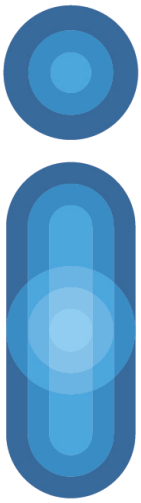

INTEGRITY

D4.1

Standard

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Contents

1.Description of the deliverable 4.1

The deliverable 4.1 is described as follows in the Application:

Drawing on the knowledge gained in in WP 2 and WP 3 the first task will be to define a standard identifying the relevant aspects that shape the teaching philosophy of RCR. This standard will include a competence profile that distinguishes learning aims in different phases of study (high school, undergraduate phase and early career researchers) and will offer a taxonomy of topics that are relevant and meaningful for each phase. The framework will cover a wide range of research areas (including often-neglected fields), will clarify where innovative tools are most urgently needed, and will particularly identify those fields where there is a significant deficit of teaching on research integrity. The framework will also distinguish the relevant phases of the educational 'journey'. In addition, it will give insight into the views and expectations that students have with regards to education in research integrity and will highlight the (knowledge) deficiencies they experience.

Drawing on the extensive research in WP 2 and 3, the competence profile will establish how high standards of attention to research integrity can be stimulated amongst students, and will disaggregate the data so as to show the range of relevant conditions, varying from minimal conditions of compliance to the maximum desired aims, namely, the creation of conditions that promote and embed a culture of research integrity, aligned to research excellence. The next step is to differentiate between three target groups (high school students, undergraduate students and early career researchers) and combine theory and practice outlined in previous WPs to understand recent innovations in formal and non-formal learning for these different groups, particularly with respect to ethics, integrity, and responsibility. This will enable us to design tailor-made approaches to building competence in research integrity, in the context of identifying what is feasible and sustainable in the different institutional contexts of learning. A matrix (or taxonomy) will be developed that distinguishes between minimum required aims according to the standard and a maximum in offerings in teaching.

In this deliverable, we distinguish three documents as a final result of this taks. The first document is a description how the task has been operationalized and how we arrived at the competence profile and taxonomy. The competence profile (4.1a) and the taxonomy (4.1b) are appendices to this deliverable. that are part of this deliverable. First, we distinguish the various concepts that are used to develop a standard, and how insights from the literature have helped to determine characteristics of concepts like RCR and empowerment education. Next, we describe how we used Delphi method as input from our consortium partners to arrive at a competence profile.

In section one, we describe how we distinguish the notions of standard, taxonomy and competence profile. In section two, we describe how we developed our view on RCR education. In section three we explain how we have developed the competence profile.

1.1. Standard

The aim of the task is to develop a document that can function as a standard for the consortium partners during the lifetime of the project and has the ambition to function outside of the consortium as a guiding tool to help design and develop tailor-made educational tools in RCR education. This ambition is quite high and aims at an ideal situation. Usually, something is considered a standard effectively if it is accepted by authorities (like governmental bodies) or if it is widely embraced by experts in the field. Whether the standard that we develop will be useful and embraced by others teaching RCR can only be answered after the lifetime of the project. For the purpose of this project, we therefore focus first and foremost on the use of the standard for the development of educational tools in WP4 and WP5. The idea is that it indicates what criteria or conditions are relevant to take into account when we teach students responsible conduct of research in an empowering way. The standard that we developed is not a recipe for its success, nor is it a narrow structure that should be followed by all. What it does offer are ingredients for teachers and educational developers to use, and to take the perspective/view that we present in the competence profile as a starting point to develop their own RCR courses, possibly also by using the tools that we developed.

An underlying assumption is that it is possible to identify relevant aspects to shape RCR education in an empowering manner. Using empowerment as a core concept is novel and needs to be explored further. Therefore, we have consulted literature on empowerment education and related it to core concepts of RCR education. The results from this literature study are used as input to develop a competence profile, with a view on empowerment towards responsible conduct of research. Next to that, the empirical findings in WP2 and WP3 are used as input for a taxonomy, that describes which topics, needs and blind spots seem most relevant for high school students, undergraduate students and early career researchers. Hence, the standard is not a self-standing document, but comprises of two documents: a competence profile and a taxonomy. Below, we explain the core focus of each of these documents.

1.2. Competence profile

A competence is basically 'being good at something' (Velde, C (ed), 2001). Thinking in terms of competence or competency originates from a practice where knowledge and skills were primary indicators for successful functioning in the workplace and are subsequently used to determine learning

outcomes for vocational education. An underlying idea to use competences is that a competence better fits in a student- or employee-centered focus and that it can better formulate what type of behavior is expected at the workplace or which abilities a student should be able to demonstrate when having finished an educational program. Nowadays, the concept of competence is more widely embraced and is also used outside vocational contexts. For the purpose of this project, we think that a competence profile is useful to determine what empowerment in RCR should entail. If we are able to define what learning outcomes we expect students to possess with regards to RCR education and how this is empowering, we will be able to translate this in the educational tools that are being developed.

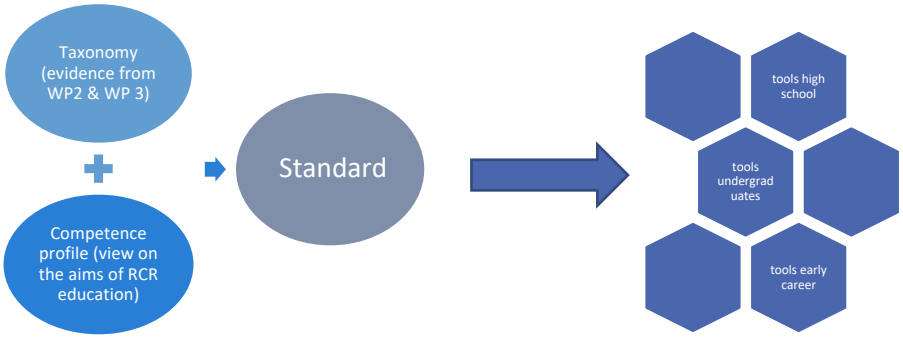
In the literature on RCR education it is debated what RCR education should aim for and what topics are relevant.(e.g. Steneck, NH, 2007) From studies in the literature we learn what objectives, aims and learning outcomes RCR courses in the past have been central (Kalichman, MK, 2013; National Academy of Sciences, Engineering and Medicine, 2017). For the purpose of this project, however, this is insufficient, as it does not yet describe what empowerment towards responsible conduct of research entails. Hence, we decided that we needed to compose a picture of what competences (as a combination of knowledge, skills and behavioral aspects) students need to acquire to be empowered, i.e. become aware of issues, be able to reflect on these and decide on how to act accordingly in a responsible manner. Such a picture needs an underlying view on what empowerment towards RCR entails. In D4.1.a the profile is presented. In section 2 we lay out how we have developed the competence profile.

1.3. Taxonomy

The data that we collected in earlier work packages of the H2020INTEGRITY project will help us to get a better picture of what specific topics, needs and blind spots exist and are relevant to teach to the three target groups that we focus on in our project. Therefore, we decided to build a taxonomy, that is supposed to give an overview of our findings. The taxonomy is complementary to the competence profile: teachers who prepare new RCR trainings can consult the taxonomy and use the competence profile to determine the topics that they will address and the learning outcomes and the teaching perspective that they take in the training(s). In D4.1.b the taxonomy is presented, based on a survey in WP2, a survey in WP3 and a literature review in WP3. The result is not a table, as we initially pictured, but a description of topics that were addressed in the empirical data that we had available, showing general pictures, possible needs and blind spots.

Figure 1 presents how we see the competence profile and taxonomy related to the standard for the H2020partners in designing, developing and testing innovative tools.

Figure 1: Connection between taxonomy, competency profile, and standard



2.Developing a view on empowerment towards responsible conduct of research (RCR)

At the start of the project H2020INTEGRITY we stated that empowerment is vital because today's students will encounter ethical dilemmas that current practice cannot yet foresee, so students must be able to anticipate what research integrity will entail in the future. Core idea of developing RCR trainings in this project is that it underpins the aim to empower students in order for them to be able to anticipate what RI will entail in the future. In this section, we will describe three routes to develop a view on empowerment towards RCR. The first is an exploration of core characteristics of RCR education that can be found in the literature. The second is to turn to notion of empowerment in the field of educational sciences and to determine how characteristics in this field relate to RCR education and what picture on empowerment towards RCR emerges. Lastly, we will shortly describe how the emerging picture aligns with principles that are mentioned in codes of conduct on research integrity.

2.1. RCR education

The concept of Responsible Conduct of Research (RCR) has been used since the late '80s last century. Several severe cases of research misconduct did not only lead to the formulation of the well-known concept of FFP (Fabrication, Falsification, and Plagiarism), but also to the formulation of a concept that expresses what good science looks like and what core values are (or should be) underlying to research, namely that of RCR (responsible conduct of research). An influential report, composed by Steneck, formulated honesty, accuracy, objectivity and efficiency as the underlying values to RCR. These values show... 'in general terms .. simply good citizenship applied to professional life'. (Steneck, NH, 2007). To Steneck, it is clear that doing research is similar to a profession requiring researchers to live up to standards, codes of conduct and defined good behaviour.(Steneck, NH, 2006). Steneck distinguishes researcher's behavior into three different categories, namely deliberate misconduct (Fabrication, Falsification and Plagiarism), questionable research practices (QRP) and responsible conduct of research (RCR). RCR reflects the ideal type of behavior, while FFP is what all should avoid. Figure presents his view. In this view, RCR is an ideal, focusing on the ethics of research integrity, while FFP focuses on the misconduct that occurs in research practices.

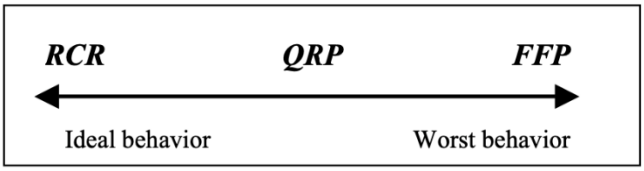


Fig. 1. Current framework for Defining Research Behaviors

Another way to look at RCR is not to see it as a type of behavior, but as a perspective that one can take on topics in research integrity. The focus is then, compared to FFP a positive one, trying to define what the 'good', 'right' and 'responsible' choice would be. Taking RCR as a perspective instead of a type of behavior allows to discuss cases of misconduct in one's trainings, not with the intention to scare people off or warn them that bad things will happen to them if they take a wrong turn, but with the purpose of learning from the situation, and helping researchers how to reflect and decide on cases that could ultimately lead to misconduct but could also turn out as acceptable or good behavior. Moreover, taking the RCR perspective is choosing to focus more on actual practices, and the many grey area issues that arise in these practices that are not immediately wrong or right and that are much more experienced by researchers (they can identify themselves with these issues). Trying to determine what to do is not always

a choice between 'entering the path of misconduct' and doing the right thing, but trying to deliberate on your options, on what would be ideal but also on what is 'out of your hands' and then decide and act. Accepting that many dillemmas are rather gray in nature and not immediately black and white is closer to practice, and takes the positive approach towards researchers, namely that one is not immediately a suspect wrongdoer, but that one is part of a practice where questions will arise and where we expect researchers to learn to handle these situations. Taking RCR as a perspective can also broaden the scope towards topics that are relevant for high school students, as types of issues that arise among researchers are also occurring amongst high school tasks and students. For example, issues of collaboration are frequently underlying to questions in both free riding and authorship. In the competence profile, we further explain this.

How is taking a RCR as a perspective related to current teaching practices in RCR education? It was due to requirements by the NIH and the NAS towards grant applicants in the US that that RCR education came into existence (Steneck, NH & Bulger, RE, 2007).The body of RCR education has grown over the past 25 years and a wide variety in content, format and goals can be found (Michael Kalichman 2013). The ORI has provided guidelines on the types of topics that need to be trained to researchers and students, including responsible publishing, peer review, mentoring, collaboration, data(-acquisition, -management, sharing, ownership), conflict of interest, research with human subjects or animals.(Steneck, NH, 2007) These guidelines still allow for a broad variety of teaching methods, assessments and learning aims. Kalichman stated that in research practices researchers need to learn *how to handle complex issues* in practice, instead of (only) gaining knowledge about rules and regulations.(Kalichman, MK, 2014) This view contrasts the bulk of literature on RCR education that still shows a tendency to focus mainly on knowledge transfer, on specific do's and don'ts and on specific skills, like reasoning skills. This is clearly shown in a recently developed Predictive Modeling Tool, that is mainly based on studies where effects on knowledge and skills have been measured, but not on behavior or attitudinal changes. (Mulhearn, TJ et al., 2017). Inspection of eleven meta-reviews led to the same conclusion regarding learning outcomes ((Krom, A & Hoven vd, MA, n.d.). If we are 'to foster a research culture in which conversations about responsible conduct of research are expected and acceptable' (Kalichman, MK 2014), RCR education needs a stronger focus on a 'positive disposition towards RCR, with a sense that there are things *they can do* in the face of concerns, and with a belief that they are part of a culture that takes RCR seriously. (ibid, italics added) RCR training is in need '*to empower* them to continue those conversations with peers, mentors and their future trainees' (ibid: 71). Fostering a positive research culture requires a combination of skills, knowledge, attitude and behavioral changes instead of a one-sided focus on knowledge transfer

or the acquisition of certain skills. We take this idea of empowering researchers towards a positive research culture as central to RCR trainings and empowerment of students and early career researchers as our starting point, thus utilize the suggestion made by Kalichman. Taking empowerment as a core perspective on RCR education narrows the focus in RCR education to what is needed for researchers in specific contexts to know what they can do, make them aware of integrity issues and help them build a positive research culture.

2.2. Empowerment & education

In order to utilize a view on empowerment towards RCR in education, we needed to explore the concept of empowerment further. We do this in two ways: first, we use findings from the literature on empowerment education as part of educational sciences to define core characteristics. Secondly, we use experts in the field of research integrity education to scrutinize the characteristics for the context of RCR education. For the literature part, we notice that the concept of empowerment in education derives from the Brazilian educator Freire, who used the concept to stimulate people to identify their own topics and assess the social and historical root of topics in education (Freire, P & Ramos, MB (translator), 2000). His work is positioned in a political context of empowering oppressed groups and has inspired a tradition of empowerment education. Empowerment education is concerned with the needs of people, by taking their own perspective into account. In this view, empowerment education is about *taking control*, and it was deemed particularly relevant for marginalized or vulnerable people. According to Lawson empowerment focuses on the development of *critical autonomy*: 'Critical autonomy includes the ability to think for oneself, the ability to use theory as a guide to action, and, crucially, the ability to evaluate the circumstances of one's life, including the structural forces that surround us' (Lawson, T, 2011). Critical autonomy includes both cognitive aspects (reflection), skills (ability to think for oneself, ability to use theory as action guiding) and meta-competences (taking circumstances of one's life into account). In addition, Israel et al. state that an empowered learner is motivated to perform tasks, finds tasks meaningful, feels competent to perform them, and feels his/her efforts have an impact on the scheme of things (Israel, BA et al., 1994). They also emphasize that empowerment is a *positive and proactive concept*. They distinguish, together with others, *three levels of empowerment*, namely at the individual level, at the organizational level and at the community level. Since then, the literature that uses the notion of empowerment in education has evolved in different directions, leading to various focal points on what empowerment entails and whom is targeted. To some, empowerment education focuses

primarily *on improving the self-esteem or self-efficacy* of individuals (Cleary TJ & Zimmerman, BJ, 2004). Others emphasize that empowerment education needs to include a perspective on the (empowerment of) the community and system in which one functions next to that of individuals (Bergsma LJ, 2004). Rappaport (1987) defined empowerment as 'a process by which people, organizations, and communities *gain mastery over issues of concern to them' (Bergsma LJ, 2004)*. Empowerment education can target both specific groups, like teaching staff (Boglera, R & Somech, A, 2004) or students and focus on a general view of 'taking control' or on very specific issues, like student characteristics (Houser, ML & Frymier, AB, 1996), student motivation or on cognitive elements of empowerment (Thomas, KW & Velthoudse BA, 1990). If we compare these characteristics to expectations of responsible researchers, we see clear overlap: researchers need to develop a critical autonomy towards integrity issues in research practices, need to learn to take control and can be held accountable for their research and the practice in which they work. It seems also true that research takes place in a context, where individual researchers have to align with customs in practices and work in systems where expectations and regulations can be demanding, hence the different levels of empowerment as distinguished by Israel et al. seem also relevant to research integrity issues.

These findings from the literature on empowerment were presented, using a Delphi method, to consortium partners of the H2020INTEGRITY project, with the question to comment and adjust these characteristics into a concept of empowerment towards RCR. It leads to the following characteristics that apply to research integrity.

Empowerment towards RCR…

1. *is about building capacities of individual researchers, who function in institutional and systemic contexts;*
2. *is learning to take control;*
3. *is to learn to develop a 'critical autonomy' which includes:*
    a. *to demonstrate a self-reflective attitude on RCR issues, one's role and responsibility in these issues and to know when and whom to consult*
    b. *being able to independently deliberate and decide upon RCR issues*
    c. *the ability to evaluate the circumstances of one's (research) practice and position, including the institutional and systemic forces*
    d. *the ability to develop strategies to become a responsible researcher*
    e. *feel up to act upon decisions*
4. *stimulates an attitude of openness, 'feeling up to' and courage (when needed)*

Next to these characteristics, it seems that several assumptions, deriving from the empowerment literature are relevant to take into account as well, even if these do not define empowerment as such.

For starters, empowerment requires to take the learners perspective as lodestar in education, which in practice could imply to let them have a say in what is being educated, to use their own experiences/circumstances as much as possible, or to use their learning aims as leading. Empowerment is also a pro-active concept which requires active participation (and take action) and a willingness of participants to become responsible researchers and anticipates a positive development towards more responsible conduct of research. Thirdly, empowerment towards RCR starts, like empowerment education in general, from the status quo which is not ideal: grey areas and misconduct (will continue to) exist, and institutional changes may be slow. Hence education towards RCR is stimulating researchers to become critically aware of their research context, determine what their role can be and how they can make changes, without thinking all will be solved (soon), or that misconduct will never happen again. Finally, RCR is not only an individual responsibility, but it is an appeal for institutional and systemic changes: conducting research in a responsible manner should be(come) the obvious and attractive way of behaving in research practice for researchers in general. Pressure to publish, impact factors etc. should not stand in the way of RCR.

With this perspective on empowerment, we now turn to the European Code of Conduct and see how the code of conduct and the core values of Transparency, Honesty and Responsibility that we focus in in this project, can be related to an empowering view of RCR education.

2.3. Core values

Codes of conduct provide a normative framework and set standards for how to conduct research in a responsible way. They entail guidelines for good research practices. As such, they are highly relevant for the standard/ the competence profile that will be developed as part of D4.1. In brief, if codes of conduct provide a normative framework for RCR, then the standard/ competence profile should somehow reflect key elements from relevant codes of conduct.[1] Of particular importance is the 2017 European Code of Conduct for Research Integrity (ECoC) by ALLEA (ALLEA All European Academies, 2017). Below you will

[1] There are other normative frameworks as well, such as laws, rules and regulations, institutional policies, and normative theories. It seems prudent for the consortium to decide which of these frameworks will be taken on-board, in addition to the European Code of Conduct.

find a summary of how elements from the ECoC could be used for the purposes of the standard/ competence profile.

To begin with, the ECoC formulates a limited number of fundamental principles on which good research practices are (and should be) based:

- *Reliability* in ensuring the quality of research, reflected in the design, the methodology, the analysis and the use of resources.
- *Honesty* in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair, full and unbiased way.
- *Respect* for colleagues, research participants, society, ecosystems, cultural heritage and the environment.
- *Accountability* for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts. (p. 4)

These principles also signify values. Here, it is relevant that the H2020 Integrity project focuses on three values in particular: Honesty, Transparency, and Responsibility (Accountability). An important question is how we should interpret the focus on Honesty, Transparency, and Responsibility. And whether this has implications for which elements from the ECoC to include in the standard/ competence profile.

Roughly speaking, a focus on Honesty, Transparency and Responsibility could mean either of two things: a) that we will *exclude* other values/principles, or b) that other values/principles will be included but will be given less emphasis. We take the more inclusive approach, taking into consideration that it is difficult to state that some values are more relevant than others and should be given priority and that it is also often the case that multiple values play a role in concrete cases, which would imply being blind to some and focusing on other values. More generally, it seems reasonable for a standard/ competence profile that aims to empower students and (aspiring) researchers for RCR not to set prior limits on the types of good research practices that are included. Empowering (aspiring) researchers for all good research practices included in the ECoC, requires including all values/principles included in the ECoC.

The ECoC mentions **honesty** explicitly, as one of four fundamental principles of research integrity on which good research practices are based (p. 4). The term 'honest' is used twice, in relation to good research practices in the context of research procedures (Researchers publish results and interpretations of research in an open, honest, transparent and accurate manner, and respect confidentiality of data or findings when legitimately required to do so. (p. 6)) and with regards to publication and dissemination (Authors ensure that their work is made available to colleagues in a timely, open, transparent, and

accurate manner, unless otherwise agreed, and are honest in their communication to the general public and in traditional and social media. (p. 7))

Transparency and responsibility are not mentioned explicitly as core values or fundamental principles of good research practice in the ECoC. That said, accountability, which *is mentioned* as a fundamental principle of good research practice, does have a strong connection to responsibility, in the sense that being accountable is commonly taken to presuppose that one bears at least some responsibility. Likewise, it could be argued that having specific responsibilities pertaining to research means that one is accountable, and that one should take accountability for what one does.

Accountability is mentioned in relation to good research practice in one specific context, namely with regards to the research environment (Research institutions and organisations support proper infrastructure for the management and protection of data and research materials in all their forms (encompassing qualitative and quantitative data, protocols, processes, other research artefacts and associated metadata) that are necessary for reproducibility, traceability and accountability. (p. 5))

Responsibility is addressed in the ECoC in different ways. Besides the ECoC being a realisation of the basic responsibility of the research community to define the criteria for proper research behaviour, et cetera, responsibility is discussed in relation to good research practice in two specific contexts, namely in collaborative working (All partners in research collaborations take responsibility for the integrity of the research. (p. 6)) and with regards to publication and dissemination (All authors are fully responsible for the content of a publication, unless otherwise specified. (p. 7))

Transparency is mentioned explicitly a) as being a part of the principle of "honesty" (Honesty in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair, full and unbiased way. (p. 4)), b) in relation to good research practices in 5 specific contexts:

- Research Environment
    - Research institutions and organisations demonstrate leadership in providing clear policies and procedures on good research practice and the transparent and proper handling of violations. (p. 5)
- Research Procedures
    - Researchers publish results and interpretations of research in an open, honest, transparent and accurate manner, and respect confidentiality of data or findings when legitimately required to do so. (p. 6)
- Collaborative Working

- All partners in research collaborations agree at the outset on the goals of the research and on the process for communicating their research as transparently and openly as possible. (p. 6)

- Publication and Dissemination
  - Authors ensure that their work is made available to colleagues in a timely, open, transparent, and accurate manner, unless otherwise agreed, and are honest in their communication to the general public and in traditional and social media. (p. 7)
- Reviewing, Evaluating and Editing
  - Researchers review and evaluate submissions for publication, funding, appointment, promotion or reward in a transparent and justifiable manner. (p. 7)

And c) in relation to dealing with Violations and Allegations of Misconduct

- 'National or institutional guidelines differ as to how violations of good research practice or allegations of misconduct are handled in different countries. However, it always is in the interest of society and the research community that violations are handled in a consistent and transparent fashion.' (p. 9)

Transparency is also addressed in a more indirect way by the ECoC, by way of synonyms or at the very least adjacent terms, such as 'open' and 'disclose' in relation to the research environment, research procedures, researchers, safeguards and publication and dissemination.

In closing, the following general considerations can help increase the connection between the standard/ competence and codes of conduct such as the ECoC.
First, the ECoC describes good research practices in a range of contexts: Research Environment; Training, Supervision and Mentoring; Research Procedures; Safeguards; Data Practices and Management; Collaborative Working; Publication and Dissemination; and Reviewing, Evaluating and Editing. (p. 5) The list above of the good research practices in which the values of Honesty, Transparency and Responsibility are mentioned, cover most of these contexts, but not all. These values are not explicitly mentioned in relation to good research practice in a) Training, Supervision, and Mentoring; and b) Data Practices and Management. To increase the connection with the ECoC, we decided to take a more inclusive approach, given that in the current set-up mentoring, and data (acquisition, management, sharing, ownership) are among the key topics of the draft standard/ competence profile. Covering these topics would require including other values/ fundamental principles from the ECoC in the standard/ competence profile as well.
Second, possible elements that are relevant for empowerment of (aspiring) researchers that are related to the ECoC include:

- Knowledge of the ECoC as a central normative framework for RCR, including its guiding principles, and how these principles are operationalised in specific so-called good research practices
- Being able to determine which relevant values are at play in a case at hand

- Knowing how to interpret the core values in concrete circumstances (the good research practices are often still quite general, and might mention, e.g., a value like honesty, without specifying exactly what honesty requires)
- Being able to identify how different values and principles that play a role in a case at hand might give rise to tensions, dilemmas and grey areas
- Being able to devise strategies that do justice to the relevant values/ principles of RCR, and to explain and justify one's choices and course of action in terms of those values and principles

In a next step, elements such as these could be formulated in terms if the type of competences mentioned in this deliverable.

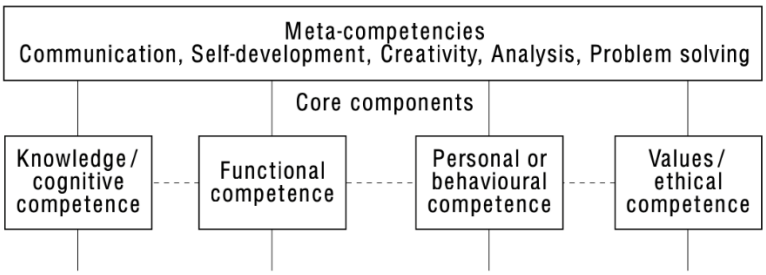
Last, the ECoC is an important guideline, but it is not the only one. Researchers in specific countries often have to follow national codes of conduct as well. These may include additional values or guiding principles compared to the ECoC. For instance, the Netherlands Code of Conduct for Research Integrity (2018) mentions honesty, scrupulousness, transparency, independence and responsibility as guiding principles that underly good research practices. (p. 7-8) (VSNU, 2018). The standard/ competence profile can support empowering (aspiring) researchers for RCR by taking these values on board. One option would be to include a modular part in the standard/ competence profile, that can be adapted to local circumstances?

3.Building a Competence profile

We will make use of a holistic approach to competences as developed by Cheetam and Chivers (Cheetam, G & Chivers, G, 1996). Until then, several views on competence profiles were being used, each with a different emphasis. For example, there are competence approaches that define competences fully in terms of 'performance criteria'. Such an approach mainly captures the (job)specific outcomes that are expected. In the US, a more behavioral/personal competence model has been popular, that focuses on the expected performance of individuals in a specific role. The difference is that the first is much more oriented on generic outcomes that match with a certain job or position, while the behavioral model focuses much more on individual competences. Combining these in a more holistic manner, Cheetam and Chivers presented a model combine various perspectives and also try to include a view on reflective practitioners' Schön (Schön, D, 1991). Schön was one of the first to point out that being a professional includes more than technical skills, namely that professionalism includes to a large extent tacit

knowledge, which is more reflective in nature. Cheetam and Chivers distinguish five components of a holistic model of competences which are interconnected, and at times seem to be able to overlap:

Figure 2
Relationship of meta-competencies to core components



The five components are divided between four core competences and one overarching competence, namely meta-competencies:

- **Knowledge or cognitive competences** could be seen as 'possessing appropriate …. knowledge and the ability to put this to effective use'
- **Functional competences** refer to the possession of skills that are needed to achieve specific outcomes. Functional skills could be broken down in 4 constituent competencies, namely a) occupation specific; b) organizational/process skills c) cerebral skills, referring to mental activities, like literacy etc. d) psycho-motoric skills (of a more physical nature, like manual dexterity).
- **Personal or behavioral competences** both refer to the social/vocational behaviors expected from a person in a certain role/position (like task-centeredness, self-confidence) as well as to interprofessional behaviors, like collegiality, adherence to professional norms etc. Notice that these personal competences in both variances refer to one's performance as professional in a role, not to one's private personal behaviors.
- **Ethical competences** refer to underlying values and refers to adherence to values, both personal moral values as well as professional moral values.
- **Meta-competences**, finally, are overarching, as they assist in developing certain specific core competences (like self-development), and take these a step further as well, including creativity, communication, analytic skills, and problem-solving competences.

How can we utilize these components for the project? Having stated earlier that in order to empower students towards RCR we need a combination of knowledge, skills and behavioral aims: to this purpose a holistic competence model could very well be used. Therefore, we decided to use this distinction between the five competences and used a Delphi method to ask the H2020INTEGRITY partners input on what kind of competences they considered relevant. At the end of the Delphi rounds, however, when composing the competence profile, we decided to let go of distinctions between the types of competences of which this holistic model consists. There are two main reasons for this decision. We agree with Cheetam and Chivers that holistic models show a clear intertwining of competences. Distinguishing separate competences seemed a bit artificial, thus we decided to simply focus on describing the competences, not on which specific aspect these described in the model of Cheetam and Chivers. Secondly, for purposes of readability, we decided that describing what we think is core to empowerment towards RCR should not be split up between all kinds of categories. Categories are less relevant. Hence, we decided to describe the competences in an inclusive, and more abstract manner. Lastly, we also decided to present just one competence profile, that can be applied to all target groups, both high school students, undergraduate students and early career researchers. Hence, we describe core competences that apply to all target groups in such a way that these can be inclusive and describe additional competences for those persons who take extra responsibilities towards responsible conduct of research.

About using a Delphi method

Delphi methods are frequently used to reach consensus on a specific topic (Okoli & Palowski, n.d.) or to make an inventory/classification of an issue and involves interaction with experts or users. Delphi methods consist of rounds where data is collected by involving experts (often individual contributions from experts), the data is reworked in a draft version and is returned to the experts to get further input. If the aim is to reach consensus, these rounds continue until the aim is achieved. If an inventory or categorization is the aim of these rounds, the rounds continue till no further or new information comes forward (saturation). In this project, we aim to achieve a list of competences that is embraced by the majority of the people involved. We combine the aim to reach consensus (on the competences) and the aim of classification.

Rounds

1. Short survey to collect data on the competence profile (via Google Forms) send to all consortium partners
2. First draft competence profile
3. Second consultation of consortium partners
4. Draft standard formulated
5. Draft standard discussed in workshop with UU partners
6. Draft adjusted
7. Draft send to UCPH and TCD partners (responsible for design and development of educational tools together with UU in WP4)
8. **Deliver draft to EU portal: first prototype competence profile**
9. Further rounds (extended) to ask input from users (teachers using the educational tools) to scrutinize the standard
10. End of project: adjusting the profile (if necessary)

For the purposes of our project, all consortium partners are experts in research integrity and potential (end-) users of the tools that are developed. Therefore, we start with a consultation of consortium partners as preparation of a prototype competence profile. Yet, additionally (which is not part of the task description, but extra), we will broaden the scope the moment that tools are being tested and used by non-consortium members. A procedure will be developed to ask the input of teachers that use the tools on the further development and scrutinizing of the standard.

The result

The result of the consultation rounds and discussions is described in D4.1.a

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Appendix D.4.1a

Competence profile
Empowerment towards Responsible Conduct of Research

Helping teachers to empower students for RCR

This competence profile is meant for teachers and educational managers who have a role in promoting & teaching Responsible Conduct of Research (RCR). Central to the profile is the empowerment of students. What do students need to know? What should they do and be able to do when it comes to responsible research? Which attitudes contribute to RCR and should therefore be promoted? Some competences are essential for all good research(ers). We call these 'core competences'. Other competences are 'additional' in the sense that they (can) apply in specific circumstances.

Outline

The profile consists of an overview of the core and additional RCR competences. After presenting the competences, we offer guidance on how the profile can be used. This includes examples on how the competence profile can be translated into actual RCR courses or trainings, for different study levels. Specifically, for high school students, undergraduate students, and early career researchers. Finally, we provide some background information on the view underlying to empowerment towards responsible conduct of research.

CORE COMPETENCES

A good researcher …
Has basic knowledge on what (a) research (project) entails (research cycle, designing a study, using appropriate methodology, collecting & analysing data, reporting findings) and what challenges this brings with it;
Can explain rules and regulations regarding academic & research integrity (like codes of conduct, rules on plagiarism, etc.) and apply them to generic cases
Is able to apply rules and regulations of responsible conduct of research and research/academic values to one's own project/field, and to conduct one's research (project) according to RCR standards and values;
Can recognize and point out what integrity issues are relevant in one's own context and how they relate to debates on Responsible Conduct of Research (RCR);
Is able to identify and reflect on relevant RCR aspects in a given situation;
Is able to determine relevant strategies in a situation in which RCR is at stake;
Can determine an appropriate course of action in a situation in which integrity is at stake (also in consultation with others);
Is an active bystander (i.e. takes active responsibility) when encountering situations that could jeopardize RCR;
Expresses adherence to norms of responsible conduct of research;
Demonstrates in one's reflections and decisions that one feels up to addressing issues of RCR and integrity with others;
Recognizes, and is able to withstand stimuli to condone misconduct;
Understands the institutional context of integrity issues, and how one's individual role is sometimes limited yet relevant;
Acts respectfully towards others (humans, animals, nature) when conducting research (projects)

Acts with honesty, responsibility, and transparency as core values of research;
Demonstrates sufficient analytic, problem-solving, and communicative skills in discussions and deliberations on RCR issues.

ADDITIONAL COMPETENCES

A good researcher can additionally …
reflect on the underlying structures and aims of academic work/research and on how they relate to debates on RCR;
understand, and is able to detect and critique the (cognitive) biases that may lead into integrity issues;
identify topical and novel issues in integrity debates and how they apply to one's field of research (like replicability, photoshopping or the impact of predator journals on the research community);
assess and analyse how the institutional and systemic context aligns or deviates from RCR and what is needed to change it towards RCR;
show the willingness and ability to initiate and lead discussions on responsible conduct of research with peers (colleagues, fellow students);
take responsibility (and shows courage if necessary) to address issues of RCR within institutional contexts;
prioritize (if necessary) responsible conduct of research above one's strive for success as researcher.

Guide to using the profile

The competences are formulated in a general manner. This is intentional. They include important aspects of what is needed for RCR and need to be further specified into learning aims for specific courses for specific target groups.

When developing new course materials, the competence profile can be used as follows.

First, we offer a few 'rules of thumb'.

Rules of thumb

1. Competences need to be interpreted from the abstract to the specific (topic, study level, discipline)
2. When aiming for a specific competence based on this profile, first ask yourself 'how will this empower the students/participants of my course towards RCR'?
3. It is impossible to achieve all competences within the context of one course. Therefore, it is wise to focus on a few competences instead of slightly touching upon them all;
4. If possible, setting up a curriculum (learning trajectory) will help to build capacities throughout the years and will lead to more competences being achieved;
5. Each competence could be achieved on each level of studies, yet it will get a different shape and might apply to different topics.[2]

Here are some examples of how the competence profile could be translated into actual courses or trainings at different study levels.

High school students

[2] So, it is well possible that one specific competence is core to multiple trainings in various study phases, while other competences could be more study phase specific (e.g. learning how not to plagiarize will not differ much across trainings)

Upper level high school students are introduced to (even though not always explicitly) and prepared for higher education. They learn to work according to a certain method if they have to write a paper, to use steps of the research cycle when conducting (a bit of) research on their own, what an experiment entails, to work in a group (and what issues can arise when collaborating with others), etc. In some countries, introductions to science are organized (via projects, via collaborations with universities…).

Example:

Is able to identify and reflect on relevant RCR aspects in a given situation;

If a student, when doing group work, encounters a situation of free-riding, (s)he should be able to recognize not only that the workload is not fairly spread, but that this is also problematic, because someone is profiting from the work that others do. Moreover, reflecting on it, instead of condoning the situation, and actively discussing it with group members (what counts as free riding to them), could be the objective of an RCR assignment.

Is able to apply rules and regulations of responsible conduct of research and research/academic values to one's own project/field, and to conduct one's research(project) according to RCR standards and values;

Knowing how to use literature, paraphrase and use references is something that is often expected, but not explicitly (enough) taught to students. Hence, if you aim to design an assignment or lesson on this topic, the competence will be interpreted as 'how to apply rules and regulations regarding plagiarism in one's own paper'.

Undergraduate students

Undergraduate students are, when entering the academy, introduced in the status quo of academic knowledge in the discipline of their choice, learn how to use methods and are, step-by-step, introduced in conducting some parts of the research cycle independently. While often undergraduate students are not expected or not allowed to conduct studies independently, they do encounter issues regarding e.g. collection and analysis of data, on how to draw on work of others, or regarding collaboration.

Example:

Can explain rules and regulations regarding academic & research integrity (like codes of conduct, rules on plagiarism, etc.) and apply them to generic cases

When students will e.g. use empirical data collection and e.g. interview persons, it is relevant, from an RCR perspective, that they know what regulations are with regards to ethics review, research ethics (like asking informed consent (IC)) and how to take due care in research with human subjects. One way to contribute to achieving this competence is therefore to help them gain knowledge and how to apply these in their situation.

Early career researchers

Students, either starting in the research master study phase or when starting a PhD project, will turn into independent researchers. They will also become more acquainted with issues that arise in daily life of research practices and are expected to take more responsibilities.

Example:

Demonstrates in one's reflections and decisions that one feels up to addressing issues of RCR and integrity with others;

For many PhD candidates, it is really difficult to feel free to bring things up, especially in hierarchically ordered working situations. So, if for example an authorship issue rises, will the PhD feel up to share her views? In RCR trainings, this could be specifically aimed for and this competence is then interpreted to apply to 'feeling up to addressing authorship issues'.

When developing your course materials…

Each course or training is always conditional on e.g. time spent, group size, expertise by the teaching staff and the mandatory or optional nature of the course, and this influences the number of topics and

issues that can be addressed in a course. If you want to know more about what has been proven effective with regards to a number of course characteristics, we refer to the Quality Checklist for RCR education[3], which gives an overview of 11 meta-reviews on RCR courses., and also advise you to have a look at the Predictive Modeling Tool as developed by Mulhearn et al. (2017).[4]

[3] http://h2020integrity.eu/about-us/documentation/
[4] https://www.tandfonline.com/doi/abs/10.1080/08989621.2016.1274886

About this competence profile

How the competence profile was built

This profile is based on a literature on competences in responsible conduct of research, literature on empowerment education, and common learning outcomes (goals, aims) of RCR education. These were combined into a view on the competences needed for empowerment towards RCR. Consortium partners in the H2020INTEGRITY project who are experts on RCR education were consulted about the formulation of the competences via a Delphi method.[5] A specific aim in building the competence profile was to formulate competences in such a way as to create an "educational pathway" to RCR through different levels of study, from high school to the undergraduate level, and from there to the level of early career researchers. To create this educational pathway to RCR we made two choices:

- To formulate general core competences that can and must be specified further for specific study levels;
- To employing a broad view on research integrity.

Both points are explained in more detail below.

More on core and additional competences

The profile consists of two levels, which are not hierarchical in the sense that all competences ultimately need to achieved by all. There are standard or core competences that, when specified, are applicable at all levels of study and that all who want to act in a responsible manner in research can acquire. We also formulated additional competences, that apply to those who are at the forefront of responsible conduct in research or have extra responsibilities in addressing integrity issues due to their role in organizations. Thus, the additional competences do not refer to the level of study of the student but rather apply to some researchers with specific positions, whereas the core competences apply to all good researchers.

[5] The process leading to this profile is described in D4.1.1 (Composing a standard).

Holistic and inclusive

This profile is both holistic and inclusive. It is a holistic model in that many competences are interconnected yet distinguished. For example, one cannot withstand stimuli to condone misconduct without being able to identify integrity issues in practice. Or being an active bystander relates closely to express adherence to norms of responsible conduct of research.

The competence profile is also inclusive. This means that it is applicable to study and research activities for upper grade high school levels, undergraduate students in all disciplines and early career researchers.[6] As a result, the profile is still quite abstract and needs further interpretation; that is why we give some examples how competences could be used at the various study levels.

A broad view on 'research integrity' supports the inclusiveness of the competence profile

In discussions on research integrity, we encounter a lot of definitions and concepts, and at times it can be confusing to put them all in place. For the purpose of this project, which includes target groups from high school students to early career researchers, we decided that more traditional distinctions between academic integrity (AI) and research integrity (RI) or scientific integrity (SI) are less relevant. Instead we will use the concept of research integrity in such a way that it covers all activities and questions that rise in contexts of research projects and that lead to integrity dilemmas. Thus, these include free riding issues, or conflicts of interests as well as issues about supervision and collaboration.

This supports the inclusive character of the competence profile. When talking about research integrity, a high school student might not feel initially addressed, yet in the concrete cases that we use, they are included. For example, we think that at upper high school levels the experiences of doing your own project, working in groups, or learning how to write a good paper are first steps towards conducting research in higher education. The same goes for undergraduate students, who may not conduct independent research yet, but are introduced to how to use research cycles and will have experiences in how to use literature, and in how to analyse and report on data.

[6] In the guide above, we offer some examples of how teachers could use the competences in teaching RCR to pupils, students and researchers.

Key ingredients: empowerment and 'grey areas'

Empowerment

Empowerment towards responsible conduct of research is the leading concept underlying this competence profile. What kind of things do students need to learn, know, and be able to do, and what kind of attitude and behaviour do we expect to see in practice so that they can live up to expectations that we currently have in the academy? The perspective of this competency profile is a positive and pro-active one. It is positive in that it is not so much about what you are expected to avoid or not to get involved in (like plagiarizing, falsifying data or committing fraud), but rather about learning how to do it right. It is pro-active in that it helps students to become knowledgeable, to become aware, skilled to recognize, address, discuss and deal with issues that are integrity related and to equip them with the tools, knowledge, skills that are necessary to do it right.

Empowerment also stimulates a reflective attitude on integrity issues. Notice that by taking this focus, rather than aiming primarily at classic FFP cases,[7] we deliberately broaden the scope towards daily life issues in research projects and practices that require attention, cases that are not always immediately right or wrong (like order of authorship, or conflicts of interests). Yet, all these cases share that they are inherent to doing research. We focus, in other words, on grey areas (see below).

In our search to define empowerment we came across empowerment educational literature, that characterizes empowerment as developing a critical autonomy, learning to take responsibility and developing an attitude of 'feeling up to' addressing (integrity) issues in practice. For example, if a group member free rides on an assignment, a student should feel up to addressing this, and the overlap with the nature of the dilemma with addressing guest or ghost authorship when preparing a manuscript is striking. Feeling up to address issues requires a bit of courage, both for a high school student and a PhD candidate or senior researcher. Empowerment also refers to developing a critical autonomy. Lawson describes critical autonomy as 'the ability to think for oneself, the ability to use theory as a guide to action, and, crucially, the ability to evaluate the circumstances of one's life, including the structural forces

[7] FFP: Fabrication, Falsification, Plagiarism.

that surround us.'[8] If we apply this to the context of research integrity, we detect the relevance of self-awareness and reflection (being able to think for oneself), the relevance of deliberations leading to action (in cases of integrity), and the urgency of being able to determine what this will imply for oneself, given the fact that one is embedded in an institutional context. Research integrity issues cannot be changed singlehandedly, and quite often, individual researchers will feel like whistle-blowers when bringing up issues in practice. Therefore, realizing that one's contribution can be modest, while the collective effort will have impact, is a highly relevant aspect of empowerment. Empowerment is about the interaction between individual, group, and system/society.

That said, this competence profile focuses on those competences that are specifically contributing towards the empowerment of students in RCR. We do think, however, that reflection on the potential impact of research culture and institutional settings on RCR are important aspects to cover in RCR education. For instance, having students reflect on the actual research culture and institutional setting in which they have to do their research, provides opportunities to empower students in relation to these contributing factors as well. Also, it prevents over-individualising RCR.

Grey areas

A similar debate like on the concepts of integrity we encounter in defining the types of issues that we want to include when talking about research integrity. To us, the most relevant cases are those dilemmas or situations that (each) researcher encounters and that require reflection and action. The cases that 'bother' people in research practices are usually not the traditional FFP type of cases, which are often clear-cut cases of wrongdoing. Rather, there are many situations that have become common practice in daily life and that can be disputed. These are the grey areas. Do you take the suggestion of a reviewer to include a certain reference, if this could be a reference to the own work of the reviewer (with the intention to be cited more often?) and do you follow up on the request of your supervisor, even if you

[8] Tony Lawson. Empowerment in education: liberation, governance or a distraction. A review. Power and Education, Vol 2 nu 2, 2011 (89-103)

and your colleague think that this is not the best way to analyse your data? Or how do you go about if a colleague is unwilling to share her data with you?

We purposely use the notion of grey area and try to avoid the use of notions like questionable research practice (QRP) or detrimental research practice (DRP) even though these are quite common in the literature on research integrity. Why? Because this is already taking a negative attitude towards issues that occur in practice and we are focusing on how to do things right. It is not immediately wrong if you feel unhappy about the order of authorship in a publication and do not dare to address it. You are not 'on the wrong track' if you encounter a situation, nor do we assume that researchers are all potential wrongdoers. Things happen, often without being aware of it (you just 'go with the flow'). Therefore, students have to learn how to discuss these issues, and this requires awareness, understanding, skills and a certain attitude to dare to address it.

It is exactly because so many situations have aspects of integrity inherent to the situation, that it is better to learn to recognize and address these issues in practice, and to try to act in the right way, instead of only focusing on the wrongdoers. Learning that responsible conduct or research is or should be the default position for researchers is not helped by only hearing about cases of misconduct. Focusing on the commonality of many situations in practice and helping them to start asking questions and to become transparent about choices, decisions and routines in research might be a better way.

Appendix D.4.1.b

Taxonomy

1 Introduction

This document is part of deliverable D4.1 (Standard). Deliverable 4.1 consists of three parts: a process description with definitions and distinctions (D4.1.1) that have led to a competence profile (D4.1.2) and an underlying taxonomy (D4.1.3). The taxonomy is based on the data that were collected in WP2 and WP3.

1.1 Characteristics of the taxonomy

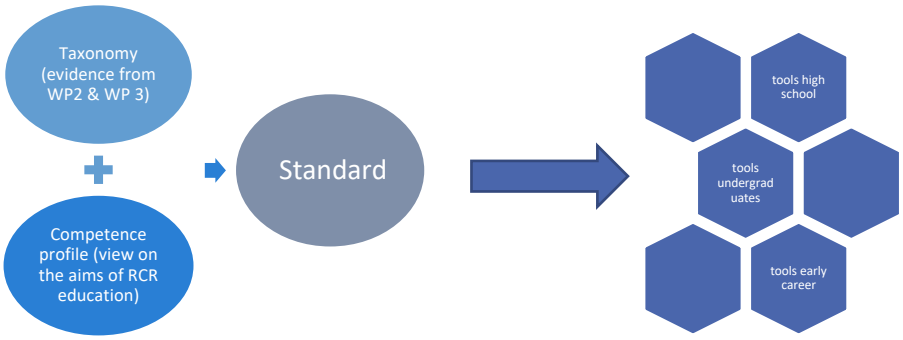
We indicated in the task description that we would provide 'a taxonomy of topics that are relevant and meaningful for each study phase, based on the findings in WP2 and WP3'. We aim to reveal blind spots in teachings on research integrity and distinguish for each target group (high school students, undergraduate students, early career researchers) what needs are found regarding RCR education. The taxonomy can help to decide what topics to focus on when developing educational tools.

Knowing what needs and blind spots exist in RCR education is crucial to develop education that can truly empower students towards RCR. For instance, knowing what students need (also from *their* perspective) to be able to recognize and deal with potential RCR challenges, is an important piece of the puzzle in that it highlights what may need extra attention in RCR education.

Our view on empowerment, together with a picture of needs and blind spots in RCR education, will help to determine what learning aims to focus on (e.g., awareness, reflection, and decision-making capacities) and which training activities seem most promising in order to help students achieve these aims. For that purpose, we have developed a competence profile.

The taxonomy and the competence profile complement each other. The competence profile offers a view on the aims of RCR education (including competences that every good researcher should have). The taxonomy, in turn, shows what evidence we found that can support working towards these aims and can help teachers and educational developers both in the H2020 INTEGRITY context and beyond the scope of our project, to decide which topics to address for which target groups. Together, the competence profile and the taxonomy form a standard. Figure 1 shows the relation between the three parts of this deliverable.

Figure 1: Connection between taxonomy, competency profile, and standard



For the developers in the H2020INTEGRITY project the Standard (i.e. the taxonomy and the competence profile) are background documents to support the design, development and testing of innovative tools for high school students, undergraduate students, and early career researchers. The ambition, however, is that the Standard is helpful for *anyone* involved in developing education for RCR.

1.2 Input for the taxonomy

Three sources were used as input for the taxonomy:

1. A survey that is part of WP2. The survey is and has been distributed amongst upper level high school students, undergraduate students and PhD students in 9 European countries. The survey makes inquiries about their knowledge and needs with regards to research integrity. Due to the Covid-19 pandemic, the survey has been delayed, and at the time of writing the recruitment has not been completed. There is an interim report of the WP2 survey results,

though, and we have used the interim report as input for the taxonomy. The taxonomy will be adjusted at a later stage and the renewed version will be made available via the website of the H2020Integrity project. A study with qualitative interviews was conducted as input for the survey. Where relevant data from the qualitative interviews are mentioned separately.

2. An exploratory survey that was part of WP3 (D3.2). The focus of this survey was teachers of research integrity in Europe. They were asked to inform us about their educational activities and experiences related to RCR. 98 respondents from 21 European countries responded to this survey.

3. A Quality Checklist for RCR education (prototype) (D3.4) that was also part of WP3. It is based on a literature review (11 meta reviews) on the effectiveness (impact) of RCR education in practice. The Quality Checklist contains insights into what could contribute to the efficacy of RCR education.

1.3 Outline

In the next sections, we will first provide more information on the set-up of the surveys and the Quality Checklist for RCR education (Section 2). Subsequently, Section 3 describes and analyzes the findings of the sources mentioned above. Section 4, finally, relates the taxonomy to the competence profile and offers suggestions for how to use the taxonomy when developing educational tools.

2. How the results from WP2 and WP3 complement each other

Combining the evidence that we collected in the surveys (WP2 and WP3) with the results of the literature review (WP3), generates useful perspectives on which needs, blind spots and topics should or could be focused on in RCR education. This is because they combine the student perspective (WP2 survey), the teacher perspective (WP3 survey), and info on what is known about what contributes to the efficacy of RCR education (the Quality Checklist from WP3). Below, we briefly describe the set-up of the surveys and the literature review. The content will be discussed in Section 3.

Student perspective

The survey in WP2 explicitly takes the student perspective. It is an anonymous survey in which students from upper high school levels (mostly 16+), undergraduate students and PhD students are asked about

their knowledge and needs regarding research integrity education. Specifically, the survey maps what students know about standards in relation to drawing on the work of others, in relation to collaboration and authorship, and in relation to collection, analysis and presentation of data. In preparation of the survey a qualitative study among 72 students and early career researchers in three countries (Denmark, Hungary and Ireland) was conducted to get an impression of the kind of integrity issues that students in the three target groups recognize and struggle with, and of how they are inclined to reason about integrity issues. The qualitative interviews offer a more in-depth perspective next to the survey results.

Recruiting students from 9 European countries (Denmark, Germany, Hungary, Ireland, Lithuania, the Netherlands, Portugal, Slovenia, and Switzerland) and aiming for a response of 6.000 students, we aim to obtain a representative picture of student needs throughout the EEA. This will ensure that the educational tools that we develop meet the needs of students in multiple countries.

At the time of writing we are still collecting data, as the Covid-19 pandemic made recruitment quite difficult in several countries. Hence, we postponed the recruitment a couple of months. For this version of the taxonomy, we therefore work with the preliminary results of the WP2 survey, an interim report that is based on a response of 2.321 respondents.[9] The interim report is based on data from six countries: Denmark, Hungary, Ireland, the Netherlands, Portugal, and Switzerland. The data pertaining to high school students is to date solely based on Swiss results (both French and German speaking). Six countries have contributed to the interim analyses of the data pertaining to undergraduate students and early career researchers. Thus, findings of this survey are still provisional and will be finalized as soon as possible after the survey is closed (Nov 1, 2020).

Teacher perspective

The survey in WP3 takes the teachers' perspective. In the Spring of 2019, an anonymous survey was composed with the aim of inquiring about the current status quo in teaching research integrity in Europe. We received 98 responses from 21 countries in Europe. It was an exploratory study, trying to gain insight into frequently used taught topics, teaching methods, hours spent on the courses and self-reported needs and blind spots. The questions were structured into the following categories: a) Features of students; b) Features of the course or lesson; c) Teaching goals; d) Principles and values; e) Topics; f)

[9] The interim report has been made by the coordinating partners of WP2 at UCPH.

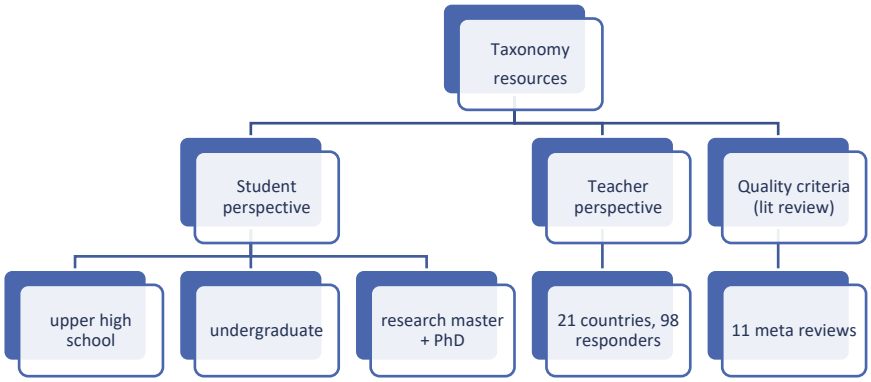
Teaching methods; g) Material used; h) Teaching outcomes and assessment; and i) Teachers background information. The survey offers a valuable insight into the perspectives of teachers working in a variety of European countries, and into the needs and blind spots that they detect.

Literature on effectiveness of RCR education

We also undertook a literature review in WP3 to get an overview of characteristics that play a role in effective research integrity education. The focus was on publications on RCR education in the period 1998-2018. For the Quality Checklist for RCR education (D3.4) that we developed, we decided to mainly base the checklist on 11 meta reviews that have been published in this period. The Quality Checklist offers a third perspective, next to teacher and student views, one that is focused on the effectiveness (the impact) of RCR courses.

Figure 2 below gives an overview of the types of information that the taxonomy is composed of.

Figure 2: Composition of the taxonomy



3 Results

This Section presents and analyzes some of the main findings of the surveys from WP2 and WP3 and the Quality Checklist. The analysis is categorized as follows. First, we present some general findings.

Next, we will discuss for a number of topics that we found across the recourses the findings for different target groups. Then, we will address specific needs that have been indicated in the various sources and lastly, we will shortly discuss possible blind spots.

A General findings

Target groups: importantly, we could find abundant information on some target groups and hardly any on other target groups. The literature mainly seems to focus on early career researchers, while there is a lacuna on RCR education aiming at high school students. This does not necessarily imply that integrity issues are not being taught at high schools, as it is also possible that integrity training in high schools is either not framed in terms of RCR or that there is no tradition yet of reporting these trainings in the literature. This finding from the literature review is consistent with the survey in WP3: none of the participating teachers reports teaching at high school levels. The survey in WP3 showed an overrepresentation of courses that target PhD students (64%), and the Quality Checklist confirms that mostly PhD or early career researchers are targeted with RCR education. That said, results from the meta reviews included in the Quality Checklist also suggest that there may not be (statistically) significant differences between the efficacy of RCR education on the one hand, and the study level of participants on the other. One caveat is that the meta reviews almost exclusively do not contain information on the efficacy of RCR courses for high school students. The survey in WP2 does inquire about any previous courses in ethics that students might have taken (for instance, in high school), but these results are not final yet.[10]

We also found that certain disciplines are better represented in the field of RCR education than others. There is mainly a lot of information (e.g., guidelines, and teaching manuals) available on RCR courses in the natural sciences and life sciences. The survey in WP3 confirmed that there is an overrepresentation

[10] Note that the focus of the survey is not on evaluating the efficacy of RCR education. More information on what contributes to the efficacy of RCR education for, e.g., high school students will be gathered from testing the tools for different target groups, that are developed as part of WP4.

of RCR courses targeting natural sciences and life sciences and that (as a result) other disciplines might be overlooked. In the literature review, we noticed a similar focus on the natural and life sciences, although business ethics studies are also more frequently addressed. As a result, other disciplines might be overlooked. This is particularly relevant because, as the Quality Checklist shows, there may be differences as to what contributes to effective RCR education between scientific disciplines. In the survey in WP2, we specifically address all disciplines, in order to find more information on often neglected fields of study.

Knowledge and needs

The interim results of WP2 suggest that students generally believe they know how to act ethically in relation to several topics in research integrity. This could have implications for teaching, as students who already think they know how to behave responsibly might be less motivated to actively engage in integrity courses. At the same time, there is also a general finding that many students have experienced 'situations of doubt' in the last 12 months. Showing and discussing these doubts more openly in educational situations could help to motivate students to engage in courses. Moreover, on specific topics the WP2 survey (interim) results show that students can overestimate their capacities to behave ethically and their knowledge about integrity. The Quality Checklist contains several insights pertaining to factors that may hinder ethical decision-making. These insights would seem to apply even in cases that we think we know how to behave ethically and responsibly. For instance, the Checklist shows that it is generally more effective to cover reasoning errors that hinder ethical decision-making, than to not cover these. In addition to reasoning errors, potential biases can also hinder ethical-decision-making, even if we think we know how to behave responsibly. The Checklist shows that addressing (potential) personal biases generally has a positive effect on ethical decision-making. Paying attention to (potential) group biases, finally, is among the topics with the largest positive effects.

Effectiveness. The Quality Checklist shows how the overall effectiveness of RCR trainings has developed over time. For instance, it shows a small positive effect in studies on efficacy done before 2007, and a moderate positive effect in studies done after 2007. Moderate effectiveness was also found for RCR courses in engineering and biomedical sciences, while there was (on average) a decrease in effectiveness for courses that are taught in the social sciences, and a decline with regard to behavioral and decision-making outcomes in business ethics (in all cases > 2007). In the WP3 survey, when asked how to improve

the efficacy of teaching, teachers answered that the most efficient method is to use case studies in combination with discussion. Other methods that stimulate quality and efficacy according to them are role-playing, individual and group presentations, and various online tools and videos. The Quality Checklist confirms that consistent positive results have been found for, among other things, case-based activities,[11] computer-based classes, as well as for debates, discussions, role-plays, and self-reflection.

B Topics

Plagiarism

A general finding in the interim report of WP2 is that students in high schools and the undergraduate study phase think they have a good understanding of research integrity in relation to plagiarism, yet find it also difficult to recognize cases of plagiarism in practice. Also, students find distinguishing between plagiarizing texts and plagiarizing ideas difficult at times, especially in high schools and in undergraduate study phases. Adressing this adequately in teaching seems, based on WP2 findings so far, necessary. The WP3 survey indicates that the topic of plagiarism is indeed quite frequently taught (3.92 on a 5-point scale). The Quality Checklist also shows that in multiple studies teaching about guidelines (like plagiarism) has positive effects, even though the size of these effects differs across studies. The findings in WP2, WP3 and the Quality Checklist do not necessarily contradict: it could well be that the students that responded in WP2 are currently not being taught in research integrity, and it could also be that the way plagiarism is dealt with in classes, could improve, so that students will not only know what plagiarism entails, but also how to recognize it and how to prevent it.

Conflicts between personal and scientific norms

While it is recognized and experienced, students show a reluctance to report academic dishonesty (including misconduct). However, students are more willing to report serious misconduct and

[11] The Quality Checklist contains a range of detailed insights into what contributes to effective case-based activities, and what are effective practice characteristics. For instance, effective case characteristics include cases of ≥ 2 paragraphs, and with low to moderate a) complexity, b) emotional content, and c) realism.

dishonesty that is harmful to themselves The interviews conducted as part of WP2 show three main reasons for this reluctance: a) Fear of negative consequences for themselves, b) feeling that they are not responsible for the actions of their peers, and c) a sense of loyalty to their friends and classmates.. Furthermore, the study shows that not reporting does not equal inaction. Students are often willing to assume a substantial responsibility for handling dishonesty peers, but prefer to confront the perpetrator personally rather than through official channels. The study shows that one important reason for this is that students perceive reporting as going against their personal norms of being a good friend. Furthermore, students experience conflicts between their personal norms of friendship and the norm of science in other contexts, for instance when it comes to collaborating on assignments that were supposed to be completed individually.

Collaboration

The interim results of WP2 show that free riding in group work is a relevant topic for high school students and undergraduates. For PhD students, the topic of collaboration was also relevant, especially in the context of appropriately assigning authorship, but also more broadly with regards to coping with or changing a research culture or structure. The Checklist includes the results of one meta review that examined the effects of different characteristics of RCR education simultaneously. According to this review, covering some types of guidelines shows a negative correlation with the *overall* efficacy of RCR education. Guidelines on collaboration are one example. Importantly, this does not rule out that paying attention to guidelines on collaboration can have positive effects. Indeed, it can empower students in specific respects, while at the same time showing a negative correlation with the overall efficacy of an RCR course. From a quality perspective, it can be important to accept a little less *overall* efficacy of an RCR course, e.g. when promoting collaboration is considered to be important.

Transgressing norms of good practice

In WP2 we investigated transgression of norms. Examples of norm transgressions are free-riding and accepting help when one is expected to do an assignment on one's own. Other examples are acknowledging someone as a co-author without that person having contributed sufficiently and presenting the data in a more positive way. Preliminary data indicated that transgression of norms could be more common among high school students and undergraduate students: these transgressions often concern free riding and accepting help from others. A large minority of Ph.D.-students has either

personally experienced or knows of someone who has experienced pressure to transgress norms of good practice, especially with regards to authorship. Furthermore, in some areas citations have been commodified. In the WP3 survey we did not ask specifically if misconduct was addressed as a topic. Regarding what topics to offer in courses, the Quality Checklist indicates that addressing (scientific) misconduct & FFP has moderate positive effects on the effectiveness of the course. The Quality Checklist does not contain specific information on the impact of addressing free riding and transgression of norms on the efficacy of an RCR course.

Theories and guidelines

The WP3 survey showed that amongst the topics least addressed in RCR education are ethical theories. Many trainings on research integrity are embedded in ethics courses that are offered in curricula, which explains the possible relation with ethical theories, to the extent that they *are* covered. The Quality Checklist can provide some guidance here. Not regarding whether or not to address ethical theory at all, but regarding what type of ethical reflection promotes the efficacy of a course. First, it shows that RCR courses that address ethical behaviors and ethical standards are generally more effective than courses that do not. Importantly, it also shows that courses that involve *idealized* ethics are generally less effective than course that do not. In practice, many courses will, instead of more abstract and idealizing ethical theories, address codes of conduct or e.g., regulations with regards to whistleblowing and maybe address the principles underlying codes of conduct, like Honesty, Reliability, Respect, and Accountability. This is consistent with the results from the Quality Checklist. The Checklist shows that addressing codes of conduct has positive effects in general. Moreover, it shows (in the context of business ethics) that a 'below average' and an 'above average' focus on guidelines has small positive effects on attitudes, and has moderate positive effects on behavioral and decision-making capacities (taken together). That said, the Checklist also shows that a high frequency of practice opportunities contributes strongly to the efficacy of an RCR course.

Data handling, data management

The Quality Checklist indicates that addressing topics of data management and data sharing in general has a moderate positive impact on participants learning. Addressing data integrity is shown to have a

large positive effect. Also, in the survey in WP2 the interim results show a need to become more knowledgeable and skilled on these topics. In the WP3 survey data handling and data management was not the most frequently addressed, nor the least addressed topic, hence it did not stand out as much as it did in the interim WP2 survey. Due to e.g. GDPR regulations and developments with regards to open science, data management is increasingly considered important. This could explain the needs that students express, while teachings might not address these issues sufficiently yet (as the WP3 survey explores the current status quo in teaching).

C Needs and blind spots

A general challenge concerning blind spots is that it can be difficult to determine what is overlooked. Still, based on the results of WP2 and WP3 we have a few indications a) that there are indeed blind spots in RCR education, and b) of what they are. Blind spots intertwine with needs where we focus on what is *lacking*.[12] In this project we are interested in what lacuna's can be filled in RCR education. Therefore, we will present the needs and blind spots as one group.

In the WP3 survey, teaching staff was explicitly asked about blind spots in their teaching. They reported a need for more practically oriented teaching instead of purely abstract/theoretical courses on RCR (like lectures) and referred to the need to discuss real-life examples with students. This is supported by the Quality Checklist, that shows that courses which are case-based are generally more effective than courses that are primarily lecture-based. Several respondents to the WP3 survey indicated the need to address grey areas instead of clear cases of misconduct. The non-mandatory nature of courses was also considered problematic by a majority. And while the Quality Checklist shows that courses where participation is mandatory are generally *less* effective than courses where participation is voluntary, it is important to note that this is most likely because participants who voluntarily sign up for an RCR course

[12] A blind spot could be seen as a need, a lacuna that can and/or should be filled. A need, on the other hand, is not always a blind spot, if it is clear what is lacking. Luckily, we can set this complexity aside (at least for the moment).

are already motivated for RCR. Hence, this could provide reasons to consider mandatory courses anyway. Respondents to the WP3 survey also indicated that topics that are poorly addressed include: whistle blower protocols, methodological issues, conflicts of interest, data analysis & data management, and social responsibility of scientists. Lastly, that online tools are not used much was also considered a blind spot. The Quality Checklist provides insights into the impact of addressing all these topics. For instance, it shows that blended or hybrid courses, with a combination of face-to-face and online activities are generally more effective than courses with exclusive face-to-face activities and more effective than courses with online activities only.

The WP2 interim results and interviews show a need amongst high school students with regards to data handling and analysis, while they are often not taught about these topics. This could be considered as a clear lacuna, if they are expected to show such capacities in school projects (and upon entering higher education). A similar possible lacuna on handling of data is found amongst undergraduate students (with the exception of the humanities and social sciences). High school students and undergraduate students feel less confident about their knowledge and skills with regards to data handling. Also, at the PhD level the collection, analysis and presentation of data seems a need, next to data management. In particular, a need is expressed by PhD students with regards to the question how to keep adequate records and safeguard the quality and integrity of data.

On the question what needs they see themselves, the answers for high school students were mostly on collecting, analyzing and presenting data, on drawing on others work and on working with others (collaboration); for undergraduate students the highest score is for drawing on the work of others, followed by collecting, analyzing and presenting data and on guidelines on research integrity; for PhD students the highest score was clearly also on the topic of drawing on other people's work, followed by collecting, analyzing and presenting data.

With regards to specific disciplines we see a difference in the handling of data between the Humanities & Social Sciences compared to other disciplines. That could imply that handling of data should be more explicitly addressed in many disciplines but might be sufficiently touched upon in the Humanities and Social Sciences. This, however, needs to be checked with the final results of the WP 2 surevey. Also, it is interesting to observe from the WP 2 interviews that in computer sciences using open source data is quite common and that views on sharing data differ from other disicplines. This finding is still preliminary and needs to be checked with the WP 2 survey results.

4. Combining the taxonomy with the competence profile

Even though we have been able to present the status quo regarding student perspectives, teacher perspectives and the debates in the literature, it remains a partial picture that we have brought together. For example, the survey in WP2 focuses on three core topics in research integrity, and hence, not on other topics. The survey in WP3, in turn, is an exploratory study based and does not allow for general conclusions about all RCR teaching in Europe, also because some countries were clearly overrepresented. Also, no teachers who are involved in teaching RCR in high schools participated in the WP3 survey. Finally, the Quality Checklist presents the results from 11 meta reviews with their own specific focus, for instance a selection of scientific disciplines, and no conclusions on the efficacy of RCR education for high school students. This sets limits to the possibility of providing a 'super table' with a complete list of clear-cut needs and blind spots for the different target groups focused on in this project: high school students, undergraduate students and early career researchers.

That said, partial pictures can be very helpful. Indeed, we think that valuable insights are given in this taxonomy. By combining results of these various sources, we see data from one source confirmed, denied, explained or complemented by other sources and we gain a broader picture of the topics and needs that RCR trainings could address. In Section 3 we have given several examples of how insights from the WP2 and WP3 surveys can be combined with insights from the Quality checklist. That way, users of this taxonomy are supported in thinking constructively about what could be done to address needs and blind spots in RCR education, in such a way that it contributes as much as possible to the efficacy of that education.

How to use the taxonomy?

The findings in this document indicate the topics to address, at least from the perspective of the needs of teachers and students. Where we found overlap between sources, we see a convincing reason to address these topics in RCR courses. While the examples given are not exhaustive, they should give readers a good sense and adequate direction for more detailed reflection on how to utilize the insights from WP2 and WP3 for the purposes of relevant and effective RCR education in their own institutional setting. When we combine these topics and insights with the competence profile, we can also determine the perspective we should take on these topics. If students e.g., lack knowledge and skills on data

handling and data analysis, the competence profile helps us ask the question 'how will we empower students at level x and in discipline y best'? Simply offering an instruction what is expected, does not invite the student to become self-reflective of issues that are relevant from an integrity perspective, hence we need to determine what is relevant for them to know how to safeguard the integrity of their data, how to store data when personal information of respondents is involved and why that is important if you want to conduct research in a responsible manner. In the competence profile, we offer a few examples how the more abstract competences can be translated into concrete contexts for the different target groups of students that we include in this project. It is up to teachers and educational developers to bring together insights from this taxonomy with the competence profile and utilize these in their educational programs. The H2020INTEGRITY team will work with these findings in developing innovative educational tools and offer teacher manuals so that individual teachers can further benefit from our efforts to bring topics, needs