 5–30). Heidelberg/New York, NY/Dordrecht/London: Springer. DOI:10.1007/978-3-319-21693-5_2 • Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. *Research Policy, 42*(9), 1568–1580. DOI:10.1016/j.respol.2013.05.008 • Taebi, B., Correljé, A., Cuppen, E., Dignum, M., & Pesch, U. (2014). Responsible innovation as an endorsement of public values: the need for interdisciplinary research. *Journal of Responsible Innovation, 1*(1), 118–124. DOI:10.1080/23299460.2014.882072
Planned learning activities and teaching methods	The course combines different learning activities and teaching methods. Students will have to complete reading assignments and prepare for a short presentation on their PhD research or research proposal in advance of the course. At the beginning of the course, a video on RRI will be presented as an input to facilitate discussion on different concepts of RRI in small groups, using an approach based on the Jigsaw method. In changing small groups, students will compare and discuss different concepts of RRI, and will also apply these concepts in discussing R&I case examples and then their own PhD research projects. Finally, students will create posters displaying their research projects and related RRI aspects and present them in an in-class poster exhibition. To complete the course, students have to write an essay.
Assessment methods and criteria	The assessment will be based on the realisation and quality of the participants' • continuous and active participation in the different workshop activities; • poster presentation of the research project and related insights regarding RRI from the different workshop activities; • and their final essay deliberating on the RRI aspects of their research project.

Higher Education Institutions
& Responsible Research and Innovation

References and further readings

Jigsaw Classroom (n.d.). The Jigsaw Classroom. Retrieved 15 February 2017, from https://www.jigsaw.org/

SciCafe (n.d.). The Science Cafes Network. Retrieved 15 February 2017, from http://www.scicafe.eu/

Higher Education Institutions
& Responsible Research and Innovation

Supporting RRI: Developing RRI Guidelines for PhD Candidates

Overview

Audience	PhD students
Year of study	Beginning of PhD research project
Number of ECTS credits	1.0 ECTS credit (workload of 25 to 30 hours)

Introduction

The demand for research to answer to societal challenges and align research with societal expectations and needs is growing. The concept of Responsible Research and Innovation (RRI) addresses and promotes the idea of reflecting the societal embeddedness and impacts of research and innovation (R&I) and of considering different aspects in research processes. This PhD workshop is designed to initiate discussion and critical examination of research in its relation to society and societal challenges. The scientific work of participating PhD students and the context in which it is conducted function as starting point for discussing possible ways to practically implement RRI.

Responsible research takes different forms depending on the scientific discipline or field, and its implementation will also look differently in every institution or work setting. Depending on the specific context, there are several ways trying to foster responsibility in research, such as regulation (hard and soft law) or a growing number of practices, rules, and governance frameworks (e.g. Kuhlmann et al., 2016; Stilgoe, Owen & Macnaghten, 2013; Wickson & Carew, 2014). These guidelines, however, are often rather generic and do not consider the specific conditions of PhD students or specific issues of certain scientific fields.

The workshop “Supporting RRI: Developing RRI Guidelines for PhD Candidates” wants to encourage students to reflect on how RRI could be practically implemented in their own domain and with the resources they have in their specific position. It draws on different notions and concepts of RRI, which then should be transferred and adapted in developing basic guidelines for PhD students. Ideally, the course addresses PhD candidates that already have some insights into how R&I processes unfold in their scientific field, but are at the same time in an early stage of their PhD studies so they can therefore use the developed guidelines as orientation in their own work. The aim is to enable students to reflect on and critically assess their research, their individual or group working routines, to pose questions, and to consider responsible behaviour specific to their discipline.

The workshop format wants to answer to the fact that PhD programmes look very differently across the globe, which range from structured formats to quite independently guided scholarly research. They all focus on conducting research, thus the day-to-day work of PhD candidates often does not leave much time to participate in extensive seminars in their curriculum. Considering that, the course is designed as a discussion-based workshop of five to six hours in-class time which should then trigger further individual contemplation. It can be held independently as a single standing course, or it can be included as a module into larger formats like introductory events at the beginning of a PhD programme, PhD retreats, or summer schools which leave more time for intensive reflection. The number of participants should be relatively small, allowing intense discussion and deep reflection in a short period of time. The recommended maximum of participants is 10–12 people. 1.0 ECTS credit is awarded on completion (workload of 25 to 30 hours).

The limited in-class time suggests a flipped classroom format: Students will have to prepare introductory texts about RRI along guiding questions for a subsequent discussion in class. This task also serves as an introduction to the concepts behind RRI, which is particularly necessary if students are not yet familiar with them. In class, first ideas for guidelines will be developed in small groups and then discussed in the plenum. Participants will have to agree on a final version of guidelines that are suitable for their discipline and will include them in a concluding reflection essay about their own (planned) research projects.

On completion of this course students will be able to (learning outcomes – LO)

1. identify possibilities to promote Responsible Research and Innovation (RRI) given their own position in research and innovation (R&I) processes and institutional structures;
2. develop and formulate RRI guidelines for PhD candidates within their field;
3. and to deliberate on how to implement RRI into their own research projects.

The assessment of the students' performance will be based on the quality of

- the preparation of RRI-related texts;
- the active participation in the group work and in plenary discussions;
- and a short reflection essay on the feasibility of the developed RRI guidelines for PhD researchers for the respective student's own research project.

This course can easily be combined with other HEIRRI training programmes which deal with RRI more comprehensively, as for example the Summer School "Considering Responsible Research and Innovation by Design" or HEIRRI's Massive Open Online Course which introduces RRI to a broader audience.

Structure of the course and implementation

The workshop should last at least five to six hours (in-class time). In preparation for the workshop, students have to read basic RRI texts considering guiding questions. The texts will serve as the basis for subsequent discussions in class. In small groups, first ideas for possible RRI guidelines for the respective discipline will be drafted, which will then be further discussed among all participants. The aim is to agree on a set of guidelines, which can for instance consist of reflection questions for PhD students, relevant aspects to be considered in order to conduct responsible research, or actors and stakeholders that should be consulted before and during a research project. This set of guidelines does not necessarily have to put forward specific criteria to assess whether a research practice or project is responsible or not, but it should rather give advice on how to design and steer a PhD research process that recognises different perspectives on what is responsible in a given context. In conclusion of the workshop, participants have to write a short reflection essay considering the guidelines for planning and/or conducting their own research project.

If participating students are all from the same higher education institution (HEI) and have similar disciplinary backgrounds, these guidelines can be very specific and tailored to the concrete situation. If they have different backgrounds and come from different contexts, the guidelines will probably be more generic.

This training programme consists of the following segments, which are described in detail below:

1. Preparation of basic RRI literature (individually; no in-class work)
2. Workshop (altogether 5–6 hours in-class work)
    a. Part 1: Introducing RRI (1,5 hours in-class work)
    b. Part 2: Put RRI into PhD research practice (1–1,5 hours in-class work)
    c. Part 3: Support practicing RRI (1,5–2 hours in-class work)
    d. Part 4: RRI guidelines for PhD students (1 hour in-class work)
3. Reflection essay (individually; no in-class work)

Preparation of basic RRI literature

There are several introductory texts on RRI that can be used for the first task of this workshop. We particularly recommend reading the articles by Owen, Macnaghten and Stilgoe (2012), Wickson and Carew (2014), as well as the brochure of the European Commission on RRI (2012). Depending on the audience and interests, other literature can be employed as well. You can find a list of recommended literature and a collection of introductory videos on RRI in the HEIRRI training materials on the HEIRRI website (http://heirri.eu) and in the HEIRRI section of the RRI Tools website (https://www.rri-tools.eu). Depending on your choice you have to modify the syllabus accordingly.

It is suggested that students prepare the following guiding questions for the first in-class discussion. The questions can be adapted, modified, or replaced by others you consider suitable:

- How do you explain “Responsible Research and Innovation” based on the texts?
- Which arguments are presented to emphasise the importance of RRI?
- Thinking about your own discipline and academic setting, where can RRI be employed and contribute to more responsible research processes and outcomes?
- Can you see hindering factors for implementing aspects of RRI into you discipline?

Workshop Part 1: Introducing RRI

The workshop starts with a short introductory round of the participants. Every student should say a few words about why they chose to participate. As a starting point for the subsequent discussion, a short introductory video about RRI can be shown. You can find videos for such purposes in the HEIRRI training materials.

The next part of this workshop is devoted to an overall discussion on the thoughts and answers on the RRI introductory texts students prepared based on guiding questions. It is recommended to leave sufficient time for discussing each of the questions and other issues that might have come up. During this discussion, students should already identify different aspects and indicators of RRI and collect them on flip charts, whiteboards, or other appropriate means. The course instructor should take care that each student actively participates in this task.

In a further step, students will group the different identified aspects of responsible research and then rank the different categories according to what they want to work on. Based on their top priorities, participants should form smaller groups of two to three people. In these groups, they will discuss possibilities for PhD students to contribute to more responsible research processes and outcomes in the next session.

For Part 1 of the workshop about one and a half hours of in-class work should be estimated. Part 1 contributes to achieving learning outcome LO1, the students’ ability to “identify possibilities to promote Responsible Research and Innovation (RRI) given their own position in research and innovation (R&I) processes and institutional structures”.

Workshop Part 2: Put RRI into PhD research practice

In the second part of the workshop, students gather in the small working groups formed at the end of Part 1. They will deliberate on how to put RRI into practice in their domains and draft first suggestions for guidelines. Moreover, they should come up with concrete ideas on how to incorporate aspects of RRI into the own research settings. By doing so, they should draw on their own experiences within their HEIs or research institutions. They should reflect on their degrees of freedom in changing the

direction and implementation of research, in what respect and how they could change the environment or the project they are working in, and how research processes could be opened up in order to incorporate aspects of RRI. In this task, students should consider the different aspects of RRI collected together in the discussion in Part 1.

Students have to systematically collect and arrange their insights from this group work on flip charts, whiteboards, or another appropriate mean. They do not have to consent on every aspect of their work; if they employ different perspectives, they can also make these visible and put the competing visions up for discussion in the subsequent part of the workshop. If it is not possible to reach agreement on each and every element and detail, the diverging views as well as their consequences should be outlined.

For Part 2 about one to one and a half hours of in-class time should be estimated. Through their work in Part 2 to Part 4 of this workshop, students show that they are able to "develop and formulate RRI guidelines for PhD candidates within their field" (LO2).

Workshop Part 3: Support practicing RRI

Depending on the number of participants and the time envisaged for the workshop, results of the group work can either be discussed right away in the whole group, or an interim step can be taken: Two groups form a bigger group or the groups are mixed up with new partners; in these new groups, first ideas for guidelines are discussed and refined. Again, notes should be taken on the results.

In the plenum, group members shortly present their ideas for the guidelines. These ideas are then further discussed and an agreement on the most important and at the same time viable guidelines should be reached. The instructor or moderator should systematically write down the results of the discussion on a flip chart, whiteboard, or equivalent. However, again, it is not necessary to consent on every detail of the guidelines. If diverging views and experiences lead to different strategies and recommendations, this should be made clear and incorporated into the guidelines.

For Part 3 of this workshop one and a half to two hours of in-class time should be estimated.

Workshop Part 4: RRI guidelines for PhD students

In this final part of the workshop, the different elements of the guidelines are distributed amongst small groups of two to three people. In these small groups, the guidelines will be formulated in detail. Before starting to work on the task of formulating the different elements of the guidelines, some general principles on the format, the length, etc. should be agreed upon or determined by the course instructor. If possible, this step should be done using laptops, computers, or tablets to have the texts in a digital format. Either a voluntary participant or the course instructor should then collect the elaborations and combine them in one document, which should then be shared among all participants.

If students formulate the guidelines using a cloud document solution, the final step of collecting and bringing together the different elements can be omitted. In any case, students should have access to or receive the final version of the document at the end of the workshop.

A concluding round of agreement ends the workshop. We also suggest discussing how the developed guidelines could be used beyond the scope of the course and beyond the group of participants. For example, it could be shared with the students' council, the study programme supervisor, or other actors and bodies within or beyond the HEI.

For Part 4 of this workshop one hour of in-class time should be estimated.

Reflection essay

After the workshop, students have to write a reflection essay integrating the prepared RRI literature, the in-class discussions, and the developed guidelines. In this essay, they have to discuss how they plan to make use of the developed guidelines for their own research projects and PhD theses.

Depending on the state of their PhD, participants can draw up a plan of how to use the guidelines already in the process of finding a research question and in the research design. If they already have a concept of or are already in the phase of conducting their research, they can revaluate it according to the guidelines and see if they can or have to make adaptions. Participants who are already rather at the end of their PhD can outline how these guidelines could be transferred into other research contexts or how they could support early-stage PhD students in making their research processes more responsible.

With this final reflection essay, students show that they have achieved LO3, "to deliberate on how to implement RRI into their own research projects".

Adaptation Possibility 1: Follow-up workshop(s) (+0.5 or +1.0 credits)

In case the PhD programmes and curricula of the participants allow more time for the workshop, this course can be extended by implementing a follow-up workshop. This workshop should be scheduled at least several weeks or more after the initial workshop, e.g. at the end of the semester, the beginning or end of the following semester, or a year later. In this workshop, the experiences concerning the guidelines, how and if they have been implemented in the students' research, if there have been any hindrances in using them, and similar points should be discussed. For doing so, students should prepare a brief presentation on their experiences and present them to the group. The students' progress as well as their individual experiences will be discussed in the plenary.

A follow-up workshop of that kind can be conducted twice (the second to be held as well at least a couple of weeks after the first follow-up workshop). 0.5 ECTS credits can be awarded for each follow-up workshop.

The discussion can also be continued online instead of the in-class follow-up workshops, using a forum or equivalent on an online learning platform. For doing so, a forum on an appropriate (e-learning) platform needs to be set up in advance of the activity. Students can exchange their experiences and pose questions to be discussed and elaborated on by all of the participants and the course instructor. For the assessment, each student has to post a short recap of their development. 0.5

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ECTS credits can be awarded for this online activity.	
Changes in syllabus	
Number of ECTS credits:	1.5 or 2.0 ECTS credits (depending on the choice of the above described modus)
Learning outcomes (LO):	*Additional learning outcome (LO4):* • "reflect on the conduct of responsibility in their own research progress."

Syllabus

Element	Description
Title	Supporting RRI: Developing RRI Guidelines for PhD Candidates
Cycle	EHEA: Third cycle EQF level: 8 Degree level: PhD
Year of study	This training programme does not have a determined year of study. At best, however, students should attend this course at the beginning of their PhD training and before they start their research projects.
Number of ECTS credits	1.0 ECTS credit (workload of 25 to 30 hours)
Learning outcomes (LO)	On completion of this course students will be able to 1. identify possibilities to promote Responsible Research and Innovation (RRI) given their own position in research and innovation (R&I) processes and institutional structures; 2. develop and formulate RRI guidelines for PhD candidates within their field; 3. and to deliberate on how to implement RRI into their own research projects.
Mode of delivery	This short PhD course is a discussion-based workshop of five to six hours in-class time. Applying a flipped classroom principle, students have to prepare basic RRI literature to be used in class. Attendance of and active participation in the workshop are necessary for the students' assessment.
Prerequisites and co-requisites	Students need to have reached the required qualification to enrol into a PhD programme.
Course content	Building on basic RRI literature and in-class discussions, students will develop responsibility guidelines for their academic setting (and potentially for their respective discipline), which are viable for the students' further PhD research.
Recommended or required reading and other learning resources/tools	• European Commission (2012). *Responsible Research and Innovation: Europe's ability to respond to societal challenges*. Retrieved 16 February 2017, from http://ec.europa.eu/research/science-society/document_library/pdf_06/responsible-research-and-innovation-leaflet_en.pdf • Owen, R., Macnaghten, P., & Stilgoe, J. (2012). Responsible research and innovation: From science in society to science for society, with society. *Science and Public Policy, 39*(6), 751–760. DOI:10.1093/scipol/scs093 • Wickson, F., & Carew, A. L. (2014). Quality criteria and indicators for responsible

	research and innovation: Learning from transdisciplinarity. *Journal of Responsible Innovation, 1*(3), 254–273. DOI:10.1080/23299460.2014.963004
Planned learning activities and teaching methods	This course combines a set of learning activities and teaching methods: Employing a flipped classroom model, students have to prepare questions on RRI literature that will then be discussed in class. The workshop itself is mostly discussion-based, and work takes place in small to medium-sized groups or in the plenary. The concrete work on the guidelines is more productively done in small groups, while the suggestions and results are discussed in the plenary to reach agreement among all participants. Short presentations by each of the small groups are necessary to share the content of the work done. Concluding their experiences in the workshop, students have to reflect on and adapt the developed guidelines for their own research projects or planned research.
Assessment methods and criteria	The assessment of the students' performance will be based on the quality of • the preparation of RRI-related texts; • the active participation in the group work and in plenary discussions; • and a short reflection essay on the feasibility of the developed RRI guidelines for PhD researchers for the respective student's own research project.

References and further readings

European Commission (2016). The EU Framework Programme for Research and Innovation. Retrieved 16 February 2017, from https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges

Kuhlmann, S., Edler, J., Ordónez-Matamoros, G., Randles, S., Walhout, B., Gough, C., & Lindner, R. (2016). *Responsibility Navigator*. Karlsruhe: Fraunhofer ISI. Retrieved 9 February 2017, from http://responsibility-navigator.eu/

Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. *Research Policy, 42*(9), 1568–1580. DOI:10.1016/j.respol.2013.05.008

Wickson, F., & Carew, A. L. (2014). Quality criteria and indicators for responsible research and innovation: Learning from transdisciplinarity. *Journal of Responsible Innovation, 1*(3), 254–273. DOI:10.1080/23299460.2014.963004

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Teaching Responsible Research and Innovation in Higher Education

Overview

Audience	Academic and non-academic HEI staff
Year of study	–
Number of ECTS credits	No ECTS credits awarded. Workload of approximately 15 to 20 hours.

Introduction

The online course "Teaching Responsible Research and Innovation in Higher Education" addresses teachers, academics, and non-academic staff members working in higher education institutions. It is an introduction for those who want to get to know and start reflection on concepts of Responsible Research and Innovation (RRI). For those who want to teach RRI in higher education, this course provides useful information and guidance on how to organise and implement this task. The course format offers a high degree of time management to study provided information, materials, and work with interactive elements, and thus allows sufficient flexibility for higher education institution (HEI) actors who want to participate besides their day-to-day work. Nonetheless, the course also supports active deliberation and exchange between participants.

The course is structured in three parts: It aims to present different aspects of RRI in a concise way, including different concepts of RRI as well as their relevance (Part 1). Selected practical approaches to address certain aspects of RRI, including ethics or open access, are sketched (Part 2) and guidelines are presented on how to teach RRI in different higher education contexts and to different audiences (Part 3). The online course is mainly based on independent study of the participants in a specified timeframe and supplemented by interactive real-time and asynchronous online formats. Thus, the course offers some flexibility in studying the offered materials on RRI and at the same supports a commitment to continuously participate. After each part an online chat (e.g. Google hangouts© or similar live-chat solution supported by the designated e-learning platform) is hosted by the course instructor, and participants are encouraged to actively engage in real-time discussions on predefined issues (duration: about one hour). Additionally, the course offers an online forum, in which participants have the opportunity to post questions and take part in asynchronous communication with the other participants and the instructor. These interactive elements facilitate further cooperative reflection on specific issues and provide the possibility to clarify open questions.

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The course instructor has to implement the course on an appropriate e-learning platform which ideally should provide the possibility to register and create user accounts, display texts, embed (or link) videos and other files, set up an online forum in which participants can write entries and comment on the entries of others, and start online chats with other participants. If some of these features are not part of the available platform, they can be substituted by free solutions of external providers. The training programme guide at hand provides suggestions for different textual and guiding elements of the course. However, course instructors are strongly encouraged to adapt and extend them.

The course has a total workload of about 15 to 20 hours; this includes reading the course instructions, small texts, and some pieces of primary literature on RRI, writing forum entries and commenting on entries of others as well as participating in online chats.

On completion of this course participants will be able to (learning outcomes – LO)

1. formulate their understanding of responsible research and responsible innovation;
2. discuss approaches to promote RRI with regards to their applicability in research and innovation (R&I) processes;
3. and to adapt strategies and approaches for teaching and learning on RRI and propose concrete teaching activities for promoting RRI in higher education.

Participants should already have practical experience in R&I and teaching. However, it is also possible to broaden the audience to participants with little or no relevant experience. In this case – and depending on the actual existing knowledge of the participants –, additional reading material and support by the online course facilitator might be necessary.

This online course can be extended by linking it with the offline HEIRRI training programme "Facilitating Reflection on Responsible Research and Innovation". The combination of the two training programmes allows that the online course provides a good basis for the face-to-face deliberations and group works of the participants. The texts written for the online course can then work as an input for real-time discussions and further deliberation in the on-site workshop. For a very basic introduction to RRI it is possible to integrate a module of the HEIRRI training programme "Studying Responsibility: A Module-Based Integration of RRI into Bachelor's Programmes" into another course or create a small standalone course based on this module.

Structure of the course and implementation

The course can be implemented on already existing e-learning platforms of higher education institutions. The three parts of this course should be completed sequentially. There should be a well-defined timeframe for each part and participants should be informed on the duration and deadlines of each part. The learning materials consist of texts, various media formats (e.g. videos), and additional

documents (articles, policy papers); the material to be used can be found in the HEIRRI training materials on the HEIRRI website (http://heirri.eu) and in the HEIRRI section of the RRI Tools website (https://www.rri-tools.eu). The description of the course structure and its implementation provided in this guide are not meant to be transferred one-to-one to an e-learning platform. Instead, it is strongly recommended to adapt the provided material to better align it to the audience, institutional conditions, and disciplines. In addition, course instructors will have to draft some texts and elements in-between different parts or task descriptions themselves. In this guide, several sample texts to be modified and used in the courses are provided in boxes, e.g. introducing different parts of the course, defining forum activities, etc.

In this online course, participants have to work independently through the materials, watch videos, and read texts on RRI and related issues. They have to actively produce texts for and make their reflection visible in an online forum and a real-time online chat. The course instructor has to set up and maintain the course on an e-learning platform and has to monitor the forum activities, provide feedback, and support the participants if requested.

The online forum and chat

Central parts of this course are an online forum and a real-time chat. Both provide space for and promote reflection on RRI and related issues. The online forum provides the opportunity that participants ask for clarification and engage in discussions on specific aspects of RRI at any time. Furthermore, the forum format allows giving comprehensive statements on various aspects of RRI and related issues. It produces a virtual space in which participants can engage with each other, present their ideas, comment on those of others, and participate in discussions. In every part of the course, there will be one mandatory forum activity and participants will have to write an entry. Apart from that, the forum will not be directed by a moderator, but threads can be created by the users themselves.

The online chat gives the possibility of immediate reaction and should encourage participants to engage in even more interactive and vivid debates on selected issues. The fixed date of the online chat should support a temporal commitment; although participants should have some flexibility in studying the material, it seems important to set a frame in order to keep participants on board. Every online chat should start with a short round of introduction in which each participant identifies themself to create some sort of group feeling.

The role of the participants and the facilitator as well as the purpose of the online forum should be made clear at the beginning of the online course. In the online forum and chat, the course instructor functions as a facilitator asking questions to initialise debates on RRI and related issues. The instructor should not intervene a lot in the discussions, but should help to maintain a constructive atmosphere and moderate if necessary. If the discussion does not get started or stops early, the facilitator should

post add-on and/or more questions, e.g. asking participants to clarify and further elaborate on certain aspects of their posts. For tips on how to use and manage an online forum for online courses, please see Pappas (2015) or Salmon (2003).

From the beginning onwards, participants should be encouraged to actively participate in the discussions. In the following, different elements ("online course elements") that can be used (and adapted) for the online course are provided in boxes. There are also selected questions to post in the online forum and chat among these elements. These should be extended by more general questions, e.g. asking for the need for clarification. Furthermore, they can be supplemented by specific questions tackling current events in the respective field or country/region with relations to RRI. Feel free to adapt them to your own audience and the institutional context you are conducting the online course in.

If it is not possible or feasible to implement an online chat for real-time discussions, it is suggested to consider Adaptation Possibility 1 and replace the online chat with further forum discussions.

Adaptation Possibility 1: Replacement of real-time online chat

The online chat provides a possibility to engage in real-time discussion with other participants and thus create a better group atmosphere. However, in some cases it might not be possible to implement this activity due to for example lack of resources or if some participants of this online course might not be able to enter the chat on a regular basis for time reasons.

If the online chat activities are not a suitable option, they can be partially or entirely omitted and replaced by forum activities which tackle similar questions.

Changes of activities

Original online chat activity	*Replacement of online chat activity*
Online Chat 1: "The meaning of RRI"	→ Forum Activity 1.1: "Revisit your first entry on your own understanding of responsible and irresponsible research and innovation: How does the concept of RRI relate to your own definition? Are there overlaps, complementarities, or contradictions?"
Online Chat 2: "Practicing RRI"	→ Forum Activity 2.1: "Think about your own working context or about R&I processes you have been involved in. How would you assess the principles described in the "Responsibility Navigator" or the framework by Stilgoe, Owen, and Macnaghten: Are they applicable in your working context?"
Online Chat 3: "Barriers for teaching RRI"	→ Forum Activity 3.1: "Considering the different approaches and ways to teach RRI in higher education: What could be possible barriers for teaching RRI in higher education and how should be dealt with these barriers?"

The description of these forum activities should be drafted in line with the other forum activity descriptions given below. Do not forget to add a submission date and a reminder to comment on the entries of other participants.

Changes in syllabus

Planned learning activities and teaching methods:	*Discard:* "The course participants have to actively engage in several online forum and online chat activities at specific points during the online course." *Additional:* "The course participants have to actively engage in several online forum activities at specific points during the online course."

Introduction to the course

Before starting with the actual content of the course, a short introduction is provided, which outlines the structure and content of the course, its different elements and how to use them, including independent learning materials (e.g. texts, videos, articles) and interactive elements (online forum and chat).

The first task participants have to fulfil is to introduce them in a short text including their scientific field, working position, interests, etc. This task can also be made an obligatory part in the enrolment process. Depending on the e-learning system used, it might be advised to also use features like user-selected or generated avatars or profiles (including user photos) that can be displayed on a central page. Through this introductory assignment, participants will get to know each other a little bit better and a better sense of a community of learners can be established.

Online Course Element 1: Suggestion for course introduction text

Introduction to the course
Welcome to the online course on *Teaching Responsible Research and Innovation in Higher Education*! Research and innovation (R&I) are important cornerstones of past and contemporary societies. Through R&I, societal, economic, cultural, ecological, technical, and other challenges have been addressed, transformed, solved, or produced. R&I developments initiated and promoted the reflection and thinking about many different aspects of our world, environments, societies, and biological and human existence. R&I brought radical change upon our coexistence and lives and can be seen as major transformative forces of and in society. At the same time, as much as R&I are driving forces of societal transformation, society is forming and defining R&I through societal structures, practices, institutions, values, and norms. R&I objectives and processes as well as many of the changes caused and promoted by them can be seen both positively and negatively, depending on the perspective you choose, the aspects you consider in your assessment, or the information and knowledge you have. A decision on their positive and negative evaluation is often not possible beyond doubt or has so many facets that an unambiguous answer is not possible. In this complex situation, it is nevertheless necessary to decide on whether or not we should start and how we should implement certain R&I developments and processes. People involved in R&I, politicians, interest groups, different other societal stakeholders, and the broader public start to think about and deliberate on how to care about certain R&I developments and related issues or about the way we organise and do R&I in general. In this context, questions such as the following come up: Is this responsible? Is it responsible to deal with these issues in one way or another? Is this responsible in view of the next generation, our environment, our safety, our society, our freedoms, etc.? In short: How should be dealt with R&I in a responsible manner – how should R&I be done in a responsible manner? In this online course you will learn about, reflect on and discuss what responsible research and responsible innovation could mean in general, and what recently emerging concepts of Responsible Research and Innovation (RRI) are all about (Part 1). Then you will deal with approaches which have the potential to make R&I processes more "responsible" (Part 2). In the last part (Part 3), you will learn about different ways how to introduce concepts of RRI and related issues in higher education

teaching.

Throughout the course you will find short information texts and videos, primary literature, and further material (and references) to read and work with. In every part of the course, you will have to write an entry in the online forum on a specified topic and then read and discuss your and other entries with the other course participants. Please take your time in thinking about the questions raised and in writing your entry. Do not forget to read and comment on the entries of the other participants. In doing this, please acknowledge the efforts your colleagues put into drafting their texts and be constructive and respectful in replying to their entries. Once in a while you should come back to the forum and have a look if new entries have been posted. Please also abide to the submission deadline.

If you have any questions, please post them in the dedicated section of the online forum or contact the course instructor. Feel free to raise issues related to RRI or other relevant aspects of the course by creating own threads in the online forum.

Part 1: Concepts and relevance of Responsible Research and Innovation (RRI)

Part 1 of the course starts with a short introduction text presenting its issues and topics (see Online Course Element 2). Please adapt, extend, and enhance the text to your own needs and bring in aspects of responsibility you deem crucial in your own field. It is also possible to illustrate dilemmas of responsibility by presenting concrete case examples to support reflection. You can find case examples to use for this purpose in the HEIRRI training materials.

However, the introduction of this part should open up reflection on responsibility and not close it down by presenting a certain definition of responsibility or RRI.

Online Course Element 2: Suggestion for Part 1 introduction text

Introduction to Part 1: "Meaning and relevance of RRI"

In the first part of our course, we will deal with the question what "responsible" research and "responsible" innovation might mean.

This is not an easy task. The terms "responsible", "research", and "innovation" have manifold meanings and evoke different pictures depending on the context in which we use it, our own culture, upbringing and socialisation, field of study and profession, political view, and so forth. When thinking and talking of "responsibility" many questions come to mind:

Who can be responsible in principal?
Who is responsible in a certain situation?
What are these people responsible for?
What type of responsibility are we talking about?
When and how can and when and how should we exercise our responsibility?
Why do we have a certain responsibility?

Here and now we do not want to start a deep and complex philosophical discussion invoking the ideas of dead or living philosophers, ethicists, legal scholars, sociologists, theologians, or others. Before turning to the concept this course revolves around, that of "Responsible Research and Innovation" (RRI), we are simply going to ask ourselves what comes to our minds when talking of "responsibility" in contexts of R&I and with regard to concrete R&I activities.

The introduction is directly followed by a short reflection exercise. Participants have to think about their own understanding of responsibility in the context of research and innovation (R&I) by writing a

forum entry. This bottom-up approach emphasises the societal constructiveness and relativity of what is seen as "responsible" and should initiate a first reflection of the participants on their own often implicit understanding of what is "responsible" with regards to research and innovation processes and outputs. The questions are open by purpose: The participants should not be directed in one way or another, only focusing on specific aspects of responsibility (e.g. personal responsibility, systemic responsibility, etc.) or certain stages in R&I (e.g. organising R&I activities, the R&I processes, or the output and outcomes of these processes).

Online Course Element 3: Suggestion for Forum Activity 1: What does RRI mean to you?

Forum Activity 1: "The meaning of RRI"
Please think about research and innovation processes and developments in your field and also beyond. Then reflect and try to answer the following questions: *What is responsible research, what is responsible innovation in your opinion?* *What is irresponsible research or irresponsible innovation?* Keep in mind that there is no definitive or "right" answer to these questions and that you are free to voice your personal views. Please illustrate your answers with concrete examples to make it easier for the others to understand your points. Post your answer in the online forum, read the entries of other participants, and do not forget to comment on them in a constructive and respectful manner. You should submit your entry until [insert date]. Then you will have time until [insert date] to read and react to the entries of the other participants. Do not forget to visit the forum from time to time to see the entries of your colleagues.

For this and every other forum activity the course instructor should define a submission date that gives participants enough time to think about and post their ideas, but also to then read and react to the entries of others. To set a deadline for submitting and commenting is crucial in order to generate a higher degree of commitment. If possible in the given e-learning framework, participants should have to submit their entry before they are allowed to proceed to the subsequent input on RRI.

After the first forum activity, participants get an overview of Responsible Research and Innovation (RRI). In a video followed by a short text the basic ideas behind RRI are outlined. In this material, both broader concepts reflecting the overall science–society relationship and concepts defining a specific number of dimensions and approaches towards RRI are presented. The material to use for this purpose can be found in the HEIRRI training materials. Part 1 also wants to embed RRI in the long history of dealing with wider societal aspects of R&I. For this purpose, the text by Arie Rip on the "past and future of RRI" should be read by all participants (Rip, 2014).

At the end of Part 1, when all participants have completed the different elements and the reading assignment, the first online chat will take place. In this, participants are encouraged to reflect their own understanding of responsibility considering the concept(s) of RRI, think about their initial post in the online forum, and reflect on the posts of the other participants.

Online Course Element 4: Suggestion for Online Chat 1

Online Chat 1: "The meaning of RRI"
After more general clarification of upcoming questions, two key questions should be raise in the online chat: *What do you think of the concepts of RRI?* *How does RRI relate to your own definition of responsible research and innovation?*

Through the individual deliberation on the concept of "responsibility" and "irresponsibility" regarding R&I as well as the exchange with others on these issues participants show their achievement of LO1, that they are able to "formulate their understanding of responsible research and responsible innovation".

Part 2: Practical approaches to RRI

In Part 2 of this course, participants get to know selected strategies and practical approaches to steer R&I processes towards RRI. Part 2 will again highlight that there is no definitive way of promoting RRI and that different means can support "responsibility" in research and innovation processes. Furthermore, it also shows the relevance of RRI through selected concrete case examples illustrating the impacts of doing RRI and not doing RRI. Through completing the activities and assignments in Part 2 participants will train to "discuss approaches to promote RRI with regards to their applicability in research and innovation (R&I) processes" (LO2).

Online Course Element 5: Suggestion for Part 2 introductory text

Introduction to Part 2: "Practicing RRI"
In the first part of our course we dealt with the meaning of responsibility with regards to R&I in general and concepts of RRI in particular. We saw that there are various understandings of what "responsible" R&I processes and outputs could be and how "responsibility" is conceptualised in different takes on RRI. In this part of our online course, we want to turn to the more applied side of RRI and think about how R&I processes could be made more responsible in practice. In this context it is important to notice that the goal of making R&I "more responsible" does not mean that past and ongoing R&I endeavours have not been responsible in general, or that researchers, engineers, and other involved actors behaved irresponsibly. However, as you might have observed when reading other course participants' elaborations on "irresponsible" research, there have always been processes going on and producing (unintended) outcomes which can be assessed negatively. Furthermore, even very positive developments might have benefitted through the consideration of aspects of RRI in their planning and implementation and might also have become more satisfying for all involved actors. As you will see, the same holds true for definitions of RRI as for practical approaches to promote RRI: There are numerous. Thus, you will deal with some exemplary approaches to promote RRI, you will learn about specific places where you can find additional ones, and learn about RRI practices in more depth. However, you will not only get to know practices of RRI, but will also have to reflect upon and deliberate on how to put RRI in place in your own institutional context.

In the HEIRRI training materials you will find material explaining practical approaches to promote RRI and case examples on how considering RRI or certain aspects of RRI worked out. These should be

integrated into the course as reading material. Depending on the professional background of the participants, it might be fruitful to identify case studies from their scientific fields.

Participants will have to read two texts on holistic RRI approaches and case examples. We suggest the following two texts; however, please feel free to choose other papers from our recommended RRI literature list you will find on the HEIRRI website.

- Responsibility Navigator (Kuhlmann et al., 2016): This "thinking tool" gives actors in R&I orientation for making R&I more responsible. It identifies ten principles and gives related questions to deliberate on in organising and conducting R&I processes (Available from http://responsibility-navigator.eu/).
- Framework for responsible innovation (Stilgoe et al., 2016): In this paper, a general governance framework for RRI is developed and then a case of "responsible innovation in action" is given.
- Furthermore, this part should encourage participants to visit the RRI Tools website (http://www.rri-tools.eu), which offers a growing number of practices and approaches of, projects on, or other entries on RRI, and give them some guidance on the "tools" this comprehensive database offers. They should browse through the RRI Toolkit database (https://www.rri-tools.eu/search-engine) and identify one tool, inspiring practice, or project they consider interesting and useful.

Participants should also be stimulated to think about how their own higher education institution is supporting RRI and how they themselves, in their department or research group, could make a difference in this regard. Furthermore, they should reflect about how to make meaningful use of concepts and approaches towards RRI. Participants have to write a short entry in the forum and then engage in real-time discussions in the final online chat.

Online Course Element 6: Suggestion for Forum Activity 2: "Practicing RRI"

Forum Activity 2: "Practicing RRI"
Considering what you have learned about concepts of RRI and approaches to promote RRI, please think about your own experiences in research and innovation and the higher education institution you are working in: *How would you assess the principles described in the "Responsibility Navigator" and in the framework by Stilgoe, Owen, and Macnaghten?* *How are they applicable in your working context?* Please feel free to not only openly voice your personal opinion, but also argue why you are thinking in one way or another. If possible, illustrate your answers with concrete examples to make it easier for the others to understand your points. Post your answer in the online forum, read the entries of other participants, and do not forget to comment on them in a constructive and respectful manner. You should submit your entry until [insert date]. Then you will have time until [insert date] to read and react to the entries of the other participants. Do not forget to visit the forum from time to time to see the entries of your colleagues.

The second online chat will pick up issues of the first online chat in a more concrete way. It will relate RRI to the working experiences of the participants.

Online Course Element 7: Suggestion for Online Chat 2: "Practicing RRI"

Online Chat 2: "Practicing RRI"
After more general clarification of upcoming questions, two key questions should be raised in the online chat: *How have you already worked towards making research and innovation more responsible?* *Which opportunities and which challenges have you experienced in this regard?*

Part 3: Teaching RRI in higher education

After the participants themselves experienced learning about the basics of RRI and practical RRI approaches, they get to know how to teach RRI themselves. Part 3 of this train-the-trainer course presents guidance on how to teach RRI in higher education contexts. Adequate learning outcomes, course contents, course designs, and teaching methods for different educational levels are presented and then some example courses will be given. This part draws on the rich findings from the HEIRRI project and presents selected RRI training programmes as well as hints for their implementation. Furthermore, selected recommendations are given for further enquiry on appropriate teaching of RRI and related aspects.

After Part 3, participants should be able "to adapt strategies and approaches for teaching and learning on RRI and propose concrete teaching activities for promoting RRI in higher education" (LO3).

Online Course Element 8: Suggestion for Part 3 introductory text

Introduction to Part 3: "Teaching RRI in higher education"
In the first parts of this course, you reflected on and learned about what responsible research and responsible innovation can mean and how concepts of RRI and practical approaches try to deal with these issues. In all of that, you also had to think about your own understandings, your own experiences, and possibilities to transfer your newly acquired knowledge into your own working context. Now we will turn to one important means to spread ideas of RRI and promote the practical implementation of RRI in research and innovation in the long run. Most researchers, engineers, and other people working in or with regards to R&I, including policy makers, members of funding agencies or civil society organisations, science teachers, etc. learn about how R&I processes are organised and implemented as a student in school or higher education institutions for the first time. Only later they get first-hand insights in a work context. Today's students will be future researchers, developers, policy makers and other actors practicing and influencing R&I. Thus, it is crucial to enable them to think about their own work in R&I and that of others, and to apply a broader perspective by taking into account societal needs and values, the perspective of stakeholders and affected groups, the long-term and unintended effects of their work, etc. They should learn to consider, reflect, and put into practice principles of RRI, but also to critically reflect on RRI concepts and their impacts. In this last part of our online course, you will get to know a variety of approaches for teaching and learning RRI in higher education. You will see that teaching and learning RRI does not mean to only present concepts of RRI and methods to implement RRI to students. Rather, it means to initiate a process of thinking and reflecting about the notion of "responsibility", about the relationship between science and society, and about ways how fruitful and constructive cooperation between different actors and groups in and beyond R&I can be promoted.

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In this part, examples for teaching RRI outlined in HEIRRI training programmes (available on the HEIRRI website and in the HEIRRI section of the RRI Tools website) should be included. It is up to you which programmes or examples you select. However, we suggest presenting a broader range of programmes in terms of the target audience, e.g. one programme for bachelor's students, another for master's students, and yet another for PhD candidates. In the HEIRRI training materials you will also find further specific materials on teaching approaches which are appropriate for organising and facilitating learning on RRI. Please select a range of material and present it to your course participants. It is also possible to split your online class and assign certain materials to specific individuals. As further reading, the course can point to the text "The EnRRICH tool for educators" (Tassone & Eppink, 2016), which gives more general guidelines on how to design or redesign higher education curricula and courses in order to integrate RRI as a subject.

In the final forum activity, participants then have to think about how they could integrate RRI teaching and learning into existing courses or curricula. Together, they should then start to deliberate on how to transfer the knowledge from this course into their higher education institutions. They should come up with concrete ideas about how to integrate an RRI course into the study programmes they are affiliated to.

Online Course Element 9: Suggestion for Forum Activity 3: "Teaching experiences and approaches"

Forum Activity 3: "RRI teaching experiences and approaches"
Now, after you have read about how RRI could be integrated into higher education teaching, please think about your own experiences and answer the following questions: *What are your experiences with teaching RRI or topics related to RRI (ethics, research integrity, open access, etc.) in higher education?* *How could you make use of the presented training programmes and teaching approaches? Please bring forward an idea of how to integrate learning on RRI into one of your own courses!* Post your answer in the online forum, read the entries of other participants, and do not forget to comment on them in a constructive and respectful manner. You should submit your entry until [insert date]. Then you will have time until [insert date] to read and react to the entries of the other participants. Do not forget to visit the forum from time to time to see the entries of your colleagues.

The last online chat encourages participants to discuss their experiences with teaching RRI-related topics and link it with their ideas of integrating RRI teaching into higher education. They should think about and discuss possible barriers for such integration and try to come up with strategies to circumvent these barriers. After exchanging opinions and experiences and after having a discussion on these questions on the barriers for teaching RRI, the online chat should end with a more general round of feedback concerning the online course, its content, and structure.

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Online Course Element 10: Suggestion for Online Chat 3: "Barriers for teaching RRI"

Online Chat 3: "Barriers for teaching RRI"
Now that you have dealt with teaching RRI in higher education and read about concrete possibilities to approach this issue, please think about the following: *What could be possible barriers for integrating RRI teaching into higher education?* *How could one to deal with these barriers?*

After the third online chat the course ends. If participants want to further learn about RRI and teaching RRI, a list of recommended literature as well as a list of links to appropriate websites about RRI should be provided; you will find a commented list of recommended literature to use for this purpose on the HEIRRI website and in the HEIRRI section of the RRI Tools website. Since this course is an in-service training, no assessment of participants' achievement is envisaged. However, by implementing Adaptation Possibility 2, participants' achievements can be assessed and they can receive ECTS credits for completing the course.

Adaptation Possibility 2: Assessment and grading of participants

In some contexts it might be necessary to assess the achievements of the participants, grade them, and award ECTS credits on completion of the course. For example, PhD students in a structured doctoral programme might also want to take courses to improve their teaching abilities, but need credits to meet their study programme's requirements.

In order to receive credits for completing this course, we suggest collecting and grading the contributions of the enrolled course participants. In the online course, there are several forum activities and all participants have to submit entries in which they reflect or elaborate on different issues of RRI. The online chat is another possibility for the participants to contribute to the course.

This very open approach to assess learning outcomes regarding RRI is in line with HEIRRI's basic understanding of RRI as a broad approach that needs to be openly reflected upon and which is hard (and probably futile) to press into a tick-box exercise (e.g. as a quiz or multiple-choice test).

The syllabus for the course has to be changed and it should be made explicit that the continuous and active participation in the online forum and chat are necessary to complete the course and receive a final grade.

Changes in syllabus

Number of ECTS credits:	1.0 ECTS credit
Cycle, Year of study:	*Additional:* Information according to target audience.
Assessment methods and criteria:	*Discard:* "In-service training; no assessment envisaged."
	Additional: "In order to complete the workshop and receive a final grade, participants have to • write entries for the online forum answering the defined questions; • and to actively participate in online discussions in the online forum and chat by commenting on the activities by others."

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Syllabus

Element	Description
Title	Teaching Responsible Research and Innovation in Higher Education
Cycle	In-service training; not part of a study programme.
Year of study	–
Number of ECTS credits	No ECTS credits awarded. Workload of approximately 15 to 20 hours.
Learning outcomes (LO)	On completion of this course participants will be able to 1. formulate their understanding of responsible research and responsible innovation; 2. discuss approaches to promote RRI with regards to their applicability in research and innovation (R&I) processes; 3. and to adapt strategies and approaches for teaching and learning on RRI and propose concrete teaching activities for promoting RRI in higher education.
Mode of delivery	This course is an online course providing different materials (e.g. articles, texts, videos, links) and interactive elements (online forum and chat).
Prerequisites and co-requisites	Participants should have a basic knowledge of philosophy of science, science technology studies, sociology of science, or similar. Furthermore, they should have experience in research or innovation processes as well as in higher education teaching.
Course content	In this online course, participants will reflect on what responsible research and responsible innovation means, and learn and discuss ideas and concepts of RRI as well as some practical approaches to promote RRI. One focus in this regard will be on teaching and learning RRI in higher education.
Recommended or required reading and other learning resources/tools	• Kuhlmann, S., Edler, J., Ordónez-Matamoros, G., Randles, S., Walhout, B., Gough, C., & Lindner, R. (2016). *Responsibility Navigator*. Karlsruhe: Fraunhofer ISI. Retrieved 9 February 2017, from http://responsibility-navigator.eu/ • Rip, A. (2014). The past and future of RRI. *Life Sciences, Society and Policy, 10*(17). DOI:10.1186/s40504-014-0017-4 • RRI Tools (web): RRI Toolkit. https://www.rri-tools.eu/search-engine • Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. *Research Policy, 42*(9), 1568–1580. DOI:10.1016/j.respol.2013.05.008 • Tassone, V., & Eppink, H. (2016). *The EnRRICH tool for educators: (Re-)Designing curricula in higher education from a "Responsible Research and Innovation" perspective. EnRRICH Deliverable 2.3.* Retrieved 9 February 2017, from http://www.livingknowledge.org/fileadmin/Dateien-Living-Knowledge/Dokumente_Dateien/EnRRICH/D2.3_The_EnRRICH_Tool_for_Educators.pdf
Planned learning activities and teaching methods	The course requires a high level of motivation and autonomous work by the participants. They have to read and comprehend the given texts, linked documents, and articles as well as case examples in defined time periods. The course participants have to actively engage in several online forum and online chat activities at specific points during the online course. They have to write entries answering to defined questions, comment on entries by others, and engage in discussions on RRI and related issues.

Assessment methods and criteria	–

References and further readings

Pappas, C. (2015). 7 Tips On How To Use Forums In eLearning. Retrieved 1 August 2016, from https://elearningindustry.com/7-tips-use-forums-in-elearning

Salmon, G. (2004). *E-moderating: The Key to Teaching and Learning Online* (2nd ed.). London/New York, NY: Taylor & Francis.

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Facilitating Reflection on Responsible Research and Innovation

Overview

Audience	Academic and non-academic HEI staff
Year of study	–
Number of ECTS credits	No ECTS credits awarded. Workload of approximately 25 to 30 hours.

Introduction

The HEIRRI project aims to promote the integration of Responsible Research and Innovation (RRI) into higher education. In the process of developing courses for training students to reflect on and practice RRI, it became obvious that although many issues related to concepts of RRI (e.g. research integrity, open access, or gender equality) have been discussed and taught in higher education settings, teachers are often not yet familiar with concepts of RRI themselves. They acknowledge the importance of steering research and innovation (R&I) processes towards RRI, but are not sure how this could be done, e.g. in terms of teaching RRI. In order to be able to teach RRI and use the HEIRRI training programmes, it is necessary to initiate a learning and reflection process on the behalf of the teachers (and other higher education actors) first.

This one-day in-service training workshop addresses this issue and proposes a way to support higher education teachers and other actors in higher education institutions (HEI) who want to promote RRI in their institution. It aims to facilitate reflection on issues of RRI among the participants of the workshop as well as to make them aware of how to facilitate reflection on RRI on behalf of their students in their own teaching activities.

Dealing with concrete case examples provided, participants will inquire and discuss the wider societal impacts of R&I processes, and will thus also deliberate on how these could be done more responsibly. Participants will get to know concepts of RRI and discuss their value in re-thinking the science–society relationship, in changing the ways of doing R&I, and in teaching students in higher education.

In the development process of the HEIRRI training programmes, involved actors from higher education institutions often remarked that they want to promote RRI or related issues in their institution or study programme, but that it is often hard to find allies in this regard. Entrepreneurs of research ethics, gender equality, open access, or other RRI-related issues sometimes feel isolated or not well connected within their institution and do not know from or work with each other. Through taking part in the

workshop, they have the opportunity to get to know others working on or interested in pursuing similar aims in higher education training. Thus, it is also a valuable opportunity to initiate collaboration, e.g. setting up a course on RRI together.

On completion of this workshop participants will be able to (learning outcomes – LO)

1. apply concepts of Responsible Research and Innovation (RRI) to discuss the societal implications of research and innovation (R&I) developments;
2. and to outline how to promote reflection on RRI and related issues in higher education settings.

This workshop consists of a sequence of plenary discussions, short presentations, and small group work. It is intended to be used as in-service training; therefore, no ECTS credits are awarded on completion of the course. However, additional assessment and awarding 1.0 ECTS credit is possible (see Adaptation Possibility 3).

Structure of the course and implementation

The workshop can be held on one day (6 to 8 hours) and consists of three main parts:

1. Reflecting the impacts of R&I
2. Applying concepts of Responsible Research and Innovation
3. Facilitating reflection on RRI in higher education

Depending on the purpose of this course in the respective higher education context, the allocation of time to the different parts can be varied. For example, if the emphasis should be on getting to know and using the concepts of RRI, more time can be used for Part 1 and Part 2 (5 hours) and Part 3 can be shortened to a more general discussion of one hour on how to promote RRI through teaching. If the emphasis should be on teaching RRI in higher education, Part 1 and Part 2 can be shortened in order to give the participants more time to come up with even more concrete course designs for teaching RRI.

Furthermore, the workshop can be extended, e.g. by additionally implementing HEIRRI training programme “Teaching Responsible Research and Innovation in Higher Education”. This online course especially addresses members of HEIs and promotes further reflection on concepts of RRI, related practical approaches, and teaching methods. Other courses focusing less on teaching RRI but more on concepts of RRI can be found among the HEIRRI training programmes on the HEIRRI website (http://heirri.eu). Especially the HEIRRI Summer School and the HEIRRI Massive Open Online Course can be adapted to suit the needs of the target group.

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Part 1: Reflecting the impacts of R&I

Through their active work in Part 1 and Part 2 of this workshop, participants will learn how to "apply concepts of Responsible Research and Innovation (RRI) to discuss the societal implications of research and innovation (R&I) developments" (LO1).

The participants, e.g. active researchers, lecturers, or study programme managers, might not be accustomed of being in the role of "students" doing reflection and discussion exercises anymore. However, the teaching approach of this course is selected by purpose: participants should experience first-hand how it is to deliberate on the "responsibility" of R&I developments in a group. Thus, they might become more sensible with regards to the challenges such reflection entails, which is an important asset when teaching RRI to students in similar ways. At the beginning of the workshop, the instructor should explain this rationale of the course design in order not to cause disconcertment among the participants.

After this short briefing and a round of introduction, the workshop starts with a short presentation of an R&I development that has the potential of wider effects on society and the environment, both deriving from the process itself and from its output. R&I case examples for this purpose can be found in the HEIRRI training materials on the HEIRRI website (http://heirri.eu) and in the HEIRRI section of the RRI Tools website (https://www.rri-tools.eu). However, it is advised to find a real or produce a realistic made-up case example analogue to the HEIRRI materials, but more closely related to the given context (e.g. regarding the scientific focus of the HEI or related to a relevant R&I development in the region/country).

Then, participants are asked to form working groups, and elaborate on and discuss what impacts these developments could have in different areas and how these impacts could unfold. Participants are encouraged to come up with different visions of the future of the R&I development under discussion and different ways how to steer the development in one way or another. In doing this, they should be stimulated to reflect on what they would assess as a "responsible" progress, but also to think about what and how other societal actors might oppose or support their assessment and what other perspectives might occur in different societal contexts. In this task, it is important that participants do not need to come up with a consensual definition, but to open up their deliberation to diverging or contesting opinions and views and try to deal with them in constructive and cooperative ways.

Participants are asked to put down the main strand of their discussion as well as their findings on posters, flip charts, or any other appropriate medium to display and present them to their fellows. Since the participants have to further work and deliberate on their findings from Part 1 in the next part of the workshop, this step is crucial; the course instructor should emphasise this and remind the participants early enough to adhere to this task. These records should be collected and further used in Part 2 of the workshop.

The course instructor is free to modify this basic approach of group discussion and work, and to apply more elaborate dialogue and discussion formats. On the one hand, such approaches need more preparation, more guidance for the participants, and more time, and on the other hand, more interesting and differentiated insights and learning effects might be their result (see Adaptation Possibility 1).

Adaptation Possibility 1: Introducing specific dialogue and discussion formats

There are numerous approaches to facilitate dialogue, discussion, and reflection on societal implications and impacts of R&I, including the scenario workshop (Gnaiger & Schroffenegger, 2008), the Round Table (Science et Cité, n.d.), the (Neo-)Socratic Dialogue (Birnbacher, 1999; Littig, 2004), or other approaches for deliberation or participatory Technology Assessment. Rowe & Frewer (2000), Elliott et al. (2005), and Participedia (n.d.) give an overview of different possible approaches to be used for this purpose. Bryndum et al. (2016) present a design developed for discussing R&I explicitly with reference to RRI (see further readings section at the end of this guide). For the purpose of the workshop, these approaches have to be modified and adapted to the given situation: In this one-day workshop time is limited and the group of stakeholders may be quite homogenous (e.g. members of the same HEI). For several of these approaches, more time, more space, and more participants from various societal fields (civil society, industry, politics, etc.) are needed. This has to be considered in organising and implementing the course using a dialogue/participatory approach.
Changes in syllabus *Planned learning activities and teaching methods:* — *Additional:* Information on the selected dialogue/discussion approach.

Part 2: Applying concepts of Responsible Research and Innovation

In Part 2 of the workshop, the basic ideas and different concepts of RRI are presented by the course instructor and subsequently discussed by the participants. RRI should not presented as one fixed concept, but the variety of approaches towards RRI should be described, including the key dimensions identified by the European Commission (see e.g. EC, 2014) and more holistic concepts of RRI (see e.g. Stilgoe & Macnaghten, 2013). In the HEIRRI training materials, presentation slides and a video for such purposes are offered.

There is no required reading for this course. However, if possible, workshop participants should receive a list of basic literature ahead of the course in order to be able to read some introductions to RRI in advance. Thus, they are able to directly raise questions and issues for more in-depth discussions and to be better prepared for the next steps in the workshop. A list of recommended literature on RRI can be found in the HEIRRI training materials.

Adaptation Possibility 2 Inviting RRI scholars or entrepreneurs

The course foresees that the course instructor presents different concepts of RRI and discusses them with the workshop participants. However, to further promote the discussion on RRI, its challenges, and benefits, it is suggested to additionally invite external RRI scholars or entrepreneurs. These guest speakers should present their own views and visions of RRI and talk about their experiences regarding the promotion and implementation of RRI. The course instructor should then moderate a dialogue between this guest speaker and the workshop participants. Together, they should think about how to

practically implement RRI in different areas of R&I, on different organisation levels, and in the training of students and researchers.	
Changes in syllabus	
Mode of delivery:	*Additional:* "an input presentation by an invited RRI scholar and subsequent discussion."

After outlining the basics of RRI, participants should revisit the visions and ideas they developed in Part 1 of the workshop. They should try to think of how the integration of RRI principles and implementation of activities supporting RRI could change the progress of development and how they could have an effect on the envisioned impacts.

The groups should collect and elaborate on their findings, e.g. via flip charts, posters, or slides, and present them to the other participants. In doing this, they should explicitly link their findings to those from Part 1 and are free to use their posters or flip charts they produced in the first part of the workshop.

Part 3: Facilitating reflection on RRI in higher education

Part 3 deals with how to facilitate reflection on RRI in different higher education settings. It will enable participants to "outline how to promote reflection on RRI and related issues in higher education settings" (LO2). The participants should discuss how the first two parts of the workshop worked out on a process level and how similar reflection exercises could be integrated into different higher education settings. They should discuss possibilities as well as barriers for such reflection drawing on their own teaching experiences. Furthermore, they are encouraged to come up with very concrete ideas on how students can learn about RRI and understand the concepts and related practices. Depending on participants' own experiences in teaching topics similar or closely related to RRI, different approaches to this task might be more or less appropriate; they can, of course, be combined.

If the participants have a good degree of experience with teaching RRI-related issues in higher education, the elaboration of ideas and designs how to teach RRI can be developed in a bottom-up fashion. They should report on their relevant teaching experiences and then gather in groups to develop a rough design or framework for teaching RRI, including possible content, learning outcomes, and teaching and learning methods. In this task, they should link their own well-tried practices and align them with the issue of RRI. It is also possible to assign a specific task to each group, e.g. to come up with a workshop for PhD students or a seminar for master's students.

In case the participants cannot draw on experiences with teaching RRI-related topics, they can use different materials as starting points for their deliberation on and the development of courses. There

have been various projects developing and collecting material regarding RRI in general and teaching RRI in higher education (and other contexts) in particular:

The HEIRRI training programmes can be used as concrete case examples for higher education courses on RRI for different educational levels and purposes.

- The EnRRICH project's "tool for educators" (Tassone & Eppink, 2016) gives some general guidelines on how to adapt existing courses or create new courses on RRI.
- The RRI Tools project (http://www.rri-tools.eu/) developed the so-called RRI Toolkit comprising RRI-related material. This database also contains more general information, concrete guidance ("tools") as well as case examples for the education community.

It is recommended to have selected material ready for the participants to work with, either printed out or digital on appropriate devices. As in the other parts of the workshop, participants should be reminded to write their findings down on flip charts or record them in another way suitable for presenting/displaying them to their colleagues.

The workshop closes with each group presenting the results of their deliberation and development process and discussing them with their colleagues. One aspect which should be discussed is how the proposals for teaching RRI could work out under different conditions, e.g. in different fields of study or faculties, and how and if these could be further developed to be actually realised in an academic context. The resulting proposals for teaching RRI should be collected, either by one individual per group or by a photo protocol, and shared among the participants.

Adaptation Possibility 3 outlines how to modify the course so that one ECTS credit (equivalent to a workload of 25 to 30 hours) can be awarded.

Adaptation Possibility 3 Additional assessment and ECTS credits

In some contexts it might be necessary to assess the achievements of the participants, grade them, and award ECTS credits on completion of the course. For example, PhD students in a structured doctoral programme might also want to take courses to improve their teaching abilities, but need credits to meet their study programme's requirements. In order to receive credits for completing the workshop, participants have to hand in a final paper which builds on their insights and knowledge from the in-class exercises in order to show that they achieved the defined learning outcomes. In this final paper, participants have to outline a design for a higher education course on RRI considering their own institutional and scientific context, develop modules to introduce RRI as a cross-cutting issue in existing courses, or propose another form of strategy (including concrete goals, practical steps, etc.) to facilitate and promote reflection on RRI in a higher education or research setting (e.g. within a research group or department).
Changes in syllabus *Number of ECTS credits:* 1.0 ECTS credit *Cycle, Year of study:* *Additional:* Information according to target audience.

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Assessment methods and criteria:	*Discard:* "In-service training; no assessment envisaged." *Additional:* "In order to complete the workshop and receive a final grade, students have to • actively participate in the workshop activities; • and to write a paper outlining a design for a standalone higher education course on RRI or on how to introduce RRI as a cross-cutting issue in their existing courses or a whole study programme."

Syllabus

Element	Description
Title	Facilitating Reflection on Responsible Research and Innovation
Cycle	In-service training; not part of a study programme.
Year of study	–
Number of ECTS credits	No ECTS credits awarded. Workload of approximately 25 to 30 hours.
Learning outcomes (LO)	On completion of this workshop participants will be able to 1. apply concepts of Responsible Research and Innovation (RRI) to discuss the societal implications of research and innovation (R&I) developments; 2. and to outline how to promote reflection on RRI and related issues in higher education settings.
Mode of delivery	This is a full-day workshop combining an input lecture by the course instructor with in-class group work using a case example, presentations, and plenary discussions.
Prerequisites and co-requisites	Experience in or knowledge about higher education teaching.
Course content	In this workshop, participants will envision possible futures connected to R&I developments. They will reflect on strategies and ways how to steer these developments and their possible wider societal and environmental impacts using concepts of RRI. Then, the course will especially focus on how to integrate such reflection on issues of RRI into higher education teaching and training. Together in groups participants will develop different approaches and designs for teaching RRI to various higher education audiences.
Recommended or required reading and other learning resources/tools	RRI teaching and learning in higher education: • Lang, A., Altenhofer, M., Wuketich, M., Griessler, E., & the HEIRRI consortium (2017). *HEIRRI Deliverable 3.2. Training Programmes*. Retrieved from http://heirri.eu/resources/deliverables • RRI Tools (web): RRI Toolkit. https://www.rri-tools.eu/search-engine • Tassone, V., & Eppink, H. (2016). *The EnRRICH tool for educators: (Re-)Designing curricula in higher education from a "Responsible Research and Innovation" perspective. EnRRICH Deliverable 2.3.* Retrieved 9 February 2017, from http://www.livingknowledge.org/fileadmin/Dateien-Living-Knowledge/Dokumente_Dateien/EnRRICH/D2.3_The_EnRRICH_Tool_for_Educators.pdf

Planned learning activities and teaching methods	First, participants will reflect and discuss an R&I case example presented by the course instructor in small working groups. In this exercise, they will deliberate on what constitutes a "responsible" progress of an R&I development and identify different perspectives on the case example. In plenary presentations and subsequent discussions they will exchange their findings with their colleagues. Second, concepts of RRI are introduced and the participants will have to re-visit their findings and further deliberate on them by referring to these concepts. Third, participants will have to develop approaches and concepts how to teach RRI in their higher education context. By doing so, they should draw on their own teaching experiences and try to link these with the concepts of RRI.
Assessment methods and criteria	In-service training; no assessment envisaged.

References and further readings

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Considering Responsible Research and Innovation by Design

Overview

Audience	Master's and PhD students, R&I actors and other stakeholders
Year of study	–
Number of ECTS credits	2.0 ECTS credits (workload of 50 to 60 hours)

Introduction

The requirements for research and innovation (R&I) to consider societal aspects of their work and developments have been increasing in the last decades. The approach of Responsible Research and Innovation (RRI), which does not only include aspects such as gender equality, ethics, or open access, but also wants to better align R&I with societal values and demands in general, is a cross-cutting issue in the European Commission's funding programme Horizon 2020. However, there are different uptakes of what "responsible" research or "responsible" innovation is and these are often contested. Furthermore, requirements linked to a certain definition of responsibility are sometimes conflicting with demands and necessities within scientific domains. In the end, it is often difficult to put concepts of RRI into practice and turn them into a concrete research or innovation project.

The interactive five-day summer school brings together different participants, and encourages and supports them finding ways to consider issues of RRI in concrete projects. Participants have to identify ideas for research projects incorporating principles of RRI, work together by using various interactive methods, and further develop their ideas into a project proposal. Finally, they will present their findings to their colleagues in an appropriate and enthralling way and write a short reflection paper on their experiences and insights. This summer school is an intense and demanding programme, but it is also an inspiring way to deal with RRI with respect to concrete research activities. It is a possibility for different groups of people to engage with each other in deliberating on RRI. Possible participant groups include but are not limited to PhD students, researchers, research administration and funding actors, and actors from civil society with relations to different fields of R&I.

The summer school is mainly based on the independent and autonomous group work of participants. The course instructor facilitates discussions and guides the participants through the different stages of the summer school. Participants are free to choose the specific topic as well as the format in which they present their findings. They are encouraged to find creative means of expression, including video, graphics, music, performance, etc., but are also free to conduct a traditional oral presentation using

slides. Participants will have to complete reading assignments on RRI in advance of the course in order to have similar background knowledge.

On completion of this summer school participants will be able to (learning outcomes – LO)

1. apply key dimensions of Responsible Research and Innovation (RRI) considering concrete research activities;
2. design a multidisciplinary research project incorporating ideas of RRI;
3. share and discuss ideas on the implementation of RRI with others in a distended context;
4. and to present project proposals in an easily comprehensible and creative manner.

The assessment of the participants' performance will be based on the realisation and quality of

- their continuous and active participation in the different learning activities;
- the creative group presentation on their research project incorporating RRI aspects;
- and the project proposal and especially its inclusion of ideas and principles of RRI.

2.0 ECTS credits are awarded on completion of this summer school (workload of 50 to 60 hours).

Structure of the course and implementation

The summer school takes place over the course of five days; the duration per day depends on the available resources but there should be at least three sessions of about two hours and sufficient breaks in-between. Depending on the target audience and purpose of the course, it is possible to organise the summer school with a clear focus on a certain societal challenge, scientific field, or R&I development. For example, the course could focus on ageing in contemporary societies and the societal challenges demographic changes or technological innovation bring in this regard. Or, the course could focus on a specific R&I development such as genome editing. However, it is also possible to leave the selection of topics entirely to the participants. You are strongly encouraged to adapt the syllabus according to your particular focus.

Participants have to come up with project proposals that incorporate ideas and aspects of RRI into their design. They have to identify a research question and define an appropriate research methodology. Coming from different fields, students should think about how to deal with their topic using different disciplinary approaches and perspectives. The summer school aims to create an environment that supports them in doing so. At the end of the course, they should be able to present their proposal to the other participants focusing on how they would deal with issues of RRI if conducting the project.

It is recommended that participants have different disciplinary and professional backgrounds in order to initiate a lively, multi-faceted discussion and to promote interdisciplinary communication and learning. In preparation for the summer school participants should read introductory literature on RRI to have some common knowledge about RRI concepts and related issues. In the syllabus of this course, some recommended literature is given; however, please feel free to select other pieces of literature or even introductory videos. You can find a list of recommended literature and videos in the HEIRRI training materials on the HEIRRI website (http://heirri.eu) and in the HEIRRI section of the RRI Tools website (https://www.rri-tools.eu).

Day 1: Exchanging perspectives – finding ideas

The first day is dedicated to getting to know each other and the participants' various perspectives on and experiences with R&I, and then to come up with ideas for project proposals to work on in groups for the rest of the summer school.

Session 1: Exchanging perspectives
The first day starts with a short round of introduction followed by an open discussion on responsible research and responsible innovation without yet introducing concepts of RRI. In this moderated discussion participants are encouraged to talk about their own perception and definition(s) of responsibility regarding research and innovation. They should think of what makes research processes more or less responsible, what important issues have to be dealt with, who has the responsibility to take care of those, how it is possible to act responsibly in R&I, etc. In this task, participants' experiences and views on these issues are explored without necessarily drawing on any fixed concept such as RRI. This will contribute to a more open atmosphere in which the participants have agency to co-create the meaning of RRI and are not bound to one predefined concept.

Throughout the course, participants should come up with ideas and produce different types of output. These should be collected in a way that allows having them (visibly) available over the course of the summer school (whiteboards, flip charts, technical devices). At best, the groups' main output is also collected at the end of the course and shared among the participants.

Session 2: Finding ideas
In the second session, participants are encouraged to think about different R&I developments and processes they are interested in or working on and then present their first thoughts and ideas to the other participants. Their ideas will set the ground for the activities of the next days and are the basis for designing a multidisciplinary research project incorporating ideas of RRI (LO2). At the end of session 2, there should be defined groups to further work on research proposals that consider RRI in the research design.

There are multiple ways and tools to facilitate and support the identification of subjects to further investigate upon in group projects. Depending on whether or not the course has a certain topical focus, the course instructor has to define and communicate the boundaries in which participants should think about possible projects. Appropriate methods should facilitate an open atmosphere in which every participant has the same chance to voice their idea and have a say in the decision-making process. For example, participants can use sticky notes to generate a pool of ideas, and to review and arrange all posted ideas; they should indicate the objective, research design, and methodology of the proposed project. Then, the group makes a pre-selection and prioritises the ideas for the possible projects considering the originality, relevance, and possible societal impact of the proposals. Another way to collect and discuss ideas is a World Café in which participants collect and further develop ideas for projects through continuously changing groups (The World Café, n.d.).

Based on their own interest, participants should form groups of similar size. The number and size of the groups depend on the overall number of participants in the summer school. We suggest that the groups should have between four and six members.

Session 3: Initiating reflection on RRI

In the third and last session of the first day, participants start discussing and applying key dimensions of RRI considering concrete research activities (LO1). They will have to answer guiding questions with regards to different key principles of RRI and should also build upon issues related to responsibility identified in the first session. You can find an RRI reflection form for this purpose in the HEIRRI training materials.

You can also adapt and use other tools for this purpose: The “Responsibility Navigator” (Kuhlmann et al., 2016) provides a framework for RRI which includes guiding reflection questions to make R&I more responsible; some of them are appropriate with regards to individual research projects. The RRI Tools website provides guidance on RRI for actors with different profiles, including researchers developing an individual project (RRI Tools, n.d.). Wickson and Carew (2014) identify “quality criteria and indicators” for RRI developing an “evaluative rubric” which also can be used. Furthermore, participants should draw on their own perspectives on RRI explored in the first session.

Regardless of the specific questions participants have to reflect upon and answer, they should collect the output of their reflection and think about how it might affect their research proposal.

Closing the first day, each group has to identify “experts” for specific aspects of RRI, for example public engagement, gender equality, ethics, anticipation, etc., and each should read one short text on the respective aspect in preparation for the second day. Thus, each group consists of “experts” on different aspects of RRI. Depending on which concepts of RRI you want to emphasise in your course, you have to

select appropriate literature on different aspects of RRI; there is a list of literature recommendations in the HEIRRI training materials.

Day 2: Integrating RRI

The second day is dedicated to discuss RRI more in depth and reflect on how to integrate aspects and ideas of RRI into a concrete research project. Through their work on the second day, participants will become more familiar with different aspects of RRI as basis to further develop their research proposal. For its successful implementation, it is necessary that all participants have read material on the specific RRI aspect. Their efforts on the second day contribute to achieving LO1 and LO2.

Session 1: Discussing RRI
The second day starts off with a short introductory presentation on RRI. You can find presentation slides and also different videos for this purpose among the HEIRRI training materials. The participants should then deliberate on and discuss different aspects of RRI concepts in line with the texts they had to read on the day before.

There are different ways to organise this reflection and work process. One approach that mixes the different working groups and creates a better and more constructive class atmosphere is the Jigsaw technique. More information on this teaching and learning method can be found online (Jigsaw Classroom, n.d.). However, please feel free to adapt the way of discussing RRI aspects of the participants' research project proposals. In this case, all experts on one RRI aspect should gather in a group; this means that the proposal working groups are mixed up. Then, each group should discuss what they have read and apply their knowledge in reflecting on a project case example provided by the course instructor (see HEIRRI training materials). Then, they are also free to further investigate their RRI aspect, e.g. through visiting the RRI Tools website or watching some information videos.

Session 2 & 3: Sharing and applying RRI
In the second and third session, participants should use what they have learned in the first session for their own project. They should think about how to integrate the different aspects of RRI into their proposal. If you use the Jigsaw method describe above, participants should return to their project proposal group and share their insights from the expert groups with their group colleagues.

In the afternoon, sufficient time should be provided to enable participants to further develop their proposals. It is recommended that the course instructor and/or tutors are available for questions. To further support workshop participants in this task, you can also prepare an excerpt of a competitive call for research proposals that asks about details on how RRI or aspects of RRI are considered in the submitted research proposal. Thus, participants will have the possibility to see how RRI is currently addressed in research funding decisions. Furthermore, they can make use of the materials they already got to know in Session 3 of the first day.

Day 3: Walkshop

On the third day, a field trip is conducted. It functions as a means to further develop and strengthen the personal relationships of the participants, but should also support them in further developing their proposal on a research project incorporating ideas of RRI. Through moving outdoors and visiting different sites, they should open up in reflecting the relationship of their project with society and its embedding in different societal contexts and share their insights in the group (LO3).

For the purpose of the field trip, a "walkshop" approach (Wickson, Strand & Kjølberg, 2014) can be adapted. In a walkshop, participants spend time together outdoors, walking or hiking and discussing different topics and issues. In the context of this course, one day should be spent on this task. In the planning phase of the course, the instructor(s) should identify appropriate locations and tracks to take a longer walk in the surrounding area of the summer school venue, organise possible visits to different organisations, or arrange meetings with different actors or groups. It is recommended to visit specific sites and places related to ideas of RRI and/or to the summer school's topical focus. For example, participants could visit a science museum or science shops, thus institutions promoting societal dialogue on R&I. If the course has a specific predefined topic it is also possible to visit institutions and places where topic-related issues become manifest. For example, if the course focuses on ageing in contemporary societies, the group could visit places where senior residents spend their leisure time, where they live, where they are taken care of, etc.

Through this approach, participants are encouraged to think about and engage with different real-life manifestations of the topic under discussion. Participants have to be informed in advance about this part of the course and related requirements, e.g. necessary equipment and abilities. You find guidance on how to conduct a walkshop in the HEIRRI training materials.

Day 4: Making research more responsible

The first half of the fourth day is dedicated to further independent group work on the project proposals. Participants should reflect and discuss their experiences and findings from the walkshop on the day before and try to come up with ideas how to include their insights into the project proposal.

The second half of the fourth day should be used for creative elaborations of their findings (LO4). Depending on the resources and the preferences of participants, the findings from the group work can be presented using text, illustrations or images (e.g. poster, flip charts), video etc. However, beyond that even plays or the development of an interactive exercise including the other participants (e.g. a role-play) are possible. In preparing their presentation, participants should think about how to communicate even a rather "dry" subject such as research proposals to a broader audience. They should try to convey their ideas in an easy way and to use more powerful and interesting presentation techniques than a simple slideshow. It has to be ensured in advance that different materials and

instruments are readily available (e.g. pens, paper, cardboard, etc.) and that participants bring their own technical devices (laptops, etc.) if there are not sufficient devices provided by the organisation. Furthermore, enough space(s) and locations should be available for the groups to separately work on their elaborations.

It is suggested to integrate a public engagement activity either as part of the walkshop, or on the fourth day if possible in your given context (see Adaptation Possibility 1).

Adaptation Possibility 1: Public engagement activity: Science Café

One important aspect of different concepts of RRI is to enter a constructive dialogue and promote mutual learning between actors in R&I, different stakeholder groups, and society in general. Although having a dialogue for its own sake is worth aspiring, public engagement in the frame of RRI should go beyond pure "talk". The input of different stakeholders and actors has to be acknowledged and should have an effect on the R&I processes.

We suggest actively seeking such public engagement also within the limits of this summer school. In drafting their research proposal, participants then have to deal with different societal perspectives and ideas with respect to their work. Either as part of the walkshop on the third day or in the first half of the fourth day, a public engagement activity should be organised in which participants discuss their ideas with others. An appropriate approach to do this is a Science Café. In an informal, non-academic context – e.g. in a coffeehouse – the different groups meet interested people, present to them in small groups their preliminary ideas for their proposals, and talk about the guests' views and perceptions (for more information see SciCafe, n.d.). After this public engagement activity, students have to show in their further elaborations how they consider the input of the Science Café participants.

This public engagement activity needs thorough preparation in advance: An appropriate location has to be found, e.g. a science museum, a science shop, or a coffeehouse in which it is possible to have such an event. Then, people have to be invited in advance. Depending on the subject of the course, it might be fruitful to invite stakeholders having specific interests and positions with regards to the topic. A sufficient number of guests (20 to 30) should be available in order to be able to promote meaningful discussions. It is also necessary to give a short introduction explaining the purpose and topic of the summer school, its overall approach, and its participants.

The summer school participants have to be briefed on the Science Café activity in advance: They have to think about how to explain their research proposal idea to people who (probably) are not researchers or scientists and who do not have in-depth knowledge on the discussed research subjects. Additionally, they have to know about the purpose of the Science Café and their role in the activity: They should reach out and listen to others and be open to consider their views and inputs.

Changes in syllabus

Learning outcomes (LO):	*Additional learning outcomes (LO5 and LO6):* • "engage with different societal actors in discussing the societal implications of a research proposal; • and to consider the perspectives of different societal actors in developing a research proposal."
Planned learning activities and teaching methods:	*Additional:* "The participants will co-facilitate a public engagement activity. They will share their ideas for research projects considering RRI with different societal actors and enter a dialogue in order to experience and understand various perspectives on their proposed project. In further developing their proposal they have to consider their insights from this public engagement activity."

Assessment methods and criteria:	*Additional:* Consideration and discussion of the input of the public engagement activity in the research proposal.

Day 5: Final presentations

On the fifth day, the working groups present the findings of their creative elaborations to the other participants. The results are then discussed in plenary, thus showing that LO4 has been achieved. By doing so, participants have to show how their research design considers aspects of RRI (LO2). It is important to have enough time for this task: The creative presentations might need more time than conventional formats and there should be enough time to discuss the research proposals of the summer school participants.

The participants should co-evaluate the presentations of their presenting peers. Therefore, they should apply RRI key dimensions to the research proposals of others (LO1). There are different ways to support or facilitate this: For example, participants could receive guiding review questions, which they should reflect upon during and after the presentation. These questions could for instance derive from actual evaluation guidelines on RRI in funding calls. You can also adapt the RRI reflection form used on the first day.

At the end of the summer school, a discussion should be initiated which aims to promote reflection on how the understanding of responsibility changed over the course of the workshop. To complete the summer school, participants have to write a short essay (two to three pages) and further deepen this reflection on responsibility in/of research and innovation drawing on the insights gained in the summer school and linking them to the literature.

Syllabus

Element	Description
Title	Considering Responsible Research and Innovation by Design
Cycle	EHEA: Second and third cycle EQF level: 7 and 8 Degree level: Master, PhD
Year of study	–
Number of ECTS credits	2.0 ECTS credits (workload of 50 to 60 hours)
Learning outcomes (LO)	On completion of this summer school participants will be able to 1. apply key dimensions of Responsible Research and Innovation (RRI) considering concrete research activities; 2. design a multidisciplinary research project incorporating ideas of RRI; 3. share and discuss ideas on the implementation of RRI with others in a distended context;

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	4. and to present project proposals in an easily comprehensible and creative manner.
Mode of delivery	This interdisciplinary summer school is an interactive workshop based on ideas of inquiry-based learning. Continuous attendance and active participation in the different parts of this blocked five-day course is necessary as well as independent study of provided texts.
Prerequisites and co-requisites	Participants should know how research projects can be designed and organised within their scientific field. A bachelor's degree or equivalent is a prerequisite for this course. However, in cases participants have work experience with relation to R&I, exceptions are possible. The summer school is recommended for advanced master's students, PhD students, active researchers, and others working in R&I-related positions.
Course content	The summer school deals with questions of how to make research projects as well as their processes and outcomes more responsible. Participants have the opportunity to first explore their own understandings of what constitutes responsible research and then deal with specific concepts and aspects of Responsible Research and Innovation (RRI) as well as concrete case examples. Their own deliberations as well as the concepts of RRI will then give orientation in their own independent group work on a research proposal that incorporates ideas of RRI. The summer school participants are free to define the concrete topic of their research proposal within the setting of the course. Thus, the course content depends to a great extent on the participants' own deliberations and discussions.
Recommended or required reading and other learning resources/tools	Participants have to read introductory literature on concepts of RRI in advance of the summer school in order to have some knowledge about basic ideas and principles of RRI. They should prepare at least one of these introductory texts: • Grunwald, A. (2011). Responsible Innovation: Bringing together Technology Assessment, Applied Ethics, and STS research. *Enterprise and Work Innovation Studies, 7*, 9–31. • Rip, A. (2014). The past and future of RRI. *Life Sciences, Society and Policy, 10*(17). DOI:10.1186/s40504-014-0017-4 • Van den Hoven, J., Jacob, K., Nielsen, L., Roure, F., Rudze, L., Stilgoe, J., Blind, K., Guske, A.-L., & Riera Martinez, C. (2013). Identifying the Problem. In *Options for Strengthening Responsible Research and Innovation: Report of the Expert Group on the State of Art in Europe on Responsible Research and Innovation* (pp. 11–22). Brussels: European Commission. Further reading material is provided during the course.
Planned learning activities and teaching methods	In this summer school, participants will experience different teaching and learning methods and settings. They will take part in moderated plenary discussions and exercises, reflecting on the responsibility of R&I processes and deliberating on concepts of RRI. Furthermore, they will discuss different aspects of RRI in changing small groups. In working groups, participants will develop research project proposals that consider aspects of RRI. They will use their insights from guided RRI reflection and from appropriate literature on RRI and different RRI aspects. In a so-called "walkshop" field trip, participants will share and reflect on their proposals in a distended context and open up to societal influences.

Assessment methods and criteria	The assessment of the participants' performance will be based on the realisation and quality of • their continuous and active participation in the different learning activities; • the creative group presentation on their research project incorporating RRI aspects; • and the project proposal and especially its inclusion of ideas and principles of RRI.

References and further readings

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RRI Tools (n.d.). How to design a RRI-oriented project proposal. Retrieved 15 February 2017, from https://www.rri-tools.eu/how-to-stk-rc-design-a-rri-oriented-project-proposal

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The World Café (n.d.). The World Café: Shaping Our Futures Through Conversation That Matters. Retrieved 15 February 2017, http://www.theworldcafe.com/

Wickson, F., & Carew, A. L. (2014). Quality criteria and indicators for responsible research and innovation: Learning from transdisciplinarity. *Journal of Responsible Innovation, 1*(3), 254–273. DOI:10.1080/23299460.2014.963004

Wickson, F., Strand, R., & Kjølberg, K. L. (2014). The Walkshop Approach to Science and Technology Ethics. *Science and Engineering Ethics, 21*(1), 241–264. DOI:10.1007/s11948-014-9526-z

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Concepts and Practice of Responsible Research and Innovation

Overview

Audience	Students, researchers, HEI actors, stakeholders, and other interested actors
Year of study	–
Number of ECTS credits	2.0 ECTS credits (workload of 50 to 60 hours)

Introduction

The demand for research to answer to societal challenges and align research with societal expectations and needs is growing. The concept of Responsible Research and Innovation (RRI) addresses and promotes the idea of reflecting the societal embedding and impacts of research and innovation (R&I) and of considering different aspects in research processes.

This Massive Open Online Course (MOOC) tries to answer to this demand by addressing a broader audience than students and researchers only, but targeting also different stakeholders and actors of higher education institutions (e.g. librarians, administrative staff) or in research and development (R&D), and ultimately also the interested public. Therefore, this training programme is created rather generic. However, it is possible and recommended to tailor the MOOC to a specific audience or a certain domain. In this case, required adaptions have to be made by the course instructor.

There are no prerequisites for attending the MOOC in the presented format. This course is thus also aimed at individual learners who might not currently be attending a programme of a higher education institution (HEI).

The aim of this programme is to give participants an overview of the ideas and concepts of RRI, show them practical examples, cases of implementation, and RRI activities, and to inspire and guide them – as far as possible – to include what they have learned in their own work. The interrelatedness of society and science, innovation, and development will further be addressed in this course. Thus, also practitioners and innovators in the corporate sector, policy makers, and other actors in R&I can attend this course in order to gain knowledge about responsible research.

The MOOC runs for eight weeks and includes two hours of online learning per week. In case you want to offer a shorter course, you can find an adaption possibility for doing so in this guide. Additionally, students will extend their knowledge with further reading of academic articles and policy papers.

Participants are encouraged to exchange questions and experiences via an online forum. The course instructor can also be addressed with questions via this forum.

Teaching material will be made accessible after registering for the course and includes video lectures, presentations, and reading material such as articles and policy papers. Online discussions and exchange with the course instructor via a forum will enrich the learning experience. This participatory approach is dedicated to engaging with each other and others' work as well as to ideally establishing worldwide networks.

Learning activities that participants have to conclude in the MOOC are three small quizzes for self-assessment of the acquired knowledge, a role-play exercise, several forum discussions, an overall final exam at the end of the course, and a short reflection post of about 500 words. A peer-review process of the final assignment will enhance exchange amongst the participants.

The total workload will amount to 50 to 60 hours, which corresponds to 2.0 ECTS credits.

On completion of this course students will be able to (learning outcomes – LO)

1. describe the history and idea of Responsible Research and Innovation (RRI);
2. discuss and contrast the different approaches and concepts of RRI;
3. and to adapt and translate their knowledge of RRI into their own work or studies.

Structure of the course and implementation

The MOOC "Concepts and Practice of Responsible Research and Innovation" is originally designed for the duration of eight weeks. An adaption possibility for shorter versions of six or four weeks is provided in this guide (see Adaptation Possibility 1). For each week, a unit of two hours of online learning are required. Additionally, background reading and preparation of the final assignment and the final exam require individual preparation. An online role-play session and an open discussion session will give participants the chance to deepen their engagement, ask questions, and discuss crucial points.

At the end of each of the first three sessions, small quizzes will serve as self-assessment of the learning progress and the knowledge gained. These quizzes, however, are not part of the final assessment of the course and will thus not be graded. Nonetheless, students have to participate in the quizzes in order to be able to take the final exam. Concluding the course, this final exam covering the course content will have to be completed online. Additionally, participants have to write a short reflection of around 500 words about what they gained from doing the MOOC and how they will and can incorporate it into their work or studies. This reflection will be posted in the forum and peer assessment of the reflection posts will be done in the last session.

Exchange in the forum, participation in the role-play exercise, and the final peer assessment are a crucial part of the MOOC. Every participant has to post questions, exchange experiences and thoughts about RRI, and discuss and assess the final reflection postings. For that purpose, a forum should be made available for every session of the course. It is suggested that you pre-structure the forum, but give participants the possibility to open threads on their own.

As the course takes place online, an appropriate online platform has to be provided for the implementation of the MOOC. This might differ from organisation to organisation and the MOOC has to be adapted to the respective circumstances. Teaching and training material will include video lectures (as well as their transcripts), presentations, and reading material such as articles and policy papers. Several training material for this purpose can be found in the HEIRRI training materials on the HEIRRI website (http://heirri.eu) and in the HEIRRI section of the RRI Tools website (https://www.rri-tools.eu). However, we highly recommend adapting the course and used training material according to your audience and domain.

For the first three sessions that mostly deliver technical information and knowledge about RRI, we provide very concrete suggestions for the course content. As this information is about conveying the concepts behind RRI, it is quite universal in nature and does not necessarily have to be adapted to a specific audience. Still, there are possibilities of choice we provide in the single sessions. The other units are held more flexible, as they have to be adapted to your audience and the domain you want to offer the course in.

Week 1: Introduction

The first session starts with a welcome note and an introduction to the MOOC, including an overview of the weeks ahead and the course format.

MOOC Element 1: Suggestion for welcome note

Welcome note
Welcome to the massive open online course (MOOC) on *Concepts and Practice of Responsible Research and Innovation* and thank you for signing up! In this online course you will learn about, reflect on, and discuss what Responsible Research and Innovation (RRI) could mean in general, get to know the emergence of the idea and deal with approaches, which have the potential to make research and innovation (R&I) processes more responsible. You will get to know inspiring examples and cases of RRI and you will see how you can consider R&I processes from different viewpoints by conducting a role-play exercise. You will discuss and reflect on different ways how to introduce concepts of RRI and related issues to your work or study settings. The schedule for the MOOC is as follows: • Week 1: Introduction • Week 2: Holistic RRI concepts • Week 3: Normative RRI framework – six policy agendas • Week 4: Inspiring RRI cases • Week 5: Role-play exercise

- Week 6: RRI in practice
- Week 7: Reflection post and open discussion
- Week 8: Final exam

Throughout the course you will find short information texts and videos, primary literature, and further material (and references) to read and work with. After the first three units you will have to complete small quizzes that test your knowledge. These are only for self-assessment and will not be graded. However, you need to complete the quizzes in order to be able to take the final exam.

In a role-play exercise, you will take different viewpoints of stakeholders involved in and affected by R&I processes. After a unit about how to implement RRI into practise, there will be an open forum discussion where open questions and concerns can be clarified and discussed with the course instructor and your fellow participants. Every participant has to write a short reflection post about that in the forum. Those posts will be assessed by and discussed with your peers in the last session, in which the final exam will also take pace.

For each session of the course there will be a forum to pose open questions and remarks. Active participation in these forums is required for certain tasks and will be indicated accordingly. Please acknowledge the efforts your colleagues put into drafting their contributions and be constructive and respectful in replying to their entries. Once in a while you should come back to the forum and have a look if new entries have been posted. Please also consider the submission deadlines.

If you have any questions, please post them in the online forum or contact the course instructor. Feel free to raise issues related to RRI or other relevant aspects of the course by creating own threads in the online forum.

After the welcome and introduction to the MOOC itself, the first task for the participants is to introduce themselves. Depending on the scope of the course, those can be quite international and come from very different contexts. Participants should state their names, their current locations and affiliations (work or study institution), and why they chose to enrol in this MOOC. The entries can be made directly in the forum, so people can immediately read the other posts.

Following this presentation of the participants, a short introductory text on the general course subject and its importance is displayed. This can strongly be adapted to specific settings.

MOOC Element 2: Suggestion for introductory text

Introduction to course subject
Research and innovation (R&I) are important cornerstones of past and contemporary societies. Through R&I, societal, economic, cultural, ecological, technical, and other challenges have been addressed, transformed, solved, or produced. R&I developments initiated and promoted the reflection and thinking about many different aspects of our world, environments, societies, and biological and human existence. R&I brought radical change in our coexistence and lives and can be seen as major transformative force of and in society. At the same time, as much as R&I are driving forces of societal transformation, society is forming and defining R&I through societal structures, practices, institutions, values, and norms. R&I objectives and processes as well as many of the changes caused and promoted by them can be seen both positively and negatively, depending on the perspective you choose, the aspects you consider in your assessment, or the information and knowledge you have. A decision on their positive and negative evaluation is often not possible beyond doubt or has so many facets that an unambiguous answer cannot be provided. In this complex situation, it is necessary to together decide on the direction of R&I processes and developments. People involved in R&I, politicians, interest groups, different other societal stakeholders, and the broader public have to start to think about and deliberate on how to care about certain R&I developments and related issues or about the way we

organise and do R&I in general. In this context, questions such as the following come up: Is this responsible? Is it responsible to deal with these issues in one way or another? Is this responsible in view of the next generation, our environment, our safety, our society, our freedom? In short: How should be dealt with R&I in a responsible manner – how should R&I be done in a responsible manner?

Following the welcome text above, a short introductory video about RRI is shown. Below, you will find a list of sources where you can find such material. Please feel free to choose those you find most suitable for your audience, if you show more than one video, or if you choose another video not listed or available on the respective pages:

- Videos on the RRI Tools website: https://www.rri-tools.eu
- Videos on the RRI Tools video channel: https://www.youtube.com/user/RRITools/playlists
- "Responsible Research and Innovation: aligning R&I with European society", produced by the European Union: https://www.youtube.com/watch?v=bs5A-4j5h-I
- "The Potentials and Barriers of Responsible Research and Innovation (RRI)", produced by the Res-AGorA project: https://www.youtube.com/watch?v=nCOsF2U2lsU

As a next task, participants will have to read an article about RRI. We recommend using "The past and future of RRI" by Arie Rip (2014), which shows how the concept of RRI is embedded in a long tradition of dealing with the responsibility and societal embeddedness of R&I processes and actors, focussing on the (changing) relationship between science and society and the changing roles of the different involved and affected actors. You can find a commented list of other recommended literature in the HEIRRI training materials as well as a short list in the syllabus of this guide, if you want to choose another text. The text can be read during the session or at a later point until the next session, if that is more suitable to the participants.

Concluding the first unit, participants have to complete a short quiz that should not last longer than 10 minutes. The questions of this quiz should relate to the text and videos you chose to use in the introductory session. They are meant to test participants' knowledge and understanding of this input; thus, the difficulty of the questions should be chosen wisely. The quiz does not have to be done immediately after the online session, but can also be taken at a later point in time, yet before the next session takes place. It will not be graded, but has to be concluded before entering the final exam.

Further reading material to deepen participants' knowledge about RRI can be given as homework. If you decide to include such a reading assignment in your course, we particularly recommend the article by Owen, Macnaghten, and Stilgoe (2012) listed in the recommended reading list of this guide, or the short policy brief by Angelaki (2016).

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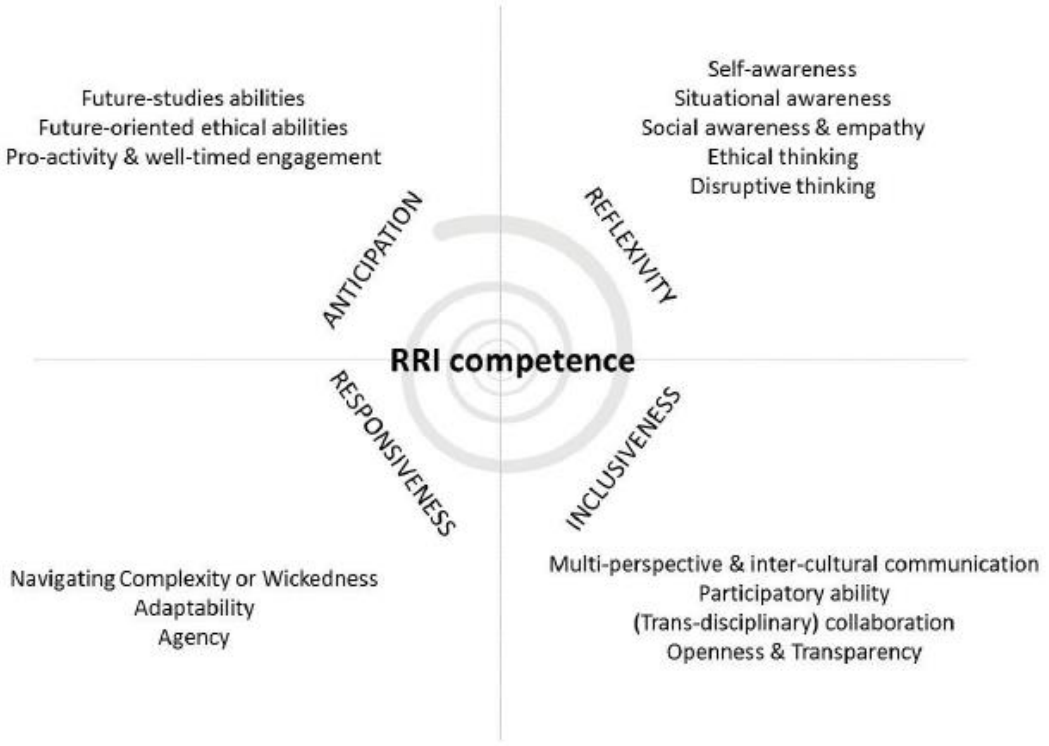
Week 2: Holistic RRI concepts

In the second session, holistic and overarching concepts of RRI will be introduced, starting with the so-called competence dimensions of RRI. Please write an appropriate introduction, explaining what you chose to include and teach in this session. We suggest starting with a video or presentation, which you can find in the HEIRRI training materials.

After that, participants can get an overview of some more information on the single dimensions and the competencies those entail. The following tables of RRI competencies are a suggestion taken from the EnRRICH project (see Tassone & Eppink, 2016). EnRRICH labels and defines the dimensions slightly differently than RRI Tools, which calls them process dimensions. You might want to either choose which one suits your audience better or shortly present both.

MOOC Element 3: RRI competencies

RRI competence framework



Source: Tassone, V., & Eppink, H. (2016). *The EnRRICH tool for educators: (Re-)Designing curricula in higher education from a "Responsible Research and Innovation" perspective. EnRRICH Deliverable 2.3.*, p. 16.

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MOOC Element 4: Detailed description of the RRI competency "Anticipation"

ANTICIPATION
"It includes competencies in anticipating societal challenges and future implications related to scientific and innovation practices **Future-studies abilities** • knowing and understanding concepts, methods and tools for exploring possible development of societal challenges in the future, for imagining possible futures, for exploring possible solutions to societal challenges and possible future implications and impacts of scientific and innovation practices (e.g. scenario analysis, forecasting methods, etc.) • skill in anticipating possible futures, by applying future-studies concepts and methods • holding appositive and engaged attitude towards anticipatory efforts, valuing anticipatory abilities **Future-oriented ethical abilities** • knowing and understanding ethical principles and resources in the context of short and long term projects and plans • skill in engaging with ethical questions about the goodness of possible futures that scientific and innovation practices can bring into the world (e.g. the "to what end" questions) and in applying ethical principles and resources when engaging into anticipatory scientific and innovation practices • holding a future-oriented ethical attitude, for example having a sense of care towards the future; valuing ethical principles for a just future **Pro-activity & well-timed engagement** • knowing and understanding the meaning and practice of pro-activity, barriers and supportive factors • skill in being pro-active and well-timed when engaging into anticipatory processes and practices, early enough to be constructive but late enough to be meaningful • holding a receptive attitude towards ones surrounding, and valuing pro-activity" (Tassone & Eppink, 2016, p. 17)

MOOC Element 5: Detailed description of the RRI competency "Reflexivity"

REFLEXIVITY
"It includes competencies in reflecting about context, ways of framing, ways of knowing, ways of doing, and ways of being in relation to the work of science and innovation and societal challenges. **Self-awareness** • knowing and understanding oneself, and tools to reflect about own actions, assumptions, norms, values and ways of framing • skill in reflecting about own actions, assumptions, norms, values and ways of framing • holding a positive constructive attitude towards self-reflection **Situational awareness** • knowing and understanding the context within which one's scientific and innovation efforts, and related societal challenges, are situated • skill in reflecting about contextual factors • holding a receptive attitude towards one's surroundings and contextual aspects

Social awareness and empathy

- knowing and understanding social values, cultures and perspectives, and related tools for reflecting on those values and perspectives
- skill in reflecting about and acknowledging social values, cultures and perspectives
- holding a social and emphatic disposition, respecting social values

Ethical thinking

- knowing and understanding tools to ethically evaluate and make judgements about perspectives, assumptions and endeavours for tackling societal challenges
- skill in ethically evaluating and judge perspectives, assumptions and endeavours for tackling societal challenges
- holding a caring and ethical attitude, valuing ethical thinking

Disruptive thinking

- knowing and understanding what disruptive thinking entails, and tools for fostering it
- skill in engaging with unconventional ways of thinking that challenge and go beyond current status-quo, ways of knowing and ways of framing.
- holding the courage to think disruptively, and valuing disruption"

(Tassone & Eppink, 2016, p. 17)

MOOC Element 6: Detailed description of the RRI competency "Inclusiveness"

INCLUSIVENESS

"It includes competencies in including, communicating with, collaborating with diverse stakeholders and the wider public within scientific and innovation practices and in relation to societal challenges.

Multi-perspective & inter-cultural communication

- knowing and understanding concepts and tools related to perspective-taking and communication with people holding different perspectives and cultures
- skill in actively listening and communicating with the wider public and diverse stakeholders by being sensitive to different perspectives and cultures
- holding an attitude of respect and curiosity towards different perspectives and cultures, valuing diversity

Participatory ability

- knowing and understanding participatory methods for including voices of diverse stakeholders, also the wider public, minorities and silent voices, within science and innovation design and practices
- skill in engaging stakeholders and including their voices within design and practices of science an innovation
- holding a participatory attitude, valuing participation

(Trans-disciplinary) collaboration

- knowing and understanding concepts and methods for collaboration across disciplines, actors and various contexts
- skill in bridging disciplines, actors and various contexts, negotiating and co-operating towards collective goals
- holding an attitude of willingness to engage with and to bridge diverse disciplines, actors and contexts, valuing collaborative efforts

Openness & Transparency

- knowing and understanding tools and processes for sharing information about findings and practices in science and innovation and in relation to societal challenges, and understanding possible restrictions in sharing

information (e.g. intellectual property rights, need to limit the circulation of sensitive data)
- skill in sharing information regarding findings and practices, while being mindful of possible restrictions
- holding an attitude of openness in sharing one's findings and processes, valuing transparency"

(Tassone & Eppink, 2016, p. 18)

MOOC Element 7: Detailed description of the RRI competency "Responsiveness"

RESPONSIVENESS
"It includes competencies in coping with and responding to emerging challenges and to new knowledge, perspectives, public values, and norms through scientific and innovation endeavours **Navigating Complexity or Wickedness** • knowing and understanding (tools for exploring) complexities, and even wickedness, of emerging societal challenges and research and innovation endeavours • skill in handling complex, or wicked, problems and make choices in spite of complexities, controversy and uncertainties • holding a constructive attitude towards complexities or wickedness, overcoming any related possible sense of paralysis or overwhelm, tolerating ambiguity **Adaptability:** • knowing and understanding tools and processes for identifying emerging challenges and changes in society, as well as for flexible and adaptable design and practices, in order to meet those changes and challenges • skill in identifying emerging challenges and changes, and in revising views and adapting the direction and course of action of research and innovation design and practices, in order to respond to those challenges and change • holding a flexible attitude towards challenges and changes, having the willingness to respond to them when they emerge **Agency** • knowing and understanding the concept and practice of agency, including also supportive and hampering factors, in the context of societal challenges and scientific and innovation practices • skill in initiating change and engaging with exploring new ways of doing • holding an attitude of courage and commitment towards initiating change, believing in ones' ability to produce change through one's action" (Tassone & Eppink, 2016, p. 18)

Following this overview, participants have to read a more detailed article about these dimensions. Stilgoe, Owen, and Macnaghten (2013) describe a governance framework for RRI based on a case study on geoengineering funded by the UK Research Council. It outlines preceding governance approaches, gives a very broad and open definition of responsible innovation and then identifies its four core dimensions (anticipation, reflexivity, inclusion, responsiveness).

Concluding the second unit, participants will have to complete a short quiz of approximately 10 minutes again. The questions of the quiz should relate to the input you chose to use in the session. They are meant to test participants' knowledge and understanding of this input; thus, the difficulty of

the questions should be chosen wisely. The quiz does not have to be done immediately after the online session, but can also be taken at a later point in time, yet before the next unit takes place. It will not be graded, but has to be concluded before entering the last exam.

Week 3: Normative RRI framework – six policy agendas

In the third session, the – six to eight - RRI keys or policy agendas as defined by the European Commission are introduced and explained. They were already touched upon in the first session and are presented in depth this week. First, participants get an overview of the policy keys as proposed in the European Commission Expert Group Report (Strand et al., 2015). As this report is very comprehensive in terms of length, it is not suitable to be used in its entirety in the MOOC. However, you can provide the link to the report as background reading and insight into EU policy making.

MOOC Element 8: Six RRI policy keys

Six policy keys and beyond
An expert group was appointed by the European Commission in 2014 in order to identify indicators according to which RRI could be assessed and monitored. The European Commission defined six policy keys, and two more were added by the expert group: 1. Governance 2. Public Engagement 3. Gender Equality 4. Science Education 5. Open Access/Open Science 6. Ethics 7. Sustainability 8. Social Justice/Inclusion "[…] the set of criteria is diverse and heterogeneous. At the same time, there is also overlap between criteria, and some (in particular ethics, sustainability and social justice/inclusion) may be thought of as being more overarching and encompassing than certain others (PE, science education and open access). Governance is in part a criterion of its own, in part an aspect of all criteria. […] Some key indicators of RRI proposed in this report will be experimental in nature. This is a consequence of acknowledging the need for moving beyond command and control towards a more dynamic governance of science in society […]." (Strand et al., 2015, p. 18)

After this short overview of the key criteria, every key is presented in more depth independently. We recommend starting each segment with an introductory video. You can find short videos about six of the RRI keys online: https://www.youtube.com/playlist?list=PLc7X7gNmtdsFMyowpI8rTZaejfdXce7lG

In the following segments, we collected different definitions of the RRI keys from different sources (European Commission, 2012; Strand et al., 2015; RRI Tools, n.d.). You can choose which one you find most suitable for your audience. You can also consult the European Commission's Horizon 2020

website for further definitions: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation.

The information you provide on the single RRI keys should be comprehensive and substantial. You can also consult the RRI Tools Toolkit (https://www.rri-tools.eu/de/the-toolkit) for examples of RRI activities on the several keys, in order to illustrate what they can mean practically.

MOOC Element 9: RRI key "Governance"

Governance
"In the first chapter we noted that the R&I process is characterised by collaborative efforts of a variety of stakeholders who each have a particular interest in this process. Overall goals are usually formulated in general terms and therefore arguably meet consensus among most stakeholders (for example green transport, healthy ageing), policymakers may encounter difficulties in the control and organisation of this process, including intellectual, financial and other material contributions. The question of how to govern such R&I networks from the perspective of funding bodies and/or government (local, national and supranational) is rapidly transforming from policy perspectives based on central control and accountability to a perspective where coordination and stimulation are key concepts. In the expert report on the global governance of science (European Commission, 2009), governance was described as entailing 'multiple processes of control and management' and involving 'directing or setting goals, selecting means, regulating their operation and verifying results'. However, 3 years later, in the EU report on ethical and regulatory challenges (European Commission, 2012b), the focus of governance shifted to reaching a consensus in a network of relevant stakeholders. In relation to governance in the context of RRI, this development is reflected in the well-known definition of RRI by von Schomberg (2011). *Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society).* The question then, of course, is how such an interactive process can be governed, especially because it is based on the assumption of trustworthy relationships among all societal actors. The solution in our view has to be sought in the active participation of all relevant stakeholders in developing an RRI policy. Frameworks in which stakeholders can collaborate to that effect are developing at all hierarchical levels of the science and innovation system. The two aforementioned EU reports regard relations at high aggregation levels (between nations), but also national and local/urban level governments and other organisations see governance more and more from a network perspective." (Strand et al., 2015, pp. 18–19) "The last dimension is the umbrella for all the others: it is Governance. Policymakers also have a responsibility to prevent harmful or unethical developments in research and innovation. Through this key we will develop harmonious models for Responsible Research and Innovation that integrate public engagement, gender equality, science education, open access and ethics." (European Commission, 2012, p. 4) "[A]rrangements that lead to acceptable and desirable futures have to (1) be robust and adaptable to the unpredictable development of R&I (de facto governance); (2) be familiar enough to align with existing practices in R&I; (3) share responsibility and accountability among all actors; and (4) provide governance instruments to actually foster this shared responsibility." (RRI Tools, n.d., p. 3)

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MOOC Element 10: RRI key "Public Engagement"

Public Engagement

"The desire to strengthen the relationship between science and society has brought developments of PE over the past decades. From a narrow perspective centred on the need to educate society in order to gain its approval for science and technology developments, to a perspective focused on the quality and benefits of the effective participation of society, one can now find a range of strategies, actions and activities regarding PE. This history is often told in terms of moving from a focus on literacy to a focus on public attitudes, both embedding the idea of worrying deficits on the part of the public, and then to a focus on a public dialogue that is more concerned with a deficit of scientists and innovators and their institutions with regard to their dialogue with society. We consider these shifts of foci less a history of progress, i.e. the new agenda displacing the older one, than one of broadening the remit of science communication and the relationship between science and society with different buzzwords (see Bauer, Allum and Miller, 2007). […]

We might define PE as a societal commitment to provide encouragement, opportunities and competences in order to empower citizens to participate in debates around R&I, with potential feedback and feed-forward for the scientific process. Deeper forms of engagement in science and technology, where citizens are peers in the knowledge production, assessment and governance processes, also deserve attention. This is described through non-equivalent expressions of different degrees of agency — such as citizen science, science in transition, do-it-yourself, fablabs, hacker spaces, maker spaces, etc. — many supported by the digital culture. PE is also a key element in R&I policies in the EU." (Strand et al., 2015, pp. 21–22)

"The first key is Engagement of all societal actors - researchers, industry, policymakers and civil society – and their joint participation in the research and innovation process, in accordance with the value of inclusiveness, as reflected in the Charter of Fundamental Rights of the European Union. A sound framework for excellence in Research & Innovation entails that the societal challenges are framed on the basis of widely representative social, economic and ethical concerns and common principles. Moreover, mutual learning and agreed practices are needed to develop Responsible Research and Innovation joint solutions to societal problems and opportunities, and to pre-empt possible public value failures of future innovation." (European Commission, 2012, p. 3)

"Public Engagement: The process of R&I is collaborative and multi actor: ll societal actors (researchers, citizens, policymakers, industry, educators, etc.) work together during the whole research and innovation process in order to align its outcomes to the values, needs and expectations of European society." (RRI Tools, n.d., p. 3)

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MOOC Element 11: RRI key "Gender Equality"

Gender Equality

"Gender equality in the context of RRI policy has two dimensions: promoting the equal participation of men and women in research activities (the human capital dimension); and the inclusion and integration of gender perspectives in R&I content. The need to monitor the development of gender equality policy is underpinned by evidence that research performance is limited by direct and indirect sex discrimination, that gender equality at all levels contributes to achieving excellence and efficiency (European Commission, 2012c) and that policy at different levels of the R&I system is slow to develop (Wynne, 1991). The main problems in advancing the gender equality agenda include: a lack of clarity in decision-making (which affects structures and processes within the research system and often reinforces status quo, for example 'old boys' networks); informal institutional practices and organisational culture (which often hides unconscious bias against women); unconscious gender bias in the assessment of excellence and the process of peer-review, especially in STEM areas; and the structuring of the workplace and the gender pay gap in academia (including research), which favours men and creates difficulties for women.

Gender bias may also have implications for the content of science itself. The integration of sex and gender analysis can increase the quality and relevance of research and its applicability, especially where gender differences play a major role, such as in the medical sciences.

The overarching goal of the EU policy on gender equality in the context of RRI is gender mainstreaming in R&I, which includes both the equal participation of men and women in R&I and reviewing research content from a gender perspective." (Strand et al., 2015, p. 26)

"The second key is Gender Equality. Engagement means that all actors – women and men – are on board. The under - representation of women must be addressed. Research institutions, in particular their human resources management, need to be modernized. The gender dimension must be integrated in research and innovation content." (European Commission, 2012, p. 3)

"The ideal of gender equality in RRI is a society where the representation of masculine and feminine values in research and innovation are balanced. Issues addressed by this policy agenda challenge people to think about the gendered nature of behaviour, discourse, products, technologies, environments, and knowledge." (RRI Tools, n.d., p. 3)

References:

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MOOC Element 12: RRI key "Science Education"

Science education

"The European Commission […] explained the RRI key of science education as follows (our emphasis):

Europe must not only increase its number of researchers, it also needs to enhance the current education process to better equip future researchers and other societal actors with the necessary knowledge and tools to fully participate and take responsibility in the research and innovation process. There is an urgent need to boost the interest of children and youth in maths, science and technology, so they can become the researchers of tomorrow, and contribute to a science-literate society. Creative thinking calls for science education as a means to make change happen.

If we analyse the quote, two goals can be identified, as shown below.

1. 'Enhance' education so that (a) 'future researchers' and (b) 'other societal actors' are equipped to become good RRI actors.

2. 'Boost the interest' in science among children and young people, with the purpose of either recruiting them to a research career or allowing them to 'contribute to a science-literate society', that is, become scientific citizens." (Strand et al., 2015, p. 29)

"Our third key is Science Education. Europe must not only increase its number of researchers, it also needs to enhance the current education process to better equip future researchers and other societal actors with the necessary knowledge and tools to fully participate and take responsibility in the research and innovation process. There is an urgent need to boost the interest of children and youth in maths, science and technology, so they can become the researchers of tomorrow, and contribute to a science-literate society. Creative thinking calls for science education as a means to make change happen." (European Commission, 2012, p. 4)

"Science Education: Focuses on (1) enhancing the current education process to better equip citizens with the necessary

knowledge and skills so they can participate in research and innovation debates; and (2) increasing the number of researchers (promote scientific vocations)." (RRI Tools, n.d., p. 3)

References:

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MOOC Element 13: RRI key "Open Access/Open Science"

Open Access/Open Science

"Open science can be defined as follows:

Open science is a practice in which the scientific process is shared completely and in real time. It offers the potential to support information flow, collaboration and dialogue among professional and non-professional participants. (Grand et al., 2014)

Another, similar, definition is 'an emerging approach to the conduct of science, technology and engineering projects, in which information about the whole of an ongoing investigation is made available on and through the internet' (Grand et al., 2010). Winfield (2014) has distinguished between three levels of open science, as shown below.

- Level 0 open science: maintenance (including frequent updates) of project websites; deposition of papers (i.e. accepted draft) in publicly accessible repositories; inclusion of datasets with publications; publication in open access journals.
- Level 1 open science equals level 0 plus the following: project blogs, and respond to comments or feedback; post project movie clips to a project YouTube or other video channel, with links to project website and blog posts with explanation and commentary.
- Level 2 open science equals level 1 plus the following: routinely upload experimental datasets to project websites, with explanatory notes (i.e. the values in each field) and commentary; daily laboratory notebooks are written online and publicly accessible in real time; regular project dialogue, i.e. discussion between researchers, partners and collaborators through a project wiki, is publicly accessible; employ rich virtual environments for processes of social learning and innovation.

Level 0 open science is essentially what is provided for in current EU open access policies. In the context of RRI, open access is not an end in itself but a means to achieve the goal of better alignment of R & I with societal values, needs and concerns. This goal requires that the openness actually be used and useful. The expert group would therefore like to propose the further development of this RRI topic and propose indicators for level 1 and level 2 open science, where appropriate." (Strand et al., 2015, p. 32)

"In order to be responsible, research and innovation must be both transparent and accessible. Our fourth key is to make Open Access a reality. This means giving free online access to the results of publicly-funded research (publications and data). This will boost innovation and further increase the use of scientific results by all societal actors." (European

Commission, 2012, p. 4)

"Open Access: Addresses issues of accessibility to and ownership of scientific information. Free and earlier access to scientific work might improve the quality of scientific research and facilitate fast innovation, constructive collaborations among peers and productive dialogue with civil society." (RRI Tools, n.d., p. 3)

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- Grand, A., Wilkinson, C., Bultitude, K., & Winfield, A. F. (2010), On open science and public engagement with engineering. In European Association for Studies in Science and Technology, Trento, Italy, 1–4 September 2010.
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- Winfield, A. F. (2014), 'Open science — a three level approach'. Presentation at the conference Science, Innovation and Society – Responsible Research and Innovation, Rome, Italy 20 November 2014.

MOOC Element 14: RRI key "Ethics"

Ethics

"The European Commission […] introduces ethics as an RRI key in the following way:

European society is based on shared values. In order to adequately respond to societal challenges, research and innovation must respect fundamental rights and the highest ethical standards. Beyond the mandatory legal aspects, this aims to ensure increased societal relevance and acceptability of research and innovation outcomes. Ethics should not be perceived as a constraint to research and innovation, but rather as a way of ensuring high quality results.

Ethics in the context of research may be seen as a complex field in which internal norms and values relating to conduct, practice, culture and organisation operate together with the norms, values, practices and structures that society imposes on research through a variety of mechanisms. In the broad RRI context ethics can be divided into the following three subfields.

- Research integrity and good research practice, which is concerned with issues such as scientific misconduct and questionable research practices (e.g. plagiarism, fabrication, fraud, authorship and intellectual property, and citation/acknowledgement practices, scientific neutrality, conflicts of interest in peer review and scientific advice, etc.). There are three main dimensions that can be monitored here: the gap between codified rules and the actual norms and values of scientific communities as expressed in practice; new organisational measures to improve accountability with respect to research integrity (and overlaps to some extent with open access/open science); and neutrality and conflict of interest and bias as an ethical as well as a quality problem.
- Research ethics for the protection of the objects of research is a well-developed dimension with institutions and practices for such protection. The ultimate goal of policy in this field is that human beings, animals and other

objects of research are duly protected. The existence and proper functioning of institutional procedures are clearly relevant measures for this goal. Their amount or the intensity of the work, however, is not very informative of proper functioning.

- Societal relevance and ethical acceptability of R & I outcomes. This dimension as an RRI key is the one that is closest to the general policy of RRI as a cross-cutting principle and the one for which the European Union has its most distinct role to play. This field is the one warranting the highest interest in the monitoring of ethics as an RRI key. It is also a field that has experienced an expansion over the latter decades in terms of specific, concrete issues considered, for example in ethics reviews. It seems likely, in particular in light of developments in ethics research and scholarship, that this expansion will continue. Specifically, many scholars would argue that the 'novel' topics presented in this report (Sections 2.7 and 2.8 on sustainable development and social justice and inclusion, respectively) both belong to ethics proper. The readers of this report may accordingly consider the recommendations in this section also as relevant for ethics policies, practices and indicators." (Strand et al., 2015, pp. 33–34)

"Our fifth key is Ethics. European society is based on shared values. In order to adequately respond to societal challenges, research and innovation must respect fundamental rights and the highest ethical standards. Beyond the mandatory legal aspects, this aims to ensure increased societal relevance and acceptability of research and innovation outcomes. Ethics should not be perceived as a constraint to research and innovation, but rather as a way of ensuring high quality results" (European Commission, 2012, p. 4)

"Ethics: Focuses on (1) research integrity: the prevention of unacceptable research and research practices; and (2) science and society: the ethical acceptability of scientific and technological developments." (RRI Tools, n.d., p. 3)

References:

- European Commission (2012). Responsible Research and Innovation: Europe's ability to respond to societal challenges, DG Research and Innovation. Retrieved 10 October 2016, from http://ec.europa.eu/research/science-society/document_library/pdf_06/responsible-research-and-innovation-leaflet_en.pdf
- RRI Tools (n.d.). RRI Tools: towards RRI in action. Retrieved 26 February 2017, from https://www.rri-tools.eu/documents/10184/104615/RRI+Tools+Policy+Brief+(EN).pdf/82ffca72-df32-4f0b-955e-484c6514044c
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MOOC Element 15: RRI key "Sustainability"

(Sustainability)

"The rationale of the Europe 2020 strategy is to address and overcome the shortcomings of the current growth model in order to achieve smart, sustainable and inclusive growth. To this end the strategy includes headline targets in five areas: employment, research and development, climate/energy, social inclusion and poverty reduction. […]

The 'Science with and for society' programme, as did its predecessors, sets out to provide research-based knowledge and best practices for more dynamic governance that will align R & I better with societal needs and goals. RRI as a cross-cutting principle throughout Horizon 2020 is intended to contribute to such governance by the actual development of RRI agendas. This important function of RRI should be reflected in RRI indicators and monitoring practices. While many, perhaps all, of the six original RRI keys are to some extent related to aspects of inclusion and sustainability, indicators for these keys cannot answer the following questions: to what extent does a research field, a research programme or an RRI initiative contribute to inclusive and sustainable growth, and how can this be assessed and monitored? Such questions are

undoubtedly highly relevant and important and can be asked about all activities and initiatives that are derived from the Europe 2020 strategy, and yet they are difficult to answer. Horizon 2020 being what it is — an EU contribution to the knowledge society — it is a good place to pursue such difficult questions that involve knowledge challenges. Furthermore, there is a substantive body of research-based knowledge that can be applied in the development of novel indicators in this field. In this report, we mainly point out the directions where the knowledge and the indicators may be found; there is also a need for further research and development in order to reduce the recognised knowledge gap in this field." (Strand et al., 2015, pp. 36–37)

References:

- Strand, R., Spaapen, J., Bauer, M. W., Hogan, E., Revuelta, G., Stagl, S., … Guimarães Pereira, Â. (2015). Indicators for promoting and monitoring Responsible Research and Innovation. Report from the Expert Group on Policy Indicators for Responsible Research and Innovation. Brussels: European Commission. Retrieved 19 July 2016, from http://ec.europa.eu/research/swafs/pdf/pub_rri/rri_indicators_final_version.pdf

MOOC Element 16: RRI key "Social Justice/Inclusion"

(Social Justice/Inclusion)

"Social justice can be defined as 'an ideal condition in which all individual citizens have equal rights, equality of opportunity, and equal access to social resources' (Maschi and Youdin, 2012). National social justice policies focus on investing in achieving inclusion rather than compensating for exclusion. The effectiveness of such policies is measured by monitoring progress in six dimensions: poverty prevention, access to education, labour market inclusion, social cohesion and non-discrimination, health and intergenerational justice (OECD, 2011).

The role of science and technology in promoting social justice is very important. Social justice, although not explicit, is a transversal theme running through most, if not all, societal challenges of the Horizon 2020 framework. However, to date no attempts to measure how social justice is actually addressed through R & I activities have been observed. The connection between science and technology and social justice is recognised through acknowledging the role of science and technology education (Dy, 1994) and technological developments, especially in the area of information and communications technology (ICT), in promoting social justice (Vrasidas, Zembylas and Glass, 2009), as well as the consideration of ethical issues and values in the design, development and implementation of new technologies […].

Social justice directly in the context of research activities can be considered from two perspectives: (a) the relationship between the researchers and the research subjects; and (b) the participation of social groups in benefits arising from research. The first perspective is concerned with researchers unfairly taking advantage of research subjects and imposing unfair burdens on them for their own benefit or the benefit of others. The second involves the potential unfair exclusion of particular groups from either participation in research and/or access to benefits arising from research (European Commission, 2010)." (Strand et al., 2015, pp. 38–39)

References:

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Concluding the third unit, participants will have to complete a short quiz of approximately 10 minutes again. The questions of the quiz should relate to the input you chose to use in the session. They are meant to test participants' knowledge and understanding of this input; thus, the difficulty of the questions should be chosen wisely. The quiz does not have to be done immediately after the online session, but can also be taken at a later point in time, yet before the next unit takes place. It will not be graded, but has to be concluded before entering the last exam.

Week 4: Inspiring RRI cases

In the fourth session, inspiring practices and activities of doing Responsible Research and Innovation will be presented. In this unit, feel free to choose examples that fit your audience and domain. You can find numerous RRI endeavours in the RRI Tools Toolkit (https://www.rri-tools.eu/search-engine). We recommend choosing cases that apply a holistic and integrated RRI approach, but also activities on single dimensions can be included if you find them more suitable, e.g. gender equality measures. Please choose one or several examples and present those practices in depth and detail.

The forum should be used for engagement and discussion on those practices. Participants are encouraged to pose questions and exchange opinions about the presented RRI examples. The goal is that participants get a more practical grasp of what RRI can mean and look like.

There is no quiz envisaged in this session, because it is more about engagement and inspiration than knowledge production. Participants should be provided with the link to the RRI Tools Toolkit so they can search themselves for more examples.

Week 5: Role-play exercise

In this week's session, a role-play exercise will strengthen participants' understanding of RRI. They will take different perspectives and try to understand the thoughts and motivation of different stakeholders relating to the posed problem. You can find examples for role-play activities in the HEIRRI training materials. You can either use these examples or take them as an inspiration for designing your own role-play exercise suited for your audience and field.

Moreover, the role-play exercises in the HEIRRI training materials are designed for in-class sessions and have to be adapted for online use. We suggest the following process: The session starts with a

welcome note and explanation on how the role-play exercise works. In a next step, you have to explain the question or problem, or the concrete case you chose to be discussed in the exercise. Please provide sufficient background information and see that this problem is defined and outlined clearly. After that, the different stakeholders that are involved in or affected by your posed problem – the different roles – are presented and their background and standpoint in the case is explained. Please make sure to include a variety of stakeholders; do not only think about people involved in the R&I or policy process, but also address civil society organisations and other societal actors, people or communities that might (prospectively) be affected in different ways by the problem you are describing, or others.

Participants then have to take one of those stakeholders' roles and write forum posts from their perspective relating to the problem you described. They do not necessarily have to take the role they sympathise with most, but should be encouraged to try to understand diverging or even opposing views. Depending on the number of participants, you might want to form groups where the different "stakeholders" discuss with each other. If you do so, one facilitator per group should be nominated to steer the debate and make sure everyone expresses their point of view.

The nature of this role-play exercise is not necessarily to reach a conclusion about the posed problem, but rather to make the different interests and views visible to the participants and to understand that various stakeholders exist also outside the R&I process.

Week 6: RRI in practice

Integrating everything that was presented so far, this session is devoted to talk about how RRI can be implemented in the participants' work or study settings. Depending on your audience, this can be done very concretely, tailored to the field they are in, or, if your audience is very diverse, in a more generic way.

Participants should bear in mind a holistic RRI approach and critically assess their own work, studies, or research based on RRI principles. They should try to identify problematic issues, lacks of consideration, and stakeholders that might be affected or should be involved in certain processes. By doing so, they should find possibilities where RRI could and should be applied. Participants should already start considering possible projects of implementing RRI and think about people they would have to activate for that; these considerations should be included in their reflection posts.

We recommend using the "Responsibility Navigator" of the Res-AGorA project (Kuhlmann et al., 2016) for that purpose. It is conceptualised as a "thinking tool" for actors in the R&I system and in R&I governance by offering ten principles and related questions to deliberate on when dealing with R&I on an individual, organisational, or institutional level. The principles are illustrated giving concrete case examples without going into too much detail and can also be used for people outside the R&I field. It can be a viable tool to make people consider different RRI entry points and possibilities. You can either

give the text as reading assignment or draft a guideline based on the text that allows participants to get to know how to adapt RRI to their domain.

As an illustrative support, there are numerous videos about RRI in different fields on the RRI Tools video channel (https://www.youtube.com/user/RRITools). Furthermore, you can find a list of videos on RRI in the HEIRRI training materials. Please feel free to search for further examples suitable for your audience.

Building on the information and insight gained in this session, participants have to write a short reflection post of about 500 words on what they gained from doing the MOOC and how they will and can incorporate it into their work or studies. Owing to the length, the posts will rather provide very brief reflections. The post has to be prepared until the next session, in which all posts have to be published to be considered for assessment.

Week 7: Reflection post and open discussion

This session is dedicated to open questions and clarifications. Participants can and should discuss issues that are crucial to them. The discussion should take place among all of the participants and with the course instructor, if the group size allows doing so. The course instructor should moderate the discussion and should set up thematic groups in order to organise the debates. Such thematic groups could be, for example, research disciplines or fields of work, teaching, the future of RRI, etc. Suggestions for thematic groups or open questions to be discussed can be sent to the instructor beforehand, so that the most popular ones can be selected in advance. This discussion is also a possibility to build networks with other participants.

We strongly suggest inviting external stakeholders to this discussion. These should be chosen according to the domain and audience the MOOC is aimed for. In doing so, first, the discussion facilitation can be distributed to the stakeholders as well, and second, participants can pose very practical questions and gain interesting insights from practice.

After this session, participants should have the possibility to make small changes in their reflection posts according to what they have learned and discussed online. You can leave a time window for publication, but there should be a submission deadline, as there should be enough time for the peer assessment taking place in the final unit.

The concluding part of this session should be a summary and wrap up of the MOOC, including pointing out the final contents to study for the final exam. Additionally, participants are invited to already read the other students' reflection posts until the next session.

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Week 8: Final exam

The last session consists of the final assessment activities in this MOOC. First, there will be the final exam. It should test the information given in the first three sessions and also the understanding of the idea of RRI. Feel free to design the exam in a way you find most appropriate for your audience. For bigger audiences, a multiple-choice test might be more suitable. If you have a smaller group, you could rather focus on open questions. The test should not take longer than half an hour to 45 minutes in order to leave time for the other final assignment, the peer assessment of the reflection posts.

For this assessment, participants answer directly to their colleagues' posts in the forum. The idea is that they give each other feedback, voice their opinion, or pose questions related to their peer's post. Ideally, they have already read all of them in advance. If this is not viable due to the group size, they can selectively read and answer to some of the posts. The facilitator should encourage final exchange and discussion, and also provide feedback to the postings. The MOOC concludes with this task.

Adaptation Possibility 1: Shorter MOOC (-0.5 or -1.0 ECTS credits)

The MOOC can be shortened to a course of a duration of six (1.5 ECTS credits) or four weeks (1.0 ECTS credit). Single modules can be skipped for that. We strongly recommend keeping the interactive parts, thus the role-play exercise and the forum discussions. A further possibility for shortening the course is to merge the information units of Week 2 and Week 3 to one session and focus on the more practical and interactive parts.

The final exam will then also be shorter and the reflection post can be skipped in the 1.0 ECTS credit version of the MOOC.

The course can also be adapted to more specific audiences in choosing respective case examples and RRI practices, and in setting the topics for the role-play exercise. If you choose to provide guidelines for implementing the RRI concept in Week 6, they can be specifically directed to certain fields.

Changes in syllabus

Number of ECTS credits:	1.0 or 1.5 ECTS credits (depending on the above described modus)
Recommended or required reading and other learning resources/tools:	Please adapt the reading list and other learning resources according to the omitted sessions and/or parts of these.
Assessment methods and criteria:	*Modify:* The final exam needs to be shortened and the content to be studied adapted. *Discard:* In the 1.0 ECTS credit version, the final reflection post can be omitted.

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Syllabus

Element	Description
Title	Concepts and Practice of Responsible Research and Innovation
Cycle	Open online course; not part of a study programme.
Year of study	Open online course; not part of a study programme.
Number of ECTS credits	2.0 ECTS (workload of 50 to 60 hours)
Learning outcomes (LO)	On completion of this course students will be able to 1. describe the history and idea of Responsible Research and Innovation (RRI); 2. discuss and contrast the different approaches and concepts of RRI; 3. and to adapt and translate their knowledge of RRI into their own work or studies.
Mode of delivery	Online course, video, and text material.
Prerequisites and co-requisites	There are no prerequisites or co-requisites for participating in this course.
Course content	This Massive Open Online Course introduces the concept of Responsible Research and Innovation (RRI) and the different approaches towards it. It will show inspiring RRI practices and activities and give participants the opportunity to investigate RRI in a role-play exercise. Participants will develop first ideas on how to implement RRI into practice and will be given the chance to exchange their views.
Recommended or required reading and other learning resources/tools	Recommended literature to be used in the MOOC: • Angelaki, M. (2016). An Introduction to Responsible Research and Innovation. *PASTEUR4OA*. Retrieved 19 July 2016, from http://www.pasteur4oa.eu/sites/pasteur4oa/files/resource/RRI_POLICY%20BRIEF.pdf • Kuhlmann, S., Edler, J., Ordónez-Matamoros, G., Randles, S., Walhout, B., Gough, C., & Lindner, R. (2016). Responsibility Navigator. Karlsruhe: Fraunhofer ISI. • Owen, R., Macnaghten, P., & Stilgoe, J. (2012). Responsible research and innovation: From science in society to science for society, with society. *Science and Public Policy, 39*(6), 751–760. DOI:10.1093/scipol/scs093 • Rip, A. (2014). The past and future of RRI. *Life Sciences, Society and Policy, 10*(17). DOI: 10.1186/s40504-014-0017-4 • Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. *Research Policy, 42*(9), 1568-1580. DOI: 10.1016/j.respol.2013.05.008 Further literature: *General introduction to RRI:* • Grunwald, A. (2011). Responsible Innovation: Bringing together Technology Assessment, Applied Ethics, and STS research. *Enterprise and Work Innovation Studies, 7*(7), 9–31. • Iatridis, K., & Schroeder, D. (2016). The Basics of Responsible Research and Innovation. In *Responsible Research and Innovation in Industry. The Case for*

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Planned learning activities and teaching methods	• Online learning via text material and videos • Reading of academic articles • Short quizzes for self-assessment • Role-play exercise • Online forum discussions • Peer review and feedback
Assessment methods and criteria	• Active participation in role-play exercise and open discussion • Overall final exam at the end of the course (online) • Short reflection post of about 500 words: Participants should reflect on what they gained from doing the MOOC and how they will and can incorporate it into their work or studies

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References and further readings

European Commission (2012). *Responsible Research and Innovation: Europe's ability to respond to societal challenges*, DG Research and Innovation. Retrieved 10 October 2016, from http://ec.europa.eu/research/science-society/document_library/pdf_06/responsible-research-and-innovation-leaflet_en.pdf

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