

SUMMARY of INTEGRITY Horizon2020

1. Excellence

INTEGRITY: empowering students through evidence-based, scaffolded learning of Responsible Conduct in Research (RCR)

Current approaches to teaching research ethics and integrity are insufficient to deal with the complex and changing world of research and its impacts. **INTEGRITY's approach combines high quality training** in research integrity with innovative modes of engagement. INTEGRITY will bring ethics alive, equipping the next generation of researchers with the capabilities to conduct research in a responsible manner and to address new and unforeseen research challenges. INTEGRITY has 11 partners who design new tools and deliver ethics testing in 8 countries.

For more than a decade, research integrity has received increasing attention. Issues of fraud, falsification and plagiarism (FFP) are much discussed in research institutions as well as amongst citizens, where cases of misconduct have become a major source of public concern about the power and influence of science in society. It has inspired national and international Codes of Conduct, and the appointment of Integrity Officers within university settings. However, as demonstrated in Figure 1, research integrity issues go far beyond FFP. Research integrity training therefore requires an ambitious scope and a dynamic methodology so that future researchers are positioned to identify, interrogate and resolve the ethical questions they will encounter through their lifetimes.

Research excellence and research integrity necessarily go hand in hand and the cultivation of future excellent researchers begins with early investment in training students at all educational stages and in all research areas. Focusing on education for early career researchers only is insufficient to tackle research integrity issues. Rather it needs to start at high schools when students first encounter (research) integrity questions. It must continue during the undergraduate phase and then to the early research career stage. This recognition is also to be found in SwafS 02-2018 and is strongly endorsed herein. Concerns that this approach may elide different issues,

Co-authoring or Not?

A Research Master student works with a research team on an ERC granted research. The professor asked her to do a background study on a specific topic. She is very pleased with the results and mentions: 'I can certainly use much of this text for the chapter that I am supposed to write'. The RM student is pleased that the professor is happy, but hesitates to ask what will be done with her work, as she apparently will not be asked to co-author that chapter. She asks for advice.

Destroying an Archive?

An oral history archive containing interviews with ex- combatants from the IRA in Northern Ireland is held at Boston College. The Police Force of Northern Ireland are seeking access to the data to corroborate information they already hold in respect of the commission of serious crimes. It is believed that individuals interviewed confessed to killing during the oral history project. The researchers want the archive to be destroyed. Should it be?

Use Big Data or Not?

A PhD is part of a research team doing research on populism and elections in three countries. As part of the design of their studies, they want to conduct a search of tweets, blogs and chats and do some searches on Facebook pages as well to see how populism is used in social media. Someone raises the question if it is allowed to gather and use data that is publicly available. Apparently, some RM students already did some scraping on the internet, and the data are ready to use.

Retractions as misconduct

At a class on research integrity, a student learns about the increased number of retractions of journal articles. She is surprised by the number and concludes that a lot of sloppy science exists. Back at her lab, she hears that her supervisor has just retracted an article from a well-known high impact journal. He tells her that some data unintentionally were wrongly interpreted. She knows him for being very precise and starts to doubt her previous conclusion. Can retractions be the result of careful research as well?

Figure 1 Research Integrity Challenges

namely *academic integrity*, *scientific integrity* and *research integrity*, are unfounded. INTEGRITY is confident that its teaching philosophy (which engages these overlaps, rather than separating them) is more compelling because it facilitates the development of a scaffolded approach that empowers students for responsible research. This teaching philosophy also drives the development of stage- appropriate and attractive educational tools to stimulate responsible research conduct (RCR) training across the different cohorts of students.

Our vision and approach: empowering students

INTEGRITY's vision and innovative approach aims to empower students in responsible research instead of seeking compliance. INTEGRITY will use the concept of RCR to build a teaching philosophy that underpins comprehensive research integrity training. RCR will of course incorporate the conventional concerns of FFP and questionable research practices (QRC). However, the orientation is new and different: the primary goal is **the empowerment of students**. This is vital and innovative because today's students will encounter ethical dilemmas that current practice cannot yet see, so students must be able to anticipate what research integrity will entail in the future. This empowerment will be accomplished *via* an interactive curriculum with new, compelling and effective tools that will be co- created with student groups. INTEGRITY will focus on key values in building programmes and tools, namely on Transparency, Honesty and Responsibility. It will complement this with innovative training and mentoring for influencers (teachers, senior researchers) and will experiment with nudging techniques for effectiveness. It is our deepest conviction that training RCR needs to be done in a scaffolded manner: capacity building will start at high school level, is will be furthered during the undergraduate phase and advanced during the early research career phase. Our programme will therefore focus on in three target groups: high school students, undergraduate students (BA) and early career researchers (RMA, and PhD). INTEGRITY will deploy training in formal, non-formal and informal contexts, recognising that each can be successful with different cohorts. Finally, INTEGRITY will explicitly cover the full range of scholarly disciplines, including computer sciences technical studies, social sciences and humanities.

We must train students to be able to anticipate what research integrity will entail in the future

INTEGRITY will innovate by:

- empowerment of students via an interactive curriculum with innovative, effective, co-created tools
- commitment to Responsible Conduct in Research incorporating FFP and QRC training
- focus on key values: Transparency, Honesty and Responsibility
- scaffolded approach – based on evidence about student need and effectiveness of approach
- three target groups of students: high school students, undergraduate students and early career researchers (including graduate students)
- innovative training and mentoring for key influencers, including teachers and senior researchers
- covering the full range of scholarly disciplines, including computer sciences, technical studies, social sciences and humanities
- proven effectiveness of newly developed tools
- experimental methodologies and nudging techniques to further effectiveness
- focus on win-win – integrity and good science go hand in hand
- Effective dissemination to teachers and senior research staff

INTEGRITY will adopt an evidence-based approach. It will develop a survey tool that will

identify and map the needs, knowledge gaps and expectations of students in their respective study phases with regards to good science and research integrity. Instead of offering uniform training to students at all levels, we take a heterogenic and multidisciplinary approach from the outset. Based on a further mapping of existing tools, programmes and literature on teaching research integrity, we will also develop an assessment tool that will help determine the effectiveness of educational programmes. This tool will be used to assess existing educational initiatives, as well as assisting in the design and development of effective new tools.

INTEGRITY's contribution to address the current lacunae

- There is a **lack of a general (European) guidelines on *how* to teach research integrity**¹ Teachers adopt different approaches;² the levels of engagement vary from none, to optional, to mandatory; the target groups varies; learning aims range from knowledge transfer to the stimulation of a virtuous

¹Committee on Responsible Science, 2017

²Steneck, NH, (2006) 'Fostering Integrity in Research: Definitions, Current Knowledge and Future Directions, Science and Engineering *Ethics*,12: 53-74.

attitude³. Only some universities have unilateral policies for all students throughout the faculties, as with our Consortium partner number 3 (see fig. 2)

Figure 2: University of Copenhagen example

The University of Copenhagen was the first university in Denmark to introduce RCR courses for all PhD students. The immediate cause of this was a scandal in 2010 involving Professor of Biomedicine Milena Penkowa and centred on alleged research misconduct dating back about 10 years. It led to criticisms and complaints alleging that senior management at the University and in the Faculty of Health and Medical Sciences had not responded in a timely and adequate manner to a number of warnings over the years (read more about this case in Chapter 3). Following the scandal, a number of initiatives were taken, first at the University of Copenhagen and later nationally, to prevent research misconduct and promote RCR. The first of these initiatives was to require courses in RCR for future researchers, i.e. PhD students. Due to national

guidelines, the requirements for RCR teaching have then been expanded to cover PhD supervisors and students at BA and Master's level.

- Although there are a number of different approaches to education in research integrity, all are fundamentally flawed in different respects. They either focus too much on compliance, are oriented exclusively towards questionable research practices (QPR), neglect grey areas, or focus on idealized behaviour that fails to take account of the impact of institutional cultures and power differentials. Instead, **INTEGRITY starts from the conviction that we need to build capacities of young researchers and help**

them learn to reflect and account for their actions.

- Well-known tools to educate research integrity often tend to focus on particular areas of research, like the life sciences. *The Lab*⁴, similar to *Integrity Factor*,

(see fig 3), an interactive video on misconduct in research, focuses obviously on laboratory contexts where pressure to publish and obtain grants is high. While in various universities the number of PhD students in the life sciences is indeed large, it is not the case that misconduct and research integrity are only relevant in particular research areas. A well-known case in the Netherlands showed that social sciences suffer from serious misconduct too, as social psychologist Diederik Stapel was found guilty of fraud⁵. In fields of engineering, computer sciences, natural sciences and humanities these issues arise as well and are easily overlooked in the bulk of literature on research integrity. **INTEGRITY will develop educational programmes and tools that align with a full range of research areas and will develop these in a tailor-made way.**

- **For many educational programmes we simply lack knowledge of how effective these are**⁶. We are in need of evidence-based programmes and tools to ensure that training programmes will actually help build capacities of students. INTEGRITY will approach the development of

Figure 3: The Lab

innovative tools in an evidence-based manner in two ways. It will inquire, *via* survey tools, what the actual needs and perspectives of students are in the different phases of their studies and their area of

³Dalal, 'Responding to Plagiarism Using Reflective Means', *International Journal for Educational Integrity*. 2015 11: 4 DOI 10.1007/s40979-015-0002-6

⁴ <https://ori.hhs.gov/thelab>

⁵ Stapel, D.(2014) 'Faking Science: A True Story of Academic Fraud', translated by Nicholas JL Brown: <http://beinspired.no/wp-content/uploads/2016/03/FakingScience-20141214.pdf>

⁶ Mumford, MD, Connelly, S. Steele, LM, (2016) 'Assessing the Effectiveness of RCR Education: Moving Forward by Looking Back', *The Office of Research Integrity Newsletter*, Vol 23 (3): 15-17

research and secondly, it will further develop assessment tools to measure the effects and effectiveness of educational programmes and tools.

Required competencies for the project

Taking our lead from best practice in RCR teaching, this Consortium is made up of experts in integrity education, from both a research and a practice perspective and who work in a broad geographical variety of European countries. The Consortium consists of leading educators in their respective universities (including companies like Elevate Health and Imcode), who are experienced in developing innovative tools for educational contexts. Partners have been involved in other European projects on research integrity (ENERI), science learning (SySTEM), and European wide initiatives to set standards for teaching on animal welfare and animal experiments throughout Europe (ANIMPACT). Consortium Partners are both experienced in developing tools for university students as well as for high school students and are skilled in public engagement on science, and citizen science. The expertise required for the successful implementation of this project involves skills in pedagogy, expertise in developing interactive tools, like games, e-courses and simulations, together with substantial knowledge of teaching philosophies in philosophy of science, ethics and research integrity.

- Objectives

INTEGRITY's innovations will be built on an evidence-base that captures the needs, perspectives and expectations of students at all levels with regards to RCR training, and that assesses the effectiveness of such training. So far there are no satisfactory metrics to measure the effectiveness of RCR training world-wide. INTEGRITY will address this. This evidence-base and the scaffolded philosophy it will support, will allow INTEGRITY to embody an inclusive view of teaching research integrity *via* teaching RCR. The RCR view that will be developed will take primary values in research integrity as its core, namely Transparency, Honesty and Responsibility, also described in the European Code of Conduct as Reliability, Honesty, Respect and Accountability. In order to maximize the likelihood of successful embedding of this training, special attention will be paid to the role of key influencers and senior staff, whose capacities as mentors and coaches in promoting research integrity has not, to date, been properly or fully addressed or utilized. In this way INTEGRITY will aim to refresh the institutional cultures of integrity and promote public trust in science by facilitating transparent, accountable, accessible, citizen- engaged discussions about the challenges of and prospects for research integrity in this dynamic environment.

INTEGRITY focuses on five main objectives. It will:

- develop an evidence-based analysis of student needs, blind-spots, and expectations regarding research integrity across 10 European countries
- map, categorize and analyse current teachings in research integrity to better detect and mitigate blind spots in teaching, and to help build tailor-made curricula for students in the whole range of research areas and in three levels of studies;
- develop a teaching philosophy on RCR that takes capacity building of students as its main aim, using three core values (Transparency, Honesty and Responsibility) and incorporating the 'QRP' approach and FFP topics;
- develop, test and disseminate innovative tools in an evidence-based, co-creative process, and design and test experimental nudges to prompt effectiveness;
- design, test and disseminate complementary tools for key influencers (teachers, senior researchers) to catalyse their roles as teachers, mentor and coaches;

O1 Develop an evidence-based analysis of student needs, blind-spots, and expectations regarding research integrity across 10 European countries

INTEGRITY's starting-point is students' perspectives on research integrity: their needs,

their deficits, their understandings of ethical research practice. Encompassing 10 countries, in WP2 INTEGRITY will develop and test a survey tool to analyse a wide range of (sub-)cultures in research and perspectives on research integrity. Several publications emphasize the different views on research integrity in European

universities⁷, while the European Code of Conduct aims to offer an overlapping consensus for all researchers working at universities throughout Europe. Through the survey these differences amongst research areas will be explicated. This analysis will form the evidence-platform for the development of innovative and effective tools and effective, tailored to the needs of students in their respective study phases. The diversity of Consortium Partners, reflects many different national research cultures from across Europe. Institutions are significantly different from each other in scale, in cultural background, in specialisations, in level of development of research cultures, international partnerships and levels of research integrity training. Thus together they are an excellent test-bed for these investigations and surveys.

O2 Map, categorize and assess current teachings in research integrity to better detect and mitigate blind-spots in teaching, and to build tailor-made curricula for students across the whole range of research areas and in three levels of studies.

The evidence-based approach to RCR training is further advanced through the mapping and categorization of current teaching practices in research integrity. This will help identify blind spots, e.g. of research areas where research integrity teaching is underdeveloped and differentiate between the various phases of studies. Innovative to INTEGRITY is that the current teaching programmes will not only be mapped, but also evaluated using criteria such as, for example, the evidence on insights of needs of students; different phases of studies; or differences in formal and informal learning with regards to research integrity. INTEGRITY will include an assessment of the effectiveness of current teaching programmes and tools in research integrity; if and how effectiveness is assessed and it will determine, based on the teaching philosophy, how RCR can be developed in a scaffolded manner in order to empower students. A prototype Tool for assessing RCR will be developed at the end of WP3.

The idea to involve these three target groups of students aligns with a view that academic integrity, scientific integrity, research integrity and research ethics have overlapping topics and educational aims, and that future researchers need to be equipped from the early acquaintance with research practices with capacities that will be stimulated throughout their further studies. We will further elaborate on this in section 3.

O3 Develop a teaching philosophy on RCR that takes capacity building of students as its main aim, using three core values (Transparency, Honesty and Responsibility)

INTEGRITY's teaching philosophy regards training in responsible conduct of research (RCR) to be a means of empowering students and stimulating virtuous behaviour. INTEGRITY will take Transparency, Honesty and Responsibility as core values to further develop a view on teaching RCR. It starts from research ethics, reflecting on how to interpret values for research practice and determine how these values can best be honoured and promoted. Using innovative pedagogies and tools, INTEGRITY's RCR will be all-encompassing, (incorporating both the current debates on QRP as well as FFP topics). The teaching philosophy will be built in an evidence-based manner, drawing on analysis of: the needs of students in different phases of their studies (WP2) and the effects of current teaching practices (WP3). These will be used to build a benchmark to develop and

test innovative teaching methods in WP 4. The ambition is to set a standard that can be used independent of the developed tools to build curricula in research integrity throughout Europe. Several Consortium Partners have been successful in doing this in the field of education in animal experimentation in the past as their standard has now been internationally widely embraced.

⁷Bonn, NA. Godelarche, S. Dierickx K. (2017) 'European Universities' Guidance on Research Integrity and Misconduct: Accessibility, Approaches, and Content', *Journal of Empirical Research on Human Research Ethics*, Vol 12 (1): 33-44.

O4 Develop, test and disseminate innovative tools in an evidence-based, co-creative process and design and test experimental nudges to prompt effectiveness

The evidence collected in WP 2 and WP3 will allow us to design **innovative and effective tools**. Key to this will be the development of tools in a **co-creative manner** together with high school students, undergraduate students and early career researchers. This will best guarantee that the tools developed will better meet their needs, will be attractive, useful and effective. RCR training programmes at the three phases of studies will be developed together with innovative and interactive tools that can also be used as stand-alone tools (to stimulate the use in faculties). The types of tools that we are currently considering include a Research Integrity Dilemma Tool, an Escape Room, Science Gallery activities (Exhibitions connected to Training Programmes), online topic modules (Small Private Online Courses) for early career researchers and a mentoring and coaching programme.

Comparable to the dilemma tool on animal welfare, a tool will be developed that shows the typical dilemmas regarding research integrity. Escape Rooms, such as The Situation Room (fig 4), are attractive methods to mimic the time pressure that many researchers often face in practice, and online topic modules will train early career researchers in a tailor-made way. All tools will fit in a scaffolded approach to RCR training, however the precise tools will depend on the co-creative process with students. The tools will be developed in WP4 and will also be tested, adjusted and retested in other Consortium partner countries. Moreover, this will be done in a co-creative manner, using infrastructures like the Ethics Lab (Dublin) and Science Galleries (Dublin and Copenhagen) to stimulate interactive learning processes, organising a Dragons-den type of event and ultimately a European Student Convention to share and present innovative educational programmes and tools on a European level. In WP 6, the innovative methods will even be taken one step further, namely by attempting to stimulate positive behaviour using nudging techniques. Experiments will be conducted to show if and how nudging can be useful in stimulating integrity in formal and informal educational settings.

In 2017 and 2018 Science Gallery Dublin (TCD) ran The Situation Room as part of their In Case of Emergency exhibition.

The Situation Room is a long-form, immersive game-like experience, in which visitors take on the role of a Government Council making choices about how to mitigate an impending catastrophe.

Participants elect a chairperson and then vote on how to react to unfolding crises (e.g. virus outbreaks with limited vaccines, super-volcano eruptions, water shortages). The outcome from each decision has ethical, social and scientific ramifications that affect each subsequent decision and the ultimate result.

Scenarios are theatrical but based on real scientific issues, which makes the format especially engaging for small groups, young people, and non-specialists.

The Situation Room provides a depth-on-demand experience for people to understand their priorities when faced with a crisis, and address in a more tangible way ethical, consequences associated with environmental, medical, digital and scientific risks.

Figure 4: The Situation Room

O5 Design, test and disseminate complementary tools for key influencers (teachers, senior researchers) to catalyse their roles as mentors and coaches

INTEGRITY will actively engage teachers, senior researchers, PIs and students throughout the project. INTEGRITY recognizes the crucial role that teachers, senior researchers, Lab leaders and others play in setting the research culture and promoting research integrity. Teachers in research integrity will be defined in a broad manner, and will engage influencers of formal and informal research cultures. In this context INTEGRITY will include senior staff in mentoring and coaching for research integrity. This will be disseminated to large numbers of researchers in WP5 and all Consortium Partners will organize events to stimulate this important process of engaging key, often overlooked players who set the tone within organisations.

- Concept and methodology; quality of the measures

1.2.1 Overall concept

INTEGRITY's approach is premised on the establishment of an evidence-base for effective education in research integrity. While education on research integrity has grown in recent years, much of the pedagogy and practice has driven by anecdote. INTEGRITY intends to remedy this with a two-pronged approach to establishing an evidence-base:

- WP2 will develop tools to provide a comprehensive assessment of the needs, knowledge gaps and expectations regarding good science and research integrity for each of the cohorts (high school students, undergraduates and early career researchers). The tools will be tested in the full range of research areas in 10 countries and deliver input to develop metrics to assess the effectiveness of educational programmes in RCR;
- WP3 will map the landscape of existing literature on teaching scientific integrity, in order to establish a comprehensive view of the current methods and tools that are in use, and on the basis of a literature review, to analyze the efficacy of the different methods and tools in order to categorize criteria for good practice in the teaching of research integrity.

Having produced an inventory of the needs (including knowledge gaps) of the various cohorts regarding their understanding the nature, importance and multiple requirements of research integrity (WP2), and completed the mapping and assessment of the current state-of-the-art regarding tools and approaches to teaching research integrity and their effectiveness (WP3) INTEGRITY will develop an international Standard for Research Integrity Education that

captures and embeds the expectations of the new Code of Conduct (WP4), and will complement the Standard with a Competency Profile and Taxonomy of topics distinguished according to appropriateness to each stage of learning. From this platform WP 4 will then focus on an ambitious programme of design, development, piloting and evaluation of innovative tools for teaching research integrity across a range of disciplines and age groups. It will employ a scaffolded approach, will take formal, non-formal and informal educational settings into account and will employ a co-creative methodology by engaging students in the design of tools for their peers. There will be a piloting phase where each tool will be tested and evaluated with a small group of students, followed by an adjustment phase.

Accompanying the development of innovative and effective tools for teaching research integrity is a complementary focus on the teachers who will be responsible for delivering these tools. WP 5 therefore will mirror the various stages of WP 4, involving a) developing of teaching modules for teachers to use innovative tools on RCR; b) stimulating the use of newly developed tools by offering train the teacher modules, and c) stimulating the use and embeddedness of the tools in university curricula. A crucial component of the INTEGRITY programme is the recognition of the central role that senior researchers play in setting the standard and tone for research integrity amongst their students and peers. The Train the Teacher WP therefore will also encompass mentoring and professional development, and use an online module to stimulate teachers to take this role, since these are vital strands in building cultures of research integrity.

Cognizant of the challenges associated with advancing and embedding research integrity through the research culture this project develops a final innovative step that aims at stimulating key actors, namely research leaders, PIs, teachers, students and researchers, to implement research integrity education in their curricula and to successfully complete their programmes and courses on research integrity. Thus, for the informal teaching settings, we will aim to develop creative solutions for implementing actionable changes, and will furthermore develop guidelines and interventions that will orient and encourage key actors towards research integrity. WP 6 therefore addresses the challenge that while identifying the needs in research ethics and developing the relevant teaching material are necessary steps in the promotion of research integrity, however they may not result in effective behavioural changes in respect of research integrity¹¹. In order to motivate students and researchers to become interested in and to abide to research integrity principles in their daily practice, further complementary actions may be needed. WP 6 introduces one of the most innovative of these complementary actions, namely nudging techniques, or nudges.

The inclusion of a 'nudging programme' to support the attainment of the objectives of the programme will provide a significant advancement of the state-of-the-art. In this project we will not only develop and test nudges that stimulate commitment and conformity with the teaching tools and that are appropriate for use in liberal democratic societies, but we will also test and evaluate these nudging tools in the phase of retesting the WP 4 tools. These will be evaluated in terms of the effects as shown in behaviour, using a controlled experiment with two groups, and measuring what students experienced, via questionnaires and interviews. In this way, not only will the project develop, pilot and evaluate innovative teaching tools, but it will also provide accompanying nudging techniques, that will also have been tested for their effectiveness, in order to address some of the well-understood limitations of traditional modes of teaching research integrity.

1.3.1.1 INTEGRITY's own approach

- *RCR as encompassing concept that drives empowerment*

Responsible conduct of research was first mentioned in the early 1990s and offered as a more encompassing view on good research practices. RCR has been developed since and is currently recognized as one of three approaches that is taken in teaching research integrity. The first is FFP oriented, mainly seeks the compliance of students and researchers and is concerned with conduct that may be criminal, or where the researcher may be liable; the second focuses on what has become known as the grey area of research questions (Questionable Research Practice), that

entails many of the daily

research dilemmas for which there are no criminal offences, and hence will rarely be reported. The third is RCR, focusing on the ideal situation of what good research entails. By now, RCR is regarded as a much more promising approach to encourage responsible behaviour, yet it is also still regarded at its infancy, and a great variety exists in its educational working methods, how it is embedded in curricula and what topics are addressed. INTEGRITY will develop a unique approach to RCR training, starting with a teaching philosophy that takes 'empowering students' as its core focus. Our approach is premised on the conviction that if the key to future quality research lies in building the capacities of researchers in research integrity as a core function of excellent science. As a result, we do not target RCR on a professional practice (research practice) or in a phase in one's academic career (starting e.g. as RM student or PhD). Rather the focus is on the question when capacity-building needs to start. INTEGRITY's view is that this must begin during high school, when students first get acquainted with research activities and academic thinking. Our focus on RCR is innovative, and needs to be supported with a **teaching philosophy**. The articulation of this teaching philosophy, will also be part of the project and will be developed together with pedagogical experts in the field (WP4). As a result, INTEGRITY therefore also explicitly seeks overlap with debates of **academic integrity and responsible research and innovation (RRI)**. Currently, these are often separated domains, but given our broad understanding of RCR this separation is not useful. Instead it is more promising to see how they overlap, where they complement each other and how each can constructively help build capacities of students. Even more, the aims of RCR as recently pointed out by the Committee on Responsible Science¹², shows that RCR and research ethics also show significant overlap. Therefore the methods, aims and approaches of research ethics are necessary ingredients of successful RCR training.

- *RCR development that is evidence-based*

A second characteristic of the unique approach of INTEGRITY is that we take an **evidence-based approach in two ways**. First, although there are numerous studies that investigate research integrity, its perspectives and practices of misconduct, so far there has hardly been little inquiry into the needs and perceptions scaffolded to the different stages of one's study phase. As a result, for the most part students are approached, inappropriately, as a homogenous group. Secondly, we will augment the evidence-base of this field in a significant way by contributing to knowledge about assessing the effectiveness of RCR training, including an evidence-based assessment of the effects of nudging in the use of our innovative tools.

- *Methodology*

In the various work packages, specific research methods will be used to optimize results. The survey tool in WP 2 will be developed using a mixed method approach that combines a literature review with both qualitative and quantitative empirical methods. INTEGRITY will develop a taxonomy of existing testing tools measuring the effect of ethics teaching. Based on preliminary literature and on-going qualitative research on student practice we hypothesize that the survey tools available today mainly come in the form of questionnaires or quizzes, where students are asked to report their view on certain practices or to assess whether or not examples of such practices constitute misconduct^{13,14}. These instruments are mainly designed to assess students' knowledge of ethical norms and values, but with the exception of Roig¹⁵ they do not expose the students to the difficult dilemmas and grey areas they will need to confront in their real-life practice. Furthermore, these tools are not designed to survey students' preconceptions of good scientific practice or students' understandings of central concepts like plagiarism, falsification and fabrication. Knowledge of this is absolutely central to this project's aim of developing student-centred teaching methods that provide a deep understanding of academic and research integrity and effective tools to navigate grey areas.

To support the development of the survey tools needed, we will first conduct an explorative qualitative investigation of the academic and scientific practice of the three different target groups. This will be based on observation and semi-structured interviews and include at least a

study of laboratory and other forms of data collection practice where relevant, as well as practices in relation to literature searches and literature studies. The aim of this research will be to identify the dilemmas that students and early career researchers face, and how they think about these. The understandings of good scientific practice and misconduct as well as the dilemmas faced are likely to vary within the three target groups across e.g. educational system, disciplines, cultural background and possibly also gender¹⁶. The explorative investigation will therefore be carried out in three different European countries selected to ensure that we capture as much diversity as possible.

This explorative research will be combined with the results from the existing research, mapped in WP3, and used in the development of a reliable package of survey tools that can be widely circulated. The aim of these tools will again be to map for each target group the preconceptions of good scientific practice and key concepts relating to questionable research practice and capture variance within each group across relevant parameters.

Once the tools have been developed and pilot tested they will be applied in a large study across Europe. More specifically we aim to distribute (translated versions of) the questionnaires to relevant populations in 10 European countries aiming to capture as much cultural and geographical diversity as possible.

In WP 3, INTEGRITY will map literature on teaching research integrity for three different groups. The literature will be reviewed in the period of 1990-2018, using the most frequently used databases for scholarly publications and using keywords that will include as many articles as possible on teaching research integrity. The data will be categorized according to a number of relevant criteria, including target groups, disciplines, aim and focus of the teaching tools, working method, evaluations and assessment of effects. At the same time, a mapping of current methods in teaching research integrity (including FFP, RCR and QRP) will be done using internet searches, network searches and an online questionnaire in each of the partner universities of INTEGRITY. It will help build an overview of 9 European countries. This overview will include the target groups of education in research integrity, whether this is mandatory or optional, what the content and focus of educational programs is, and what working methods are being used. It will also focus on possible instructions for teachers on how to teach research integrity. One of the results will be that we will, relating the findings to the European Code of Conduct, reveal current blind spots in teaching.

	Science Galleries
	Research Integrity Dilemma Tool
	Topic oriented SPOCS Mentoring and coaching tool
	Standard including teaching philosophy on RCR, Blended: Teaching modules for f2f contact complementary to innovative tools

Table 1.3: methods of delivery

WP 3 will develop a model for assessing effectiveness of RCR training. INTEGRITY adds to the current debate on effectiveness of RCR training¹⁷¹⁸¹⁹, by emphasizing that assessing the effectiveness is, just like the development and teaching of RCR, still at its infancy. A recent review by Mumford shows that there are modest indications that RCR training is effective, yet Antes & Dubois indicate clearly that in order to determine what counts as effective, we need to determine what goals RCR strives for and how these should be measured (long term, or course-based). INTEGRITY will, by developing a benchmark that is scalable for the relevant study phase, make it possible to develop a scalable approach to assessment of effectiveness as well; building a prototype view on assessment of the effectiveness is part of WP 3 and will be further

developed and piloted in WP4. The fact that knowledge how best to teach RCR is still developing, and that INTEGRITY will contribute to this in its own unique way, implies that determining how best to assess the effects is also fully developing. INTEGRITY will build on insights

¹⁶ Witmer, H. Johansson, J (2015) 'Disciplinary Action for Academic Dishonesty: Does the Student's Gender Matter?'

International Journal for Educational Integrity, 11: 6 DOI 10.1007/s40979-015-0006-2

¹⁷ National Academies of Sciences, Engineering, and Medicine; Policy and Global Affairs; Committee on Science, Engineering, Medicine, and Public Policy; Committee on Responsible Science, (2017) op.cit.

¹⁸ Antes, AL. DuBois, JM. (2014) 'Aligning Objectives and Assessment in Responsible Conduct of Research Instruction, *Journal of Microbiology & Biology Education*, 108-116.

¹⁹ Mumford, MD, Connelly, S. Steele, LM, (2016) op.cit.,

from the field of moral education, following broadly Kalichman and Mumford's conclusion that there are only a few basic goals of RCR education that could be assessed, namely, i) knowledge increase, ii) increased skills in ethical decision making, iii) improved attitudes and iv) improved behaviour²⁰. The latter is difficult to establish, even on a short-term course. INTEGRITY will use nudging techniques to see how, in informal settings, behaviour can be stimulated in a positive way, while in the field of formal education we will build on existing tools to develop an assessment tool that fits the aims of INTEGRITY, namely to teach RCR so that it empowers students. The NAS reports²¹ that blended tools seem most promising to show positive effects and that online tools that are not interactive, are most difficult to measure. It is fully in line with INTEGRITY to develop blended RCR training programs, using online interactive materials.

The methodology used to develop assessment tools is as follows: based on the data gained in WP 2 and WP3 we will combine this with an analysis of INTEGRITY's teaching philosophy on RCR, its objectives, aims and goals and working methods that will be developed in WP4 and develop an assessment protocol. This protocol will be operationalized in WP4, making use of knowledge of current tools, developing a new way to measure INTEGRITY's effectiveness in a scalable manner.

Work package 4 will develop tailor-made innovative tools in a co-creative process with three different groups of students. This way, we will ensure that the tools later developed, will more likely be recognized and embraced by end-users. We will develop the tools will be usable in a blended curriculum, since part of the pedagogical stance in INTEGRITY is that we may need online tools to reach sufficient numbers of students, but that we also need face to face (f2f) contact to teach RCR in a meaningful way. For high school students, we will involve an Ethics

Canvas²² method to involve students to help develop their own tools, which will be presented in a Dragon's Den type of event. The result will be a first prototype tool that then will be further developed. For undergraduate students an online tool 'Research Integrity Dilemma Tool' will be developed, inspired by the animal ethics dilemma²³ tool that was developed earlier. It will cover introductory issues as well as transitional issues by presenting students to realistic situations that occur in research practice. Additional learning modules will be designed to use in classes. For early career researchers hands-on knowledge is

mostly required, hence some online modules on specific topics will be developed. In this

phase it is also necessary to mentor and coach students towards responsible research; therefore a tool will be designed

Figure 5: Animal Ethics Dilemma

that will focus on this role specifically, using story-telling to help students internalize issues of RCR better. It is highly innovative to address the mentoring aspect of RCR via modules. All tools and modules will be piloted and tested, if necessary adjusted and retested. In WP 5 we will approach the teaching staff in their mentoring role, by developing online modules for them to simplify taking the mentoring role and use the method of diner-pensants (working dinners with reflective methodology) to stimulate this. Next to that, manuals and teaching modules will be developed that will be shared with teachers via workshops in each Consortium partner university.

In WP6 we will make use of nudging techniques to stimulate students to follow research integrity principles in practice (via informal education) and seek compliance with using the online developed tools (formal education). The methodology is to first organize a workshop in order to make an inventory of

²⁰ National Academies of Sciences, Engineering, and Medicine; Policy and Global Affairs; Committee on Science, Engineering, Medicine, and Public Policy; Committee on Responsible Science, (2017) op.cit.

²¹

²² <https://www.ethicscanvas.org/>

²³ www.aedilemma.net

promising nudges in RCR training with experts on nudging, and then develop the most promising nudges for both educational contexts. Using insights from the literature on nudging, we will select several nudge- types that have proven effective (e.g. 'commitment nudges', 'make it easy nudges', 'make it timely nudges') and use experiments to see if these nudges are effective in this context too. Among others, we plan to develop an 'easy-to-use' tool for asking 'commitment' from students before they start an online course, in order to motivate them to finish. For instance, a 'commitment nudge' will involve a research on the typology of commitments (verbal, written, communal etc.) and reported impacts of their use²⁴ and on the existing practical tools that may be used for asking commitment (paper-based, online program, etc.). Or a 'make it easy nudge' will involve identifying the most common periods of transition and the factors/events that are usually felt as disruptive, stressful, conflicting, during ordinary students' career; and it will also identify what events, environments, or state of knowledge contribute in making students receptive to research integrity topics (e.g. the outbreak of a scandal; the attribution of an integrity award). We will obviously take into account ethical issues on nudging techniques²⁵ and seek the advice of an Ethics Review Committee while developing the nudges.

A second type of nudges will focus on **informal educational settings**. We will select several nudge- types that have proven efficient in various contexts (e.g. 'make it timely nudges', 'make it easy nudges', 'conformity nudges') and develop a specific version of these nudging techniques in order to stimulate researchers and students to get involved in topics of research integrity and to behave with integrity in the informal school environment. The analysis of the experiments will together with the insights on most promising nudges be described in clear guidelines how and when to use nudges to stimulate RCR, and made available on the website.

3 Implementation

Overall structure of the work plan

INTEGRITY's activities will cover a period of three years. Its structure is clear and straightforward, as our approach itself is precise and targeted. The project activities will be organized in seven work packages (WP): the centrepieces are WPs 4 and 5. WP 4 designs, develops and tests innovative and effective tools for high school undergraduate and early career researchers, while WP 5 develops the complementary training for teachers, mentors and research leaders to embed research integrity in the various cultures of research. In WP 6 we experiment with nudging techniques to stimulate greater compliance and use of the tools, as well as to stimulate (discussion on) research integrity in the contexts of work and study. This experimental core is supported by two work packages (WPs 2 and 3) that provide the evidence base for the design of effective tools. The provide

Figure 6: Interaction of the Work Packages

an inventory of student needs and knowledge gaps across 10 countries (WP2) and map and assess the effectiveness of existing tools, WP 2 and WP3 will help build a teaching philosophy that is developed into a standard that will be used to design and develop tailor-made and scalable innovative learning tools for students at three levels. The management package (WP1) will guarantee optimum communication between partners and safeguard the project's progression, while WP 7 will optimize communication and dissemination of INTEGRITY's output.

3.1 Work plan – Work packages and deliverables

Table 3.2.1 Meeting schedule

Kick-off	1	1	UU
Annual meeting 1	1	12	VU
Annual meeting 2	1	24	UL (TEOF)
Annual meeting 3	1	36	IBMC
Ethics Lab experience co-creating with high school students	4	22	TCD
Workshop with early career researchers	4	22	UU
European Student Convention	4	28	TCD/UD
Train-teacher workshops	5	33	Each partner university one session
Diner-pensants	5	33	Each partner university
Nudging workshop	6	21	UNIGE

