COMPETENCY PROFILE FOR TEACHING AND LEARNING RESEARCH INTEGRITY

Jurij Selan
Mira Metljak
Sanja Berčnik
Mateja Dagarin Fojkar

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Participating institutions in the 'INTEGRITY' project: UNIVERSITEIT UTRECHT, project coordinator (Heidelberglaan 8, Utrecht, the Netherlands), UNIVERZITA KARLOVA (Ovocný trh 5/3, 11636, Praha 1, Czech Republic), UNIVERZA V LJUBLJANI (Kongresni trg 12, 1000 Ljubljana, Slovenia), ELEVATE BV (Heidelberglaan 8 – 4.17; 3584CS, Utrecht, The Netherlands), ACADEMIC INTEGRITY CONSULTING LTD (Dobson House, Regent Centre, Gosforth, Newcastle upon Tyne NE3 3PF United Kingdom).

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UNIVERZA V LJUBLJANI

Participating organisations

UNIVERSITEIT UTRECHT, UNIVERZITA KARLOVA, ELEVATE BV, Academic Integrity Consulting LTD

Utrecht University

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Introduction

Purpose and Background

Acting in accordance with the principles of research integrity is increasingly complex and challenging in contemporary science and research. Therefore, students at all levels of study (Bachelor (BA), Master (MA), and doctoral (PhD)) should develop the ability to do so and become 'streetwise' concerning research integrity. This competency profile provides a set of competencies to enable that.

'Streetwise' means that students are aware of what constitutes good conduct in research by learning how to recognise problematic situations, how to discuss these situations with their fellow students, and how to develop strategies for dealing with them. Doing so requires them to:

1. become competent in identifying problematic issues and dilemmas related to research integrity,
2. become aware of cultural differences related to research integrity among different disciplines, institutions, and countries,
3. learn to reflect on these issues and apply strategies that help them find solutions,
4. take responsibility for their actions and decisions in specific situations,
5. internalise certain values and dispositions, such as mindfulness, responsibility, and courage, that are necessary to meet the standards of honesty and integrity in conducting research.

Methodology

The profile was created via the following procedure. First, a list of possible sources was compiled, including various codes of conduct, policies on research integrity, and similar (see Sources and Resources section). After reviewing the sources, the categories of competencies in the profile were determined. Since most sources identify roughly the same categories with minor differences and subtleties, the goal was to create (collect, merge, or group) a cross-section and unified set of competencies that name all possible aspects of research integrity that one might encounter in various sources and literature. This was then underpinned by a thorough theoretical investigation (see Theoretical Background section). Once the overall structure of the competencies was established (see Model section), the behavioural indicators for them were defined and clustered into a competency rubric (see sections: Values and Principles, Research Practice, Publication and Dissemination, Violations) according to a set of basic assumptions (see Annotations below). As a final point, the extensive list of research integrity competencies was summarised into core learning objectives and outcomes for all study levels (see Objectives and Outcomes section).

Definitions

Competence

A combination of related knowledge, skills, and attitudes (KSA) that correlates with (contributes to or predicts) performance and is criterion-referenced (i.e., behaviourally related and observable so that it can be measured against specific criteria and accepted standards).

Behavioural Indicators

Descriptions of behaviours (Thoughts, Actions, Feelings (TAF) that correlate with Knowledge, Skills, Attitudes (KSA)) that demonstrate in a concrete, verifiable, and observable way that a student has acquired and is able to demonstrate a particular competency.

Competency Profile

A detailed compilation/description of the competencies and behavioural indicators necessary for successful performance related to research integrity.

Competency Rubric

A set of behavioural indicators of competencies divided and clustered by complexity.

Competency Model

A visualisation of the structure of fields and subfields in a competency profile.

Elements

The following elements are provided for each competency in a profile (see sections: Values and Principles, Research Practice, Publication and Dissemination, Violations): a name or label (indicating the competency described), a general definition (a brief description that provides a broad understanding of the type of behaviour expected of a competency), a brief explanation (of the content addressed in a competency), and behavioural indicators (specific TAFs indicating that an individual has acquired the KSA) clustered in competency rubrics by level of complexity, roughly corresponding to levels of study (BA, MA, PhD).

Annotations

When reading through the competency profile, the user must consider some implicit assumptions underlying it. These assumptions are not always explicitly stated in a particular competency/behavioural indicator, so a user of the profile should be implicitly aware of them when assessing the competencies/behavioural indicators:

Levels of Complexity

We speak of levels of complexity rather than levels of study because different educational environments have different expectations for students at different levels of study. For example, what the University of Ljubljana expects from an undergraduate student is not necessarily of the same complexity as what the University of Utrecht expects from its undergraduate students. Therefore, the proposal of levels set in the profile may correspond to study levels for some institutions but not others. The purpose of the profile is that each institution can uniquely 'build' the combination of indicators from different levels of complexity that fits its educational process. Clustering competencies by levels of complexity also suggests that the

behavioural indicators are progressive but not regressive. If an indicator is relevant to the basic level, it is also relevant to the intermediate and advanced levels; however, an indicator relevant to the advanced level may not be relevant to the basic and intermediate levels. Therefore, if an indicator is missing (marked with the symbol '/'), it means that either the competency is not relevant for this level or that an indicator from a previous level still applies.

Grey Areas

One of the most important aspects of becoming 'streetwise' is the ability to respond to situations that are not black and white (corresponding to blatant misconduct vs appropriate behaviour) but 'grey' (corresponding to questionable research practises). Various codes of conduct can guide students and researchers about blatant misconduct, particularly in relation to legally sanctioned practices such as fabrication, falsification, and plagiarism (FFP). However, there is a large grey area between right and wrong where things can be altered to suit different perspectives and where it is difficult to give unconditional answers; this is the area known as questionable research practises (QRP). Research integrity policies (national, institutional, etc.) set out principles and rules to distinguish appropriate conduct from blatant misconduct and to determine in a straightforward way what is (legally) permissible and what is not. In reality, however, researchers usually find themselves in 'grey' situations in which it is not immediately clear what is right or wrong, and in which they have to decide whether there is a risk of questionable research practises and determine how to avoid them - practises that, although not legally prohibited, may nevertheless undermine responsible conduct of research. Thus, researchers need to understand such 'grey' situations and acquire the ability to make integrity-enhancing decisions within them. They need to be able to recognise such situations, discuss them with their colleagues, and develop strategies for dealing with them. The profile incorporates the idea of 'grey areas' in two ways: first, by mentioning questionable research practises (QRP) in more detail in the profile (see Violations section); second, by also understanding the idea of levels of complexity as representing a progression from black and white situations to increasingly complex situations in which students are confronted with 'grey areas'. Although students may encounter 'grey areas' in their research practice at the BA level, they become increasingly important at the MA and PhD levels. Therefore, students should gradually develop, roughly in line with progression through the study levels, the ability to navigate 'grey areas' and make decisions when confronted with dilemmas in complex real-life situations.

From One's Domain to Other Domains

Research integrity practices vary among different academic fields, research disciplines, nations, cultures, and institutions. The competency profile takes this diversity into account in such a way that students develop competencies at the BA and MA levels in relation to their national, institutional, and professional environment and scholarly field, and gradually gain the ability to engage with practices from different environments and fields at the PhD level. Doctoral-level research often requires interaction with institutions and researchers from other research environments (including internationally), so PhD students need to understand possible differences in research practices.

From Knowledge to Actions

Each competency is defined by a triad of knowledge, skill, and attitude (KSA) and a triad of corresponding behavioural indicators (Thoughts, Feelings, Actions (TAF)). However, the gradual transition from black and white situations to 'grey areas' goes hand in hand with a progression from the acquisition of knowledge to the development of the ability to act and display the right attitude. Whereas black and white situations in research integrity require mainly knowledge (students need to know the rules, the do's and don'ts of research), grey zones require an attitude and a corresponding ability to act in difficult situations in which it is not enough to decide on the basis of rules. This situation also roughly corresponds to the progression within Bloom's taxonomy through six levels, divided into three groups: Knowledge and Understanding, Application and Analysis, Synthesis and Evaluation. To become 'streetwise' in terms of research integrity is to build self-confidence in behaving responsibly in research. To do this, a student must acquire the appropriate knowledge, skills, and attitudes. Since not all BA students will go on to the MA level and not all MA students will become PhD students, it is important to note that competency at any level of study requires the integration of all three elements (KSA); this is emphasised in a competency definition. Nevertheless, we can assume that the behavioural indicators for each competency progress from knowledge-based to attitudinal and skill-based competency indicators across levels of study, including on the basis of students' personal growth. Therefore, the competency rubric emphasises knowledge at the basic level and attitude and skill at the intermediate and advanced levels.

From Mentorship, Supervision to Autonomy and Independence

Progressing through the levels of complexity also requires a student to gradually develop the ability to act autonomously and independently in terms of research integrity in any given real-world situation. Acting autonomously means that a student is able to stand behind his or her values/actions and make free and uninfluenced ethical choices, and take responsibility for them. Acting independently on the other hand suggests that a student is able to solve an issue and work on his/her own, without mentorship and supervision. Therefore, when 'reading through' competencies across levels, one must keep in mind that at the basic and intermediate levels, competencies are acquired and tested under mentorship and supervision, and at the advanced level, students should eventually develop an ability to act autonomously and independently. This is not to say that when students become independent researchers, they should not consult others and discuss difficult questions, but, at the most advanced level, they should be able to take full responsibility for their actions and solve issues independently.

Theoretical Background

Research Integrity as Integral Part of Research

According to Böttcher and Thiel (2018), research competencies can be divided into five skills:

1. skills in reviewing the state of research, 2. methodological skills, 3. skills in reflecting on research findings, 4. communication skills and 5. content knowledge.

Hauser, Reuter, Gruber, and Mottok (2018) reconfigured these five skills into four factors that are particularly characteristic of research:

1. Content knowledge, 2. Methodological skills, 3. Evaluation and operationalisation of research, and 4. Ethical issues.

The US National Postdoctoral Association (NPA Core Competencies Committee, 2007-2009) also lists six core research competencies:

1. Discipline-specific conceptual knowledge; 2. Research skill development; 3. Communication skills; 4. Professionalism; 5. Leadership and management skills; 6. Responsible conduct of research (RCR).

Thus, research integrity (ethical issues or responsible conduct of research (RCR)) is not external to the research but is an integral part of the research. The US National Research Council also emphasises this in its report in the chapter 'Promoting Integrity in Research through Education' (2002):

> However, in this chapter, the committee argues that the provision of instruction in the responsible conduct of research derives from a premise fundamental to doing science: the responsible conduct of research is not distinct from research; on the contrary, competency in research entails responsible conduct and the capacity for ethical decision making. Indeed, the committee argues that integrity in research should be developed in the context of an overall research education program. (p. 84)

In its project 'OECD Future of Education and Skills 2030', the Organisation for Economic Co-operation and Development (2019, pp. 59-70) also emphasises the three crucial transformative competencies that students need to develop in the future in order to be able to meet the challenges of the 21st century:

1. creating new value, 2. reconciling tensions and dilemmas, and 3. taking responsibility.

The second and third competencies are closely related to issues of integrity and research integrity:

> In an interdependent world, students need to be able to balance contradictory or seemingly incompatible logics and demands, and become comfortable with complexity and ambiguity. This requires empathy and respect. Students who have the capacity to take responsibility for their actions have a strong moral compass that allows for considered reflection, working with others, and respecting the planet. (OECD Future of Education and Skills 2030, 2019, p. 61)

The ethical dimension is thus the crucial aspect of future competencies.

The US National Research Council (2002) lists the main practices that characterise responsible conduct of research (RCR) at the individual and the institutional level:

> Individual level: For the individual scientist, integrity embodies above all a commitment to intellectual honesty and personal responsibility for one's actions and to a range of practices that characterize the responsible conduct of research, including: intellectual honesty in proposing, performing, and reporting research; accuracy in representing contributions to research proposals and reports; fairness in peer review; collegiality in scientific interactions, including communications and sharing of resources; transparency in conflicts of interest or potential conflicts of interest; protection of human subjects in the conduct of research; humane care of animals in the conduct of research; and adherence to the mutual responsibilities between investigators and their research teams. (p. 5)
>
> Institutional level: Institutions seeking to create an environment that promotes responsible conduct by individual scientists and that fosters integrity must establish and continuously monitor structures, processes, policies, and procedures that: provide leadership in support of responsible conduct of research; encourage respect for everyone involved in the research enterprise; promote productive interactions between trainees and mentors; advocate adherence to the rules regarding all aspects of the conduct of research, especially research involving human participants and animals; anticipate, reveal, and manage individual and institutional conflicts of interest; arrange timely and thorough inquiries and investigations of allegations of scientific misconduct and apply appropriate administrative sanctions; offer educational opportunities pertaining to integrity in the conduct of research; and monitor and evaluate the institutional environment supporting integrity in the conduct of research and use this knowledge for continuous quality improvement. (p. 5)

The US National Academies of Sciences, Engineering, and Medicine (2017) lists the following best practices in a checklist for researchers, which includes research integrity:

> *Research Integrity:* Maintain high standards in own work; Understand policies; Raise questions and problems promptly and professionally; Strive to be a generous and collegial colleague. (p. 174)
>
> *Data Handling:* Develop data management and sharing plan at the outset of a project; Incorporate appropriate data management expertise in the project team; Understand and follow data collection, management, and sharing standards, policies, and regulations of the discipline, institution, funder, journal, and relevant government agencies. (p. 174)
>
> *Authorship and Communication:* Ensure that general and disciplinary standards are followed for research publications; Acknowledge the roles and contributions of authors; Be transparent when communicating with all audiences. (p. 174)
>
> *Mentoring and Supervision:* Model and instruct on research best practices; Regularly check work of subordinates and ensure adherence to best practices; Clarify expectations. (p. 174)
>
> *Peer Review:* Provide complete and timely review; Maintain confidentiality; Disclose conflicts, and eliminate or manage them as appropriate. (p. 174)

> *Research Compliance:* Protect human subjects and laboratory animals; Follow environmental and other safety regulations; Do not engage in misuse; Disclose and manage conflicts of interest. (p. 174)

The US National Postdoctoral Association (NPA Core Competencies Committee, 2007-2009) similarly suggests the following Core Competencies Self-Assessment Checklist for researchers; responsible conduct of research (RCR) also plays an important part:

1. Discipline-Specific Conceptual Knowledge: Analytical Approach to Defining Scientific Questions; Design of Scientifically Testable Hypotheses; Broad-Based Knowledge Acquisition; Interpretation and Analysis of Data.

2. Professional/Research Skill Development: Literature Search Strategies and Effective Interpretation; Experimental Design; Statistical Analysis; Data Analysis and Interpretation; Laboratory Techniques and Safety; Principles of the Peer Review Process.

3. Communication Skills: Writing; Speaking; Teaching; Interpersonal; Special Situations.

4. Professionalism: Workplace; Institutional; Collegial; Universal.

5. Leadership & Management Skills: Leadership-Strategic Vision; Leadership-Motivating and Inspiring Others; Management-Project Management; Management-Data and Resource Management; Management-Research Staff Management.

6. Responsible Conduct of Research: Conflicts of Interest; Data Ownership and Sharing; Publication Practices and Responsible Authorship; Identifying and Mitigating Research Misconduct; Research with Human Subjects (when applicable); Research Involving Animals (when applicable).

Objectives and Goals of RCR Education: a Four-Component Model

The US National Academies of Sciences, Engineering, and Medicine (2017, p. 166) distinguishes between Objectives, Goals, and Benefits of RCR Education in relation to Research Integrity Education or Responsible Conduct of Research (RCR) Education.

Objectives are the general aims that RCR education seeks to achieve in the long term. In this regard, the objective of the Erasmus+ Integrity project, under which this competency profile was created, was to make students 'streetwise' in research integrity. Alternatively, as the US National Academy of Engineering (2009) puts it:

> Workshop participants generally agreed that a major goal of ethics education is to encourage faculty and students to question the decisions, practices, and processes around them so they can make better informed decisions and help shape a community of which they want to be part. (p. 11)

The US National Academies of Sciences, Engineering, and Medicine (2017) lists the following eight major objectives of RCR education identified in the literature:

> 1) Ensuring and improving the integrity of research; 2) promoting good behaviour and quality research conduct; 3) Preventing bad behaviour; 4) Decreasing research

> misconduct; 5) Making trainees aware of the expectations about research conduct within the research enterprise and as articulated in various federal, state, institutional, and professional laws, policies, and practices that exist; 6) Making practitioners and trainees aware of the uncertainty of some norms and standards in research practices due to such factors as changes in the technology used in research and the globalization of research; 7) Promoting and achieving public trust in science and engineering; 8) Managing the impact of research on the world beyond the lab, including society and the environment. (p. 197)

Since RCR educational objectives are difficult to measure within a given course, learning goals, or learning outcomes, as opposed to objectives, are established to be narrower in scope and more specific to be measured in the assessment of a given activity. Therefore, learning goals are specific learning outcomes related to learning objectives in the sense that they can contribute to them. However, in addition to the objectives and goals, RCR education may have other benefits that are not identified as objectives or goals of RCR education itself but may benefit other areas (The US National Academies of Sciences, Engineering, and Medicine, 2017, p. 166).

According to the European Centre for the Development of Vocational Training (Cedefop), learning goals or learning outcomes are statements of what a learner knows, understands and is able to do on the completion of a learning process. Learning goals are defined in terms of competencies, meaning knowledge, skills, and attitudes (The European Centre for the Development of Vocational Training, 2011).

The Tuning Project (Gonzáles & Wagenaar, 2008) distinguishes even more precisely between learning outcomes and competencies:

> Learning outcomes are statements of what a learner is expected to know, understand and/or be able to demonstrate after completion of learning. They can refer to a single course unit or else to a period of studies, for example, a first, a second and a third cycle programme. Learning outcomes specify the requirements for award of credit.
>
> Competencies represent a dynamic combination of knowledge, understanding, skills and abilities. Fostering competences is the object of educational programmes. Competences will be formed in various course units and assessed at different stages. (pp. 16-17)

Furthermore, the Tuning Project distinguishes three types of competencies (Gonzáles & Wagenaar, 2008, pp. 16-17, 29-30):

Instrumental Competences are those that have an instrumental function. They include cognitive skills; the ability to understand and manipulate ideas and thoughts; methodological skills to manipulate the environment (such as time management and learning strategies, making decisions, or solving problems); technological skills related to the use of technological devices, computing, and information management skills; linguistic skills such as oral and written communication or knowledge of a second language.

Interpersonal Competences are individual skills that refer to the ability to express one's feelings, critical and self-critical skills. Social skills, which refer to interpersonal skills or teamwork or the expression of social or ethical commitment. They are used to facilitate processes of social interaction and cooperation;

Systemic competences are skills and abilities that relate to whole systems. They require a combination of understanding, sensitivity, and knowledge that allows one to see how the parts of a whole relate and come together. These skills include the ability to plan change to make improvements in whole systems and to design new systems. Systemic competencies require the prior acquisition of instrumental and interpersonal competencies as a foundation.

Tuning (Gonzáles & Wagenaar, 2008) structures these three types of competencies into 30 competency units:

> *Instrumental competences:* Capacity for analysis and synthesis; Capacity for organisation and planning; Basic general knowledge; Grounding in basic knowledge of the profession; Oral and written communication in your native language; Knowledge of a second language; Elementary computing skills; Information management skills (ability to retrieve and analyse information from different sources); Problem solving; Decision-making (p. 31)
>
> *Interpersonal competences:* Critical and self-critical abilities; Teamwork; Interpersonal skills; Ability to work in an interdisciplinary team; Ability to communicate with experts in other fields; Appreciation of diversity and multiculturality; Ability to work in an international context; Ethical commitment; (pp. 31-32)
>
> *Systemic competences:* Capacity for applying knowledge in practice; Research skills; Capacity to learn; Capacity to adapt to new situations; Capacity for generating new ideas (creativity); Leadership; Understanding of cultures and customs of other countries; Ability to work autonomously; Project design and management; Initiative and entrepreneurial spirit; Concern for quality; Will to succeed (p. 32)

The US National Academies of Sciences, Engineering, and Medicine (2017), lists (after the US National Academy of Engineering (2009)) the following set of nine goals that should be developed in RCR education:

> 1) Recognize and define ethical issues; 2) Identify relevant stakeholders and sociotechnical systems; 3) Gather relevant data about stakeholders and systems; 4) Understand stakeholder perspectives; 5) Identify conflicting values; 6) Construct viable alternative actions or solutions and identify constraints; 7) Evaluate alternatives in terms of consequences, public defensibility, and institutional barriers; 8) Engage in reasoned dialog or negotiation; 9) Revise options, plans, or actions (p. 167).

The US National Postdoctoral Association (NPA Core Competencies Committee, 2007-2009) distinguishes between components/principles and delineation of specific skills in RCR education:

Components/Principles: 1. Improve ability to make ethical and legal choices; 2. Develop appreciation for the range of accepted practices for conducting research; 3. Be familiar with the regulations, policies, statutes, and guidelines that govern the conduct of government-funded research, as appropriate. 4. Be aware of the available tools and resources to which they can turn when ethical questions and concerns arise.

Delineation of Specific Skills: 1. Data ownership and sharing (a. Sharing of data with collaborators, including industry-specific concerns as appropriate; b. Ownership and access to data, particularly once a postdoctoral fellow's appointment ends; c. Legal ramifications of intellec-

tual property, patents and copyright.); 2. Publication practices and responsible authorship (a. Criteria for authorship; b. The elements of responsible publication); 3. Research with human subjects (a. Ethical principles for conducting research with human subjects; b. Informed consent and subject confidentiality; c. Institutional Review Boards; d. Reporting clinical trials.); 4. Research involving animals (a. Ethical principles and federal policies for conducting research with animals; b. Understanding the Three Rs: Replace, reduce and refine animal use in research; c. Institutional Animal Care and Use Committee.); 5. Identifying and mitigating research misconduct (a. Definitions; b. Reporting procedures; c. The role and risks of being a whistle-blower.); 6. Conflicts of interest (a. Personal and intellectual conflicts; b. Conflicts of commitment; c. Financial conflicts; d. Profits and intellectual property rights; e. Confidentiality and bias in peer review; f. Conflicts and potential competition between mentor and trainee.)

Learning goals in RCR education are more systematically divided by Bebeau (2002b, 2002c; Bebeau & Thoma, 1999) and Davis (Davis & Riley 2008; Davis & Feinerman, 2010) into four aspects of RCR education according to Rest's four-component model of morality (Rest, 1983; see also National Research Council, 2002, p. 88):

1. Ethical sensitivity (interpreting the situation as ethical): improving and increasing students' sensitivity to issues concerning the standards of their profession and the ability to identify the ethical issues in some situation;

2. Ethical knowledge or judgment (judging which of the available actions are most justified): Increasing and improving students' knowledge of how to resolve an ethical problem once it has been noticed (from being aware of the appropriate standard to consider - and how to interpret it - to knowing where to go to make a complaint or seek advice);

3. Ethical motivation (prioritising ethics over other important concerns): improving students' judgment and ability to develop an acceptable course of action and provide an appropriate rationale;

4. Ethical commitment or character (being able to construct and implement actions that serve ethical decision-making): Reinforce and increase student commitment to the standards of their profession and the likelihood that the student will act on them.

Similarly, Antes, and DuBois (2014) divide research integrity learning outcomes into four categories: ethical problem-solving skills; ethical sensitivity skills; knowledge of research ethics; attitudes and values.

The US National Research Council (2002) also elaborates on the four-component model:

> The educational program should be built around the development of abilities that give rise to responsible conduct. These include the ability to (a) identify the ethical dimensions of situations that arise in the research setting and the laws, regulations, and guidelines governing one's field that apply to those situations (ethical sensitivity); (b) develop defensible rationales for a choice of action (ethical reasoning); (c) integrate the values of one's professional discipline with one's own personal values (identity formation) and appropriately prioritize professional values over personal ones (showing moral motivation and commitment); and (d) perform with integrity the complex tasks (e. g., communicate ideas and results, obtain funding, teach, and supervise) that are essential to one's career (survival skills). (p. 86)

Intermediate Concepts

Bebeau and Thoma (1999) emphasise the need for intermediate concepts in RCR education. They distinguish three levels of abstraction in moral or ethical cognition and RCR education. The most general level involves abstract concepts and related principles (such as the concept of equality and the corresponding principle 'everyone must be treated equally'). However, such abstract concepts are difficult to apply to practice because they offer little guidance for one's actions. The six stages of moral development described by Kohlberg (1969, 1976) tend to be general and abstract, like epochs in history, rather than detailed. At the other end of the spectrum, there are very concrete concepts in professional codes of ethics, which are very specific and highly contextual, based on the profession, as different scientific groups have different codes. Such codes are rarely explained in terms of general ethical theories but are taken for granted, functioning like the 'ten commandments'.

Teaching ethics courses in various fields, however, takes place somewhere between the abstract and the concrete. Ethics courses are often organised around concepts that are more concrete but still general enough to combine practical instruction with moral theory and reasoning. These are concepts such as 'professional autonomy', 'confidentiality', 'informed consent', 'whistleblowing,' and similar. Such concepts mediate the abstract and the concrete and can be referred to as 'intermediate level' concepts. Intermediate level concepts provide more concrete guidance for actions than the general concepts and link concrete actions to theory, which codes do not do.

Davis and Feinerman (2010) have developed a list of such intermediate concepts for teaching RCR to graduate engineering students. However, they emphasise that most of the concepts relate to research in general, so they are relevant to teaching research integrity in various scientific fields. The list is as follows:

> Accessibility (designing with disabilities in mind); Animal subjects research; Authorship and credit (co-authorship, faculty and students); Publication (presentation: when, what, and how?); National security, engineering research, and secrecy; Collaborative research; Computational research (problems specific to use of computers); Conflicts of interest; Cultural differences (between disciplines as well as between countries); Data management (access to data, data storage, and security); Confidentiality (personal information and technical data); Human subjects research in engineering field; Peer review; Research misconduct (fabrication, falsification, and incomplete disclosure of data); Obtaining research, employment, or contracts (credentials, promises, state of work, etc.); Responsibilities of mentors and trainees; Treating colleagues fairly (responding to discrimination); Responsibility for products (testing, field data, etc.); Whistle blowing (and less drastic responses to wrongdoing). (pp. 354-355, footnote 5)

The competencies in the competency profile we have developed in the Erasmus+ Integrity project are intermediate concepts that link concrete actions to abstract principles and theory. They are intended to cover all aspects of integrity in research, and the user can choose from them those that are relevant to his/her research area.

How to Teach Research Integrity?

Having identified the four aspects of learning outcomes in RCR education, the most important question that follows is: how should these four aspects be taught?

For RCR education, the US National Research Council (2002) draws on the analogy with the education of students in the critical analysis of the research literature:

> The committee believes that useful insight into the best practice for education in the responsible conduct of research comes by analogy to the education of students in the critical analysis of the research literature in their fields. How is critical reading taught? First, students are introduced to the primary literature as soon as they enter an educational program. Second, the complexity of the readings and the depth of the analysis are gradually increased. Third, critical reading of journal articles, under the guidance of a mentor, is integrated into all aspects of the curriculum: core courses, seminars, the design of research projects, and the preparation of research manuscripts. Fourth, critical reading is taught by the very scientists who provide instruction in other aspects of research and who serve as primary role models. Finally, student competence is tested whenever students are asked to provide support for their ideas and conclusions. Consistent with the principles of effective instruction, assessment and feedback are continually provided from a student's first seminar presentation to the final thesis defense and submission of manuscripts for publication. (p. 85)

Similarly, just as critical analysis of research literature is an integral part of training in all subjects in a study programme, RCR education should be an integral part of training in all subjects in a field of study. In this sense, the four aspects (ethical sensitivity, ethical knowledge, ethical judgment, and ethical commitment) should form the basis of education in the responsible conduct of research. The US National Research Council (2002, pp. 87-97) elaborates on how this should be done. Each of these aspects is considered from two perspectives: Teaching Strategies and Assessment Methods.

Ethical Sensitivity

Ethical sensitivity involves the researcher's awareness of how his actions affect others. It includes the following skills: anticipating the reactions and feelings of others involved in the research (colleagues, mentors, participants, etc.); anticipating alternative courses of action and their effects on all those involved in the research; constructing possible scenarios with knowledge of cause-and-effect chains of events; having empathy and the ability to assume roles; seeing things from the perspective of others involved in the research and considering research scenarios from the perspective of legal, institutional, and national viewpoints; recognising when to apply laws, regulations, and standards in one's profession.

Ethical sensitivity (to issues) differs from the capacity for ethical reasoning (about issues) in the following ways. Ethical sensitivity is the ability to recognise (and not overlook) an ethical issue in a complex situation. In contrast, ethical reasoning is the ability to argue and discuss why an already identified ethical problem is a problem. Thus, focusing on policies and practises related to the conduct of research (e.g., the use of humans and animals in research; codes related to health and safety; procedures for dealing with allegations of misconduct; author-

ship practices and policies; data management; conflicts of interest, etc.) is merely a foundation that allows students to develop sensitivity to identifying ethical issues. Ethical sensitivity, however, is not about memorising policy documents and passing knowledge tests but about understanding that such policies and regulations exist and, more importantly, why they exist and how to apply them in real-world situations. Therefore, policies and regulations should be referred to as often as possible in courses so that students become familiar with them and their ability to identify ethical issues and refer to policies becomes habitual.

In training ethical sensitivity, students should develop the ability to recognise ethical problems in complex situations. Therefore, a useful training strategy for improving students' ethical sensitivity is to design complex, real or hypothetical cases or situations that require students to refer to policies, identify stakeholders, consider consequences, and engage in probabilistic reasoning. Sensitivity training differs from standard ethics courses in that cases are presented without any preconceived interpretation to stimulate sensitivity in identification and subsequent discussion. The cases simply present clues to an ethical problem, and students should refer to guidelines and codes themselves to demonstrate proper behaviour. Therefore, the student ethical sensitivity test should assess the student's ability to identify ethical problems, meaning to distinguish relevant from irrelevant information in the cases presented and to identify the norms and values from the guidelines by which the cases should be considered. Several such tests have been developed in which students are presented with hypothetical situations via video; students respond to the cases presented to them, and their responses are assessed.

Ethical Reasoning or Judgement

> Ethical reasoning implies that professionals should be able to critically analyze their own moral arguments and develop defensible points of view for new problems that are likely to emerge during the course of professional life. (National Research Council, 2002, p. 90)

Students should develop the ability to determine how to modify existing rules to meet the new moral problem. The most useful instructional strategy for promoting ethical reasoning is a teaching and assessment strategy that incorporates the dilemma discussion technique (see also Bebeau, 2002a). The greatest improvement is achieved when the teacher's intervention is added gradually with instruction to enable students to develop well-reasoned written arguments. In this way, the intervention affects students' reasoning in two ways: developing new thinking to meet new moral problems; and reducing or rejecting students' simplistic thinking based on personal interest arguments.

According to the US National Research Council (2002, p. 92), ethical or moral reasoning is defined as the ability to systematically examine a situation and then choose and defend a position on that issue. Arguments are evaluated in terms of the respondent's ability to describe ethical issues and points of conflict, including precedents, principles, rules, or values that support the prioritisation of one interest over another; stakeholders or parties that have a vested interest in the outcome of the situation; likely consequences of possible courses of action; and ethical obligations of central characters.

The difference between hypothetical cases intended to stimulate ethical sensitivity and those intended to stimulate ethical reasoning is this: cases designed to enhance sensitivity are de-

signed to make finding and understanding the ethical problem or conflict difficult (to stimulate sensitivity to ethical issues); in contrast, cases for improving reasoning are designed so that ethical problems or conflicts are relatively easy to identify. However, they are presented as dilemmas that stimulate argumentation and interpretation. Because discussion of dilemmas can lead to fruitless exchanges of student opinions, the teacher should intervene and encourage students to explore the criteria for evaluating moral arguments before engaging in discussion and then to use the criteria to critique each other's oral or written arguments. Assessing ethical reasoning is, therefore, different from assessing ethical sensitivity. In assessing sensitivity, students are presented with complex cases in which they are asked to detect an ethical problem; in tests assessing ethical reasoning, ethical problems are presented through dilemmas, and students are expected to be able to reason and debate them.

Ethical Motivation

Why be moral? This is the fundamental question that promotes ethical motivation. Ethical motivation requires the individual to weigh many legitimate concerns that may be incompatible with moral choices (e.g., financial and professional pressures, established relationships, personal concerns) that compete for the researcher's attention (National Research Council, 2002, p. 94). Ethical motivation is the responsibility to bridge the gap between knowing the right thing to do and doing it. Ethical motivation (doing the right thing) is therefore linked to personal responsibility in identity formation (doing the right thing because I truly believe it is my responsibility to do so). Indeed, individuals may do the right thing not for the sake of personal responsibility but for other opportunistic reasons (e.g., to gain rewards or esteem to avoid negative consequences) without achieving personal responsibility.

Although the development of personal responsibility in identity formation is a lifelong process, instructional strategies could be used to encourage it. In the past, personal responsibility was developed informally, through social interaction with the positive research environment and role models, such as mentors and colleagues; today, it can also be developed in more formal ways, such as through lectures on norms and values in science or by presenting exemplary scientists and their stories. Doing so encourages students to identify with good examples of scientists who have contributed to a larger society and thus develop their sense of responsibility.

Assessment of ethical motivation can be achieved by asking students to write and reflect on the role of scientists ('What does it mean to be a scientist?') and to refer to the norms and values of science in their writing. This work is then assessed by a teacher. Another more quantitative method, as described by Bebeau (2002c), is to use a norm-referenced measure of role concept that measures the extent to which the individual incorporates norms and values of the profession into their identity.

Ethical Commitment or Character

Becoming 'streetwise' in research integrity requires not only ethical sensitivity, reasoning, and judgement, but also commitment. The US National Research Council (2002) calls this 'survival skills':

> Fundamental to responsible conduct in any profession is the ability to perform the complex tasks of the discipline with integrity, i.e., to have acquired survival skills. /.../ Integrity, ego strength, perseverance, backbone, toughness, strength of conviction, and courage are also qualities required for effectiveness as a researcher. A researcher may be ethically sensitive, may make good ethical judgments, and may place a high priority on professional values; but if he or she wilts under pressure, is easily distracted or discouraged, or is weak willed, a moral failure may occur because of a deficiency in character and competence. (p. 96)

Ethical commitment or courage could be fostered so that students develop skills that are often neglected in research training but are essential as a survival skill for a scientist: how to present results at scientific meetings; how to defend one's methods; how to write written reports; how to learn from critical comments made by one's colleagues and how to comment or evaluate one's colleagues; how to obtain funds for one's research; how to hire collaborators; how to teach courses; and how to mentor students. Therefore, the assessment of ethical commitment could be achieved by asking students to edit a description of an experiment, review a research article written by a colleague, and similar tasks The point of stimulating and assessing ethical commitment is that students should develop the courage to communicate with the research community, to express and accept criticism of their work, and thereby be prepared for the types of evaluation they will encounter and experience in their careers.

At which Study Level to Teach RCR?

Historically, the primary responsibility for training scholars in RCR has rested with their mentors, meaning RCR training occurred informally, led by examples within a research group, led by a senior researcher who served as a mentor to all novices in the group. In recent decades, RCR has been formalised at the initiative of national agencies and governments, resulting in widely varying approaches to RCR education, with the majority of institutions adopting a framework that requires students to complete online courses (Diaz-Martinez et al., 2019). Despite these efforts, according to Diaz-Martinez et al. (2019), the following three setbacks remain: 1) RCR education is mostly reserved for the postgraduate level. Research integrity is mostly taught at PhD level when students are more intensively engaged in research and research collaboration. 2) Although RCR is an integral part of research, RCR training is mostly taught in a stand-alone format that places it outside the context of the research sphere. 3) RCR education is most often designed to address issues in general and in various contexts and does not address context-specific practices and standards of research integrity.

With the recent impetus to include authentic research opportunities as part of the undergraduate curriculum (in the U.S. via course-based undergraduate research experiences called CUREs; see Diaz-Martinez et al., 2019), there is also a growing need for undergraduate RCR education that does not stand alone but is integrated with research itself.

Diaz-Martinez et al. (2019) suggest that teaching teams seeking to implement RCR education effectively within their undergraduate research consider an approach that includes:

1. identification of appropriate RCR student learning objectives (SLOs) and specific topics that are relevant to the research; 2. The design and/or identification of curricular minilessons that are aligned with assessment(s) and SLO(s); 3. development and/or identification of appropriate assessments that are aligned with respective curriculum and SLO(s); 4. facilitation of professional development for those individuals implementing E/RCR education within CUREs (e.g., instructors of record, teaching assistants, peer leaders).

Diaz-Martinez et al. (2019) identified six student learning objectives (SLOs) that are broadly relevant. Based on these objectives, learning goals could be developed for students in specific research areas specific to the experiences students will encounter in their research. Diaz-Martinez et al. (2019) present an example for biology education in the table below (p. 5):

SLOs	Special considerations	Curriculum example(s)	Assessment example(s)
1. Students will be able to describe the importance of E/ RCR as part of the research process.	Emphasis should be placed on the ethical values that drive the scientific pursuit (i.e., honesty, fairness, trustworthiness, objectivity, openness, and respect) rather than on examples of misconduct.	Instructors can assign students the following article and make use of scaffolded discussion prompts to begin to connect general topics addressed in the article with the research focus of the CURE.	Students' views regarding the importance of E/RCR as part of the research process can be formatively evaluated using one or more free-response prompts. In turn, responses can be used as the basis for further discussion.
2. Students will be able to define research misconduct, questionable research practices, proper data acquisition and management, collaboration, and authorship in the context of the CURE.	The specific topics to be addressed depend on the type of data being obtained in the CURE. If the goal is to publish the findings generated in the CURE, the topics of authorship and authors' responsibilities should be addressed.	Active-learning approaches should be used; e.g., the following three-part exercise could be implemented: 1) an overview of applicable ethical guidelines; 2) analysis of a relevant case study; and 3) interactive role-play of the case study.	Knowledge can be assessed using Hirsch's survey, which consists of 30 content questions covering all nine RCR areas defined by the Office of Research Integrity. Case responses can be assessed using a case-study rubric.
3. Students will be able to identify potential ethical concerns associated with the development and/or implementation of their own research.	Students should be able to apply E/RCR standards to identify areas of their own projects where potential questionable research practices could arise. This will allow students to be fully aware of the E/RCR standards that apply specifically to their projects.	Use the Decision Procedure Checklist (DPC) to analyze potential ethical concerns encountered in the CURE. This checklist walks a student through the process of identifying stakeholders, resources to address the problem, and the short- and long-term consequences of the proposed solutions.	The Decision Procedure Scoring Guide allows instructors to score responses to the DPC as a summative assessment.
4. Students will be able to articulate and/or implement mechanisms to address potential ethical concerns that might arise in the conduct and reporting of their own research.	Emphasis should be placed on how to effectively facilitate student discussion of E/ RCR concerns, with the CURE instructor, as such concerns arise.		
5. Students will be able to collaborate respectfully and professionally	Emphasis should be placed on defining roles and responsibilities, identifying mechanisms for effective decision-making and team accountability, and defining when and how to end unproductive collaborations.	While not unique to CUREs, engaging students in creating a group contract can serve to address one or more special considerations associated with this SLO.	Student collaboration can be assessed using the Association of American Colleges and Universities Teamwork Valid Assessment of Learning in Undergraduate Education (VALUE) Rubric. Specific guidelines and instructions for using the rubric are included with the rubric itself.
6. Students will be able to articulate potential scientific and social implications of their research.	In CURES with a community-engagement dimension, this SLO should go beyond awareness of implications and address also the responsibilities, benefits, and challenges of engaging the community in the research process.	Activities can include discussions and the creation of a cognitive map depicting the ethical implications of students' research projects.	Cognitive map analysis can be used for assessment purposes by analyzing the complexity, relationships, and message of the cognitive map.

Grey Zone and Questionable Research Practices

Butler et al. (2017) caution that obvious examples of overt fraud revealed in public, such as in falsification, fabrication, and plagiarism (FFP), obscure less blatant and more subtle instances of 'questionable research practices' (QRP), which often involve misrepresentations, inaccuracies, or bias (e.g., misattribution of authorship, omission of outliers, and salami slicing of data). Butler et al. (2017), in their study of business school academics, identify the next most common QRP practices: playing with numbers, playing with models, and playing with hypotheses (also called HARKing - making or changing hypotheses after the results are known).

Butler et al. (2017) attribute the existence of QRPs to three reasons: the inadequate training of researchers, the pressures and incentives to publish in certain outlets, and the demands and expectations of journal editors and reviewers. Studies have shown that QRPs are far more widespread than FFPs, with between 30% and 90% of researchers using them.

Butler et al. (2017) find the reason – ironically – in the increasing awareness of FFP, which leads scientists to systematically 'push' their results in the desired direction by artificially inflating significance in some way, but being careful not to cross the line into overt misconduct. Like athletes, scientists are aware of the 'black' line of misconduct and are therefore careful not to cross it but to approach it as closely as possible to increase 'performance'. However, the responsibility for QRP does not rest on individuals, and exposing a few individuals only masks systemic problems, such as the role of journals in creating an environment in which QRPs thrive, as editors want to inflate impact factors and increase journal rankings, and therefore encourage authors to 'play the game' to increase their chance of publication.

Similarly, Hall, and Martin (2019, p. 415) emphasise that misconduct does not occur in a vacuum but arises from organisational or institutional constraints and incentives - so-called 'organisational misconduct.' Wherever one chooses to draw the line, FFPs are seen as inherently negative, 'black' practices, while QRPs fall into an ethical 'grey area' between acceptable (scientific best practices) on the one hand and unacceptable ('black' FFPs) on the other. For this reason, QRPs are a fruitful starting point for discussing research ethics within an academic field (Butler et al., 2017). Butler et al. (2017), therefore, appeal:

> The stakes of studying QRPs now become clear: If our aim is to promote research integrity and research ethics, rather than simply to expose and punish wrongdoers for their flagrant transgressions, then we must take the grey zone into full consideration. (p. 96)

Focusing only on FFP allows a whole range of practices to fall through the cracks and results in published work that is misleading in some way (Butler et al., 2017, p. 106). Fanelli (2013, p. 149; see also Butler et al., 2017, p. 106) therefore suggested redefining academic misconduct as 'distorted reporting', which can refer to any omission or misrepresentation of information necessary to assess the validity and significance of research, meaning any discrepancy between what was done and what was reported. Such an approach would capture not only FFPs but also QRPs, shifting the focus from the most egregious cases of FFP to more subtle forms of potential misconduct where the greatest public harm occurs (Steneck, 2006, p. 66).

Hall and Martin (2019) developed a formal taxonomy that:

1. Distinguishes appropriate conduct from blatant misconduct, but with a particular focus on the 'grey areas' between these extremes in the form of questionable and inappropriate behaviour. The taxonomy differentiates between the categories of blatant misconduct (e.g., data fabrication, data falsification), inappropriate conduct (e.g., selective reporting, omitted data), questionable conduct (e.g., HARKing), and appropriate conduct (e.g., Winsorization).

2. Assesses these categories based on the stakeholders (other researchers, employees, students, editors and journals, societal stakeholders) affected by the misconduct as well as the severity, ranging from very high severity (in premeditated dishonesty and intentional rule-bending), to medium (in less intentional poor behaviour that may arise due to complexity, sloppiness, ignorance) and to low severity (in honest error). For each of these categories, Hall and Martin (2019) give examples of behaviour, theoretical sources of misconduct and samples of corrective measures.

Validation of Competency Profile

In the competency profile we developed, competencies are defined in terms of categories (a kind of intermediate concepts (see above)) that cover all possible areas of research integrity. These categories could be translated into factors of a measurement instrument to assess competencies at all four levels of RCR (sensitivity, reasoning, motivation, commitment). Such an instrument could validate the competency profile in a similar way that Hauser, Reuter, Gruber, and Mottok (2018) validated and modified the factor structure of Böttcher and Thiel's (2018) F-Comp questionnaire to measure research competencies. Similarly, based on factor analysis, the categories in the profile could be modified into a validated and more appropriate factor structure by accentuating some categories that are not as exposed now and eliminating others. This is an opportunity for future research on the presented competency profile.

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Objectives and Outcomes

The research integrity competencies defined in the profile (see sections: Values and Principles, Research Practice, Publication and Dissemination, Violations) can be summarised as:

- core learning objectives, which encompass the most general aims of integrity education,
- learning outcomes, which summarise competencies across all levels of study.

Learning Objectives

'Streetwise' in terms of integrity means that students have developed all four aspects of integrity education in research (sensitivity, reasoning, motivation, and commitment) according to Rest's four-component model of morality (see Theoretical Background section). To become 'streetwise', students should be able to recognise and discuss integrity issues and problematic situations with their colleagues (sensitivity), develop and justify strategies to respond to integrity issues (reasoning), be motivated and confident to respond to integrity issues (motivation), and commit to promoting research integrity in their research environment (commitment) (recognise-justify-respond-promote). Therefore, the following set of core objectives corresponding to the four aspects of research integrity education (see Theoretical Background section) can be summarised. These objectives can be considered key goals that students should achieve after completing the three levels of study (BA, MA, PhD).

Purpose and Value

Students should understand the importance, purpose, and value of research integrity as a fundamental component of quality research. They should have internalised the values and dispositions of research integrity, such as the mindfulness, responsibility, and courage necessary to meet the standards of honesty and integrity in the conduct of research.

Relevance

Students should be aware of the relevance of research integrity to all disciplines, including the relevance of research integrity to their research.

Responsibilities

Students should be aware of the responsibilities of researchers and institutions. They should understand and be able to explain the key ethical responsibilities they have as researchers, the challenges they might face in fulfilling those responsibilities and take responsibility for their actions and decisions in specific situations.

FFPs and QRPs

Students should be aware of practices that undermine the trustworthiness of research, not only those that are widely accepted as blatant (FFP) but also those in the ambiguous 'grey area': the 'questionable research practices' (QRP).

Sensitivity

Students should develop sensitivity to problems, conflicts, and dilemmas related to research integrity in order to recognise, define, and respond to them in relevant situations.

Strategies

Students should be able to develop, justify, and demonstrate strategies for dealing with pressures and difficult situations.

Consequences and Alternatives

Students should be aware of the consequences of their actions and be able to develop and adequately justify an acceptable alternative course of action. They should be able to evaluate and justify alternatives in terms of consequences, public defensibility, and institutional barriers, and construct viable alternative courses of action or solutions and identify constraints.

Guidance

Students should know where to find guidance, advice, and support on good research practice and misconduct, and they should know who to contact when confronted with research misconduct. They should be aware of the tools and resources available to them to turn to when ethical issues and concerns arise, and they should explain and follow the correct procedures.

Legislation

Students should be aware of the legislation (governmental and institutional), professional guidelines, and related governance processes (rules, issues, options, and resources) of research integrity and be able to address any legal and regulatory requirements that affect their research.

Ethical Approval

Students should understand and be able to explain when ethical approval for research should be obtained and understand and be able to outline the processes necessary to obtain this approval.

Commitment

Students should commit to translating the governing principles of research integrity into trustworthy research.

Stakeholders

Students should be able to identify relevant stakeholders and sociotechnical systems and understand their perspectives.

Impact

Students should be able to manage the impact of research on the world outside the laboratory, including society and the environment.

Differences

Students should be aware of cultural, national, and institutional differences related to the research integrity.

Uncertainties and Changes

Students should be aware of the uncertainty of some norms and standards in research practice (due to factors such as changes in technology used in research and the globalisation of research).

Reflect

Students should be able to critically analyse/reflect on their actions and behaviours in conducting research and in their interactions with research participants, supervisors, collaborators, and similar.

Defend and Justify

Students should be able to justify and defend the ethical management (design, data collection, etc.) of their research (e.g., before an examining committee; before an ethics committee).

Promote

Students should develop a positive attitude towards continuous learning about research ethics and awareness to promote public trust in science.

Transfer

Students should be able to transfer research integrity skills to any career, which will help them become a more well-rounded individual (e.g., revise options, plans or actions; engage in reasoned dialogue or negotiation; collaborate effectively; stick to one's principles; make fully informed judgements and take appropriate action; be self-aware and know when to ask for advice; be an independent learner; be better prepared to overcome challenges in their research; be 'professionally socialised' within their research discipline and in the higher education context).

Learning Outcomes

Learning outcomes set the aims and standards that students have to achieve for each study phase in order to acquire the core objectives of research integrity education. Differentiation of learning outcomes on the BA, MA, and PhD levels is aligned to the EHEA Framework for Qualifications of the European Higher Education Area,* whose qualifications were adapted to fit the research integrity goals.

* Paris Conference of European Ministers Responsible for Higher Education 24-25 May 2018 (2018). The Framework of Qualifications of the European Higher Education Area (revised 2018). Paris Communiqué Appendix III. (May 25th 2018). Retrieved from: http://ehea.info/media.ehea.info/file/2018_Paris/77/8/EHEAParis2018_Communique_AppendixIII_952778.pdf

BA

Values and Principles

Bachelor students recognise research integrity as an issue that is part and parcel of research practice and for which account should be made.

Bachelor students are able to describe the importance of research integrity as part of the research process.

Bachelor students are able to define and explain basic values and principles of research integrity (including values underlying human and animal research) and apply them by developing and sustaining arguments and solving problems in small-sample research in their research area.

Bachelor students can communicate values related to the research integrity to both professional and non-specialist audiences.

Bachelor students should develop the skills necessary to conduct further study and research consistent with research integrity with a high degree of autonomy.

Bachelor students should understand the process of ethical decision making and can apply it to their small-sample research project.

Research Practice

Bachelor students are able to define and explain basic research designs (e.g., qualitative, quantitative), basic research methods (sampling, data collection, etc.), basic qualitative and quantitative data collection styles (e.g., survey, interview), and are able to apply them in small-sample research.

Bachelor students are able to collect and interpret relevant data in their research area to make judgments consistent with research integrity.

Bachelor students are able to find, identify, collect, and organise ideas and current knowledge to make analyses and decisions consistent with research integrity.

Bachelor students know and understand why they must obtain consent when conducting research and understand that subjects have the right to withdraw from research.

Bachelors students are able to recognise potential research integrity issues related to the development and/or conduct of their research.

Bachelors students are able to work respectfully and professionally with their fellow students and supervisors.

Bachelors students are able to articulate potential scientific and societal implications of their research.

Publication and Dissemination

Bachelor students are able to communicate information, ideas, problems, and solutions about their research consistent with research integrity.

Bachelor students are able to define and explain the difference between skimming, scanning, intensive reading, and extensive reading and are able to apply them in their writing.

Bachelor students understand why they need academic writing skills and are able to recognise the skills needed to write an academic paper.

Bachelor students are able to identify and differentiate among various styles of academic writing.

Bachelor students are able to identify and explain the structure of an academic paper (abstract, introduction, body, and conclusion) and elements of responsible publication (IMRaD) and are able to apply them in writing.

Bachelor students are able to recognise different citation styles and apply knowledge of citation (citation styles, in-text citation, and end-of-text citation) in their writing.

Bachelor students know how to find information from reliable sources (using search engines on the Internet) and are able to write about a topic by analysing sources and literature.

Bachelor students are able to identify the importance and reliability of sources from contextual clues (title, author, images, illustrations, etc.)

Bachelor students are able to distinguish between paraphrasing and quoting and to choose when to quote and when to paraphrase, and make a proper citation or paraphrase.

Bachelor students are able to follow the author guidelines of their institution when writing a research paper.

Violations

Bachelor students are able to define and distinguish appropriate conduct, blatant research misconduct (FFP), and questionable research practices (QRP) in the context of their field of study or research.

Bachelor students are able to define and distinguish plagiarism, identify different types of plagiarism, and identify ways to avoid plagiarism.

Bachelor students are able to articulate and implement mechanisms to address potential ethical concerns that may arise when conducting and reporting one's research.

Bachelor students understand personal conflicts of interest and how to avoid them in their studies and research.

Bachelor students are able to find information on policies and procedures regarding violations and allegations of misconduct at their university and know how and to whom to report identified misconduct.

Bachelor students are aware of the importance and risks of reporting misconduct in order to make a proper decision about whether or not to make a report, and they understand the consequences of making a false allegation.

Bachelor students know how to handle peer pressure situations.

MA

Values and Principles

Master students demonstrate knowledge and understanding that extends and enhances Bachelor level and provides a foundation for originality in developing research ideas consistent with research integrity.

Master students know the key ethical frameworks and understand how they provide a way of thinking about research dilemmas.

Master students are able to apply their knowledge, understanding and problem-solving skills to new or unfamiliar situations within broader (or multi-disciplinary) contexts and with due regard for research integrity.

Master students can integrate knowledge and deal with complexity in their area of research and formulate judgments in accordance with values and principles of research integrity with incomplete or limited information while also reflecting on social and ethical responsibilities.

Master students can clearly and unambiguously communicate their conclusions on research integrity issues and the knowledge and arguments that underpin them to both expert and non-expert audiences.

Master students have the learning skills that enable them to engage with issues of research integrity in a largely self-directed and autonomous manner.

Master students know the milestones in the development of concepts and approaches to research integrity and understand the relationships and differences between general academic integrity, research integrity and the ethics of their future profession (e.g., MD, teachers, social workers, etc.).

Research Practice

Master students understand and are aware of sensitive research areas (human and animal rights, environmental protection, health, safety) and possible misuse of research.

Master students understand and are aware of new and emerging research approaches and their ethical challenges (e.g., online research, administrative data, Big Data, etc.).

Master students understand and are able to apply advanced research methods (research analysis and research statistics) and are aware of the potential misuse of research methods (e.g., 'cargo cult science', the use and misuse of statistical methods, hypotheses ex ante, ex post, etc.).

Master students are able to manage relationships with research participants and can assess risks.

Master students are able to compare and contrast basic principles and ethical issues in different types of research (ethnographic, critical, action research, etc.).

Master students are able to deal with sensitive information and data in research (data protection, GDPR, chance/secondary findings).

Master students understand and are aware of the importance of the FAIR principle of data curation.

Master students are aware of the process of ethical review of research proposals at their research institution.

Master students can prepare a research plan and submit it to their institution's ethics committee.

Master students can prepare a consent form appropriate for diverse populations.

Master students understand their roles in research teams and are able to collaborate with colleagues and supervisors on research projects (teamwork, collaboration on manuscript writing, collaboration with third parties outside the university, working in interdisciplinary and transdisciplinary teams).

Publication and Dissemination

Master students are aware of the discrepancy between the reporting of research and the actual research process (understanding that different research designs in different scientific fields have different organisation and timeline, but the report itself is uniformly structured and presents a research process as linear).

Master students understand the process of publishing the manuscript in a peer-reviewed journal.

Master students are able to provide feedback to peers, are able to handle critical feedback/ review of their research paper, and are able to revise the paper (essay, thesis) accordingly.

Master students are aware of new trends, requirements, but also new pitfalls in scientific communication (predatory / vanity publishing, etc.).

Master students are able to use anti-plagiarism software and other tools for writing and editing manuscripts.

Master students are aware of trends in open access publishing.

Master students understand authorship issues in publishing research.

Violations

Master students understand the main reasons and sources why scientists deviate from good research practice.

Master students understand different types of conflicts of interest, can give examples of them, and can avoid them in their research.

Master students appreciate the value of good research practice (GRP), can explain the difference between bad research practice (BRP, such as FFP) and questionable research practice (QRP), and understand the dangers of BRP and QRP for individuals, their careers, institutions and society.

Master students understand the legal aspects of research integrity within and outside the research institution (e.g., intellectual property, copyright) and know where to find policies on research integrity governing their area of research.

PhD

Values and Principles

Doctoral students demonstrate a systematic understanding of research integrity and an independent and autonomous mastery of research skills and methods in a manner consistent with research integrity.

Doctoral students are able to differentiate what values underlie research practice (such as honesty, transparency, and responsibility) and understand how issues that arise in practice relate to these values (as trade-offs between values, as in need of protection, as in need to be actively promoted, etc.).

Doctoral students can use reflection on research values to predict the most appropriate decisions or actions in complex, 'grey area' situations.

Doctoral students can communicate with their colleagues, the larger scientific community, and society at large about research integrity issues.

Doctoral students can assess how research values affect decisions and actions in their own research context.

Doctoral students incorporate the core values of human interaction (e.g., respect, fairness, health, safety, welfare, and efficiency) into research practice and are encouraged to develop attitudes of respect toward colleagues, human research subjects, animals, and nature.

Doctoral students are stimulated to become aware of problems that can arise in human interactions (leading to unfairness, risk, a reduction in welfare, etc.) and have learned strategies to address them.

Doctoral students are motivated to contribute to a culture of research integrity within the institution.

Research Practice

Doctoral students demonstrate the ability to prepare independently and rigorously (conceive, design, conduct, and adapt) a substantive research process with respect for research integrity and are aware of the risks involved.

Doctoral students are able to contribute through original research that extends the frontier of knowledge within their research field in accordance with research integrity.

Doctoral students are capable of critical analysis, evaluation, and synthesis of new and complex ideas in their research field, consistent with the principles of research integrity.

Doctoral students are able to carry out complex research procedures independently and responsibly (e.g., research design, choice of appropriate methodology, data collection, data analysis, and data reporting) with due diligence.

Doctoral students have knowledge of (institutional) policies relevant to the conduct of research, standards respected in their discipline, and the ability to reflect critically on the strengths and weaknesses of their chosen process.

Doctoral students are able to explain what ethical problems may arise during a research procedure (such as the handling of human subjects), are able to reflect on these problems and apply strategies (within their institute or country) to help overcome them.

Doctoral students demonstrate sufficient knowledge and understanding of the regulations (institutional, national, and international) governing the handling of research data.

Doctoral students are able to develop a data management plan and know how to find support to improve the plan.

Doctoral students will know how to comply with international regulations on data protection and data security and that they are accountable as researchers.

Doctoral students are able to independently manage data (storage) and identify potential risks of the infrastructure used to store research materials.

Doctoral students are able to distinguish the elements that constitute a good research environment in their field and are actively encouraged to contribute to a good research environment.

Doctoral students are able to assess (mutual) expectations regarding supervisory and mentoring responsibilities in order to maintain a productive and supportive research environment.

Doctoral students are able to assess mutual responsibilities in mentoring and to discuss issues related to the process and content of mentoring (frequency, quality of mentoring, conflicts of interest, etc.) with their senior supervisor.

Doctoral students are able to self-reflect on their mentoring roles to bachelor and master's students and how their mentoring fosters a productive and supportive research environment.

Doctoral students are able to assess their responsibilities in working with others and manage mutual expectations in relation to fellow researchers, stakeholders and third parties.

Doctoral students are able to take a lead role in research processes and assign work to others on a research team.

Doctoral students encourage open, transparent, and collegial collaboration among researchers and are able to ensure that issues of data collection, data management, intellectual property, and publication are decided fairly.

Publication and Dissemination

Doctoral students are able to promote the responsible conduct of research in academic and professional contexts.

Doctoral students are able to determine authorship order, acknowledgements, and conflicts of interest when preparing manuscripts and are able to identify and discuss deviations in practice.

Doctoral students know what strategies to use when reviewing the work of others (e.g., what criteria to use) and are able to evaluate the work of others in an unbiased and constructive manner.

Doctoral candidates are able to independently assess the quality of, for example, research proposals in the context of an evaluation.

Doctoral students demonstrate the ability to independently write a research proposal and find support within the institution to complete the proposal.

Doctoral students are able to independently write a scientific report, respecting the elements of responsible publication, evaluating different types of publication according to rank and form, and know that authors should adhere to the same integrity criteria regardless of journal rank.

Doctoral students can independently assess the quality of publishers and follow submission procedures in different journals as corresponding authors.

Violations

Doctoral students understand how different stakeholders (other researchers, students, employers/institution, editors/journals, societal stakeholders) are affected by different types of research misconduct.

Doctoral students understand what infrastructure is available for research (mis)conduct issues at their institution and at the state level and how to handle research inquiries properly.

Doctoral researchers know where to find support when dealing with third parties (e.g., legal advice) and how to reflect on and deal with conflicts of interest that arise when dealing with third parties or society.

Doctoral students understand research infrastructure, can deal with processes of research funding systems and grant application procedures and are able to deal with relevant ethical issues (e.g., conflicts of interest).

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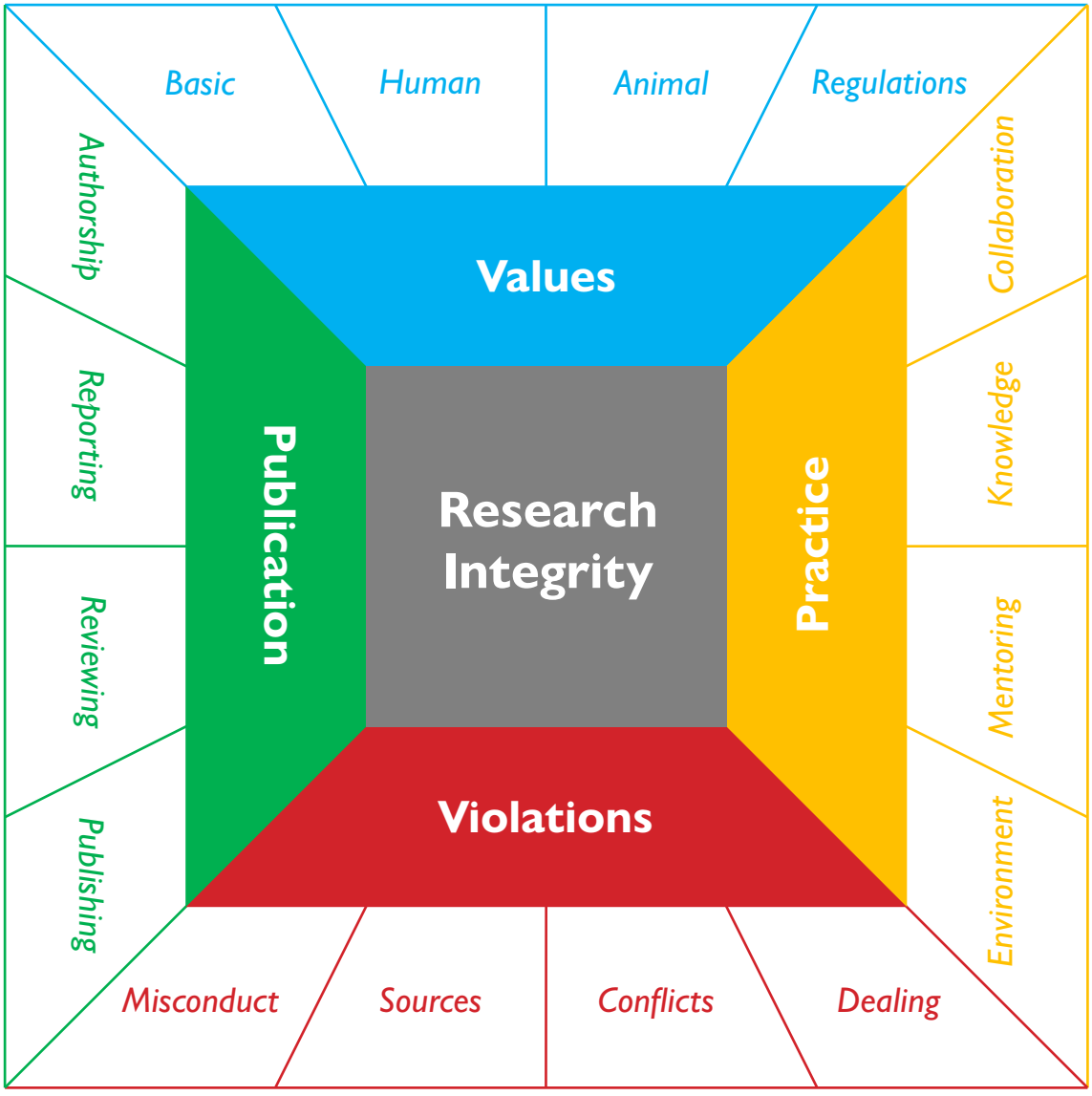
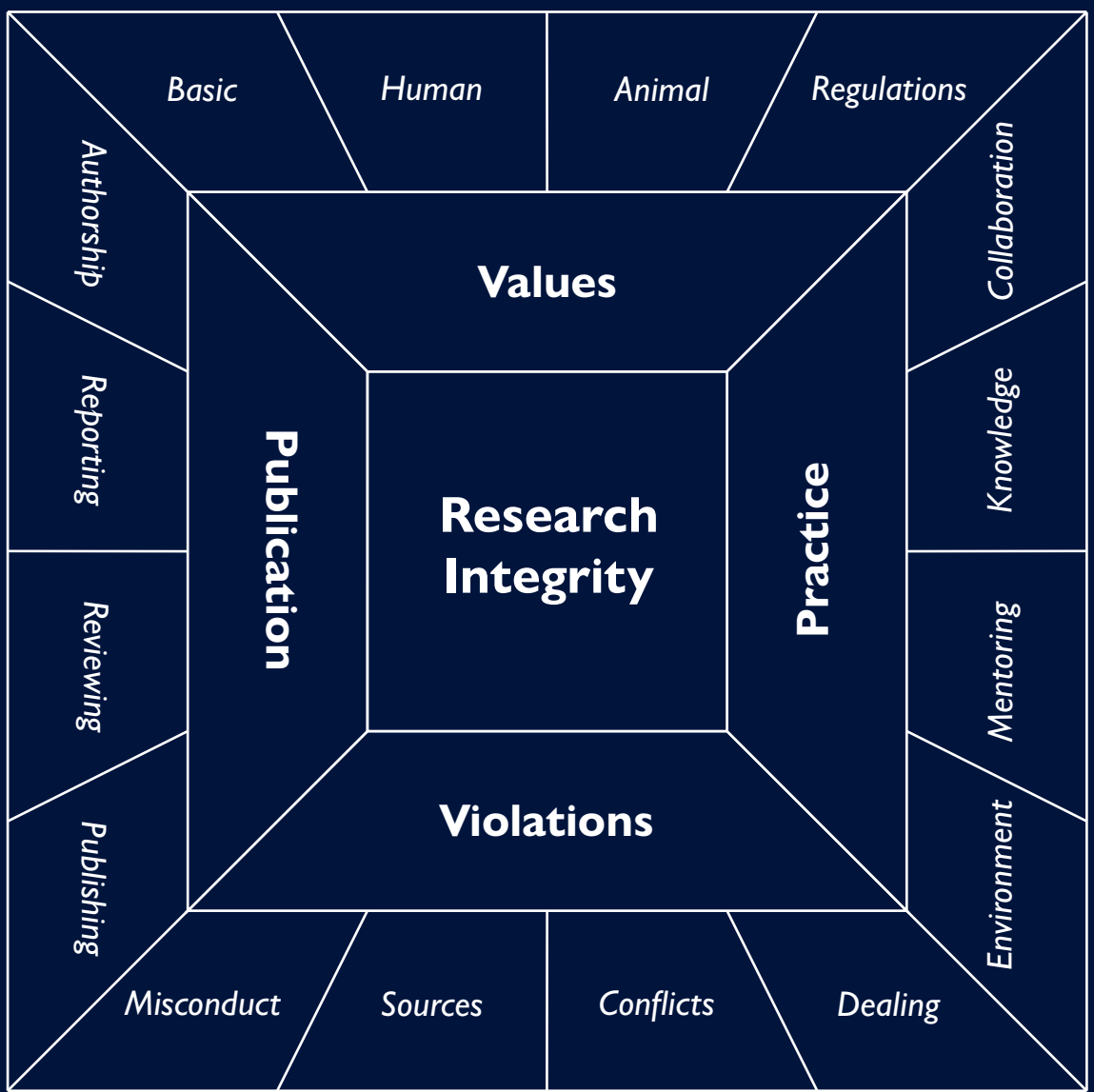
Model

The model identifies four main areas of research integrity: Values and Principles, Research Practise, Publication and Dissemination, and Violations. Each is divided into four sub-fields covering issues within the main field. The model is visualised in a box-like structure, and each field is also identified by a colour that has symbolic value: blue to symbolise wisdom for values and principles; yellow to symbolise an action for research practice; green to represent a 'green light' for publication and dissemination; and red to represent 'stop' for what is not allowed for violations.




Basic
Human
Animal
Regulations
Authorship
Collaboration
Values
Reporting
Knowledge
Publication
Research Integrity
Practice
Reviewing
Mentoring
Violations
Publishing
Environment
Misconduct
Sources
Conflicts
Dealing

Values and Principles

Subfield	Competency			Competency Rubric (Behavioural Indicators)		
				Levels of Complexity/Study Levels		
	Competency Name	Competency Definition	Explanation	Basic/BA	Intermediate/MA	Advanced/PhD
Basic Values	*Values underlying research activities (honesty, transparency, objectivity, accuracy, carefulness)*	*Understanding and showing awareness of the importance of honesty, transparency, objectivity, accuracy as basic values of research.*	Researchers should develop, conduct, review, report, and communicate research in an honest, that is, transparent, truthful, careful, thoughtful, accurate, and unbiased manner.	Students can define and explain the basic values of research (honesty, transparency, objectivity, accuracy, carefulness) and apply them in small-sample research.	Students are able to compare and contrast basic values of research and address their research problems in a careful, well-considered, and unbiased way.	Students are able to face dilemmas and issues regarding the basic values of research (discuss potential ethical problems and wrong-doing with peers) and respond appropriately.
	Values underlying human interactions in research practices (respect, fairness, health, safety, welfare, efficiency)	*Understanding and showing awareness of the importance of respect, fairness, health, safety, welfare, efficiency as basic values of treatment.*	Researchers should treat students, staff, colleagues, research participants, society, ecosystems, cultural heritage, and the environment with respect and fairness. Researchers shall be considerate of the health, safety, and welfare of the community, collaborators, and others associated with their research. Researchers should be efficient by using resources wisely and avoiding waste.	Students show proper behaviour towards people when performing small-sample research and treat all people with dignity and equality, regardless of their social status, race, gender, and sexual orientation.	Students are able to compare and contrast diverse points of view, demonstrate their understanding in their research work, and are able to establish open and honest communication with peers and mentors.	Students are able to commit to the highest ethical standards and human rights and face dilemmas and issues by examining their own biases and behaviours to avoid stereotyping (they remain fair and objective when determining skills needed for projects when selecting effective team members).
	Values of responsibility (accountability, trust, and trustworthiness)	*Understanding and showing awareness of the importance of accountability, trust, and trustworthiness as basic values of responsibility.*	Researchers should be responsible for research from idea to publication, for its management and organisation, for training, supervision, and mentoring, and for its wider impact. Like any other human activity, scientific research is built on trust. Scientists trust the results reported by others, and society trusts the results of research. Trust will only endure if the scientific community is dedicated to upholding the values associated with ethical scientific conduct.	Students can define and explain the basic values of responsibility (honour commitments; stay focused on tasks) and are able to apply them to small-sample research projects (follow instructions; meet deadlines; keep promises and commitments made to others; tell the truth and be honest in all dealings).	Students demonstrate discipline and willingness to produce outputs and are able to take responsibility for their actions in research projects (do the right thing, do not make excuses for errors, acknowledge and correct mistakes, do not manipulate others etc.).	Students take full responsibility for all work activities and personal actions in their research (implement decisions that have been agreed upon; maintain confidentiality; acknowledge and learn from mistakes without blaming others; recognise the impact of one's behaviour on others (maintain professional presence and poise, even under pressure).
Values and Principles in Human Research	*Respect, beneficence, justice*	*Understanding basic principles in human research: respect for persons, beneficence, justice.*	In human subjects research, researchers should respect individuals and their right to make decisions for and about themselves without undue influence or coercion from anyone else (such as researchers, funders, etc.). Researchers should have beneficence or a commitment to maximise benefits and reduce risks to subjects. Researchers should develop justice or a commitment to distribute benefits and risks equally without disadvantaging certain individuals or groups (e.g., mentally disadvantaged, according to race or gender, etc.).	Students can define and explain basic values in human research and can adhere to them in small-sample research.	Students are able to defend the basic principles of human research when treating human subjects in their research.	Students are able to recognise possible threats in human research and can solve issues autonomously and independently.
	Regulations and risk without benefit	*Understanding that human subject research is regulated by society to prevent risk without benefit.*	Human research is carefully regulated by society to ensure that the risks do not outweigh the benefits. Researchers should therefore avoid exposing people to risk without knowing the benefits of the research.	Students know about laws, rules, and regulations with which society regulates human research, know where to find them, and are able to apply them to small-sample research	Students are able to justify laws, rules and regulations in human research and are able to act accordingly in their own research.	Students are able to classify possible positive and negative impact on others during and after research (check assumptions against facts) and are able to gather relevant information in legislation to decide accordingly autonomously and independently (propose a course of actions or make recommendations).

	Approval, Informed consent, right to withdraw	*Understanding the importance of obtaining appropriate approval before conducting research involving human subjects and how to do it. Understanding the importance and the role of informed consent. Understanding the importance of the right to withdraw.*	Researchers are responsible for obtaining appropriate permission in accordance with the regulations of their country and institution before conducting research involving human subjects. Approval is based on three questions: 1) Does the work qualify as research? 2) Does it involve human subjects? 3) Is it exempt from the requirements for obtaining permission. Research is conducted with the intent to draw conclusions, has some general applicability, and uses a generally accepted scientific method. People are considered subjects if the researcher directly interacts with or interferes with them or collects identifiable private information. Decisions about whether studies are exempt from the requirements from obtaining permission must be made by a responsible institutional official and not by the researcher. Subjects should be fully informed of the research in which they are participating and give prior consent. Subjects should have the right to withdraw from experiments at any time.	Students can define and explain why consent is important, are able to get approval when doing small-sample research and understand that research subjects have the right to withdraw from research at any point.	Students can justify the need for gathering informed consent in their research projects (ensure that information is well-organised, understood by all parties and shared in timely manner using the most appropriate method).	Students are able to face and judge complex dilemmas regarding the informed consent and the right to withdraw (that some subjects cannot give informed consent), are able to address the most vulnerable groups in human research autonomously and independently and to decide upon regulations.
Values and Principles in Animal Research	*Moral issues, proper care, concern for different species and reducing pain and suffering*	*Understanding the moral issues regarding the use of animals in research and the issues raised by concern for different species. Understanding the importance of proper care in animal research. Understanding the importance of reducing pain and suffering in animal research.*	There are several moral questions regarding the use of animals in research, such as: What animals can reasonably be used in research, testing, and teaching? Should animals be used to test the safety of experimental drugs? Should they also be used to test the toxicity of chemicals or cosmetics (as was once common, but has now been largely abandoned)? Animal research also raises moral considerations whether some animals, such as primates and pets, deserve more protection than other animals. Researchers should follow the rules and regulations for transporting, caring for, and using laboratory animals, such as feeding and housing the animals appropriately and providing veterinary care. When using research animals, researchers should use appropriate sedation, analgesia, or anaesthesia. They should avoid or minimise pain, discomfort, and distress when consistent with sound scientific practices. Some experimental information cannot be obtained without inflicting pain and suffering on animals. How much pain and suffering is acceptable in experiments is not easily determined.	Students can define and explain moral issues (e.g., moral considerations regarding different species in animal research, like primates or pets) regarding the use of animals in research, know animal behaviour (e.g., signs of pain) and practices and procedures (rules and regulations for the transportation, care and use of research animals, know how to reduce pain and suffering in animal research, etc.) which should be considered if performing research on animals.	Students can compare and contrast different approaches in using animals in research and use practices and procedures for the care and management of animals in their research (monitor animal wellbeing, rules, and regulations for transportation, and methods for reducing pain and suffering).	Students are able to face dilemmas and issues autonomously and independently regarding the use of animals in research and judge the usage of different species in specific research.
	RRR (Replacement, reduction, refinement)	*Understanding basic principles in animal research: replacement, reduction, refinement.*	Replacement means using non-animal models, such as computer simulations, or lower species. Reduction means the use of methods aimed at reducing the number of animals. Refinement means the elimination or reduction of unnecessary pain and suffering.	Students can define and explain RRR as the basic principles in animal research.	Students are able to plan research within the basic principles of animal research under supervision.	Students are able to face dilemmas and issues regarding the RRR in animal research and are able to propose, plan, and use alternative research approaches (e.g., computer simulations when eligible) autonomously and independently.
Regulations and Safeguards	*Government regulations, institutional policies, and professional codes*	*Understanding the sources of rules for the responsible conduct of research (where the rules come from). Understanding government regulations, institutional policies, and professional codes. Understanding the importance of public availability of integrity policies in research institutions.*	Sources of rules for the responsible conduct of research are: government regulations, institutional policies, professional codes, and personal beliefs. Countries and institutions have different regulations, policies, requirements, guidelines, and recommended practices regarding the conduct of research. Institutional guidelines are often more comprehensive than governmental policies. Several policies are adopted as fundamental by many countries and societies, such as the Nurnberg Code and the Declaration of Helsinki. Information on institutional research policies, links to government policies, forms and instructions, research training programmes, and lists of key personnel should be posted by research institutions on their websites.	Students can define and explain four basic sources of rules of research integrity (government regulations, institutional policies, professional codes, and personal convictions) and are able to find publicly available sources and adhere to them in small-sample research.	Students are able to compare and contrast many government regulations, institutional policies and professional codes in research conduct and can use them in their research. They can justify the necessity for integrity policies to be publicly available.	Students understand the differences in the norms for responsible conduct between fields (countries, institutions, scientific areas, etc.) and are able to adhere to them autonomously and independently when researching.

	Personal responsibility and professional self-regulations	*Understanding the need for developing personal responsibility in research integrity. Understanding and showing awareness of the importance of self-regulation in avoiding and dealing with research misconduct.*	Rules set only the minimum standards for research integrity; therefore, responsible research requires more than just following rules. It is not enough to follow the rules to resolve personal conflicts and moral dilemmas that arise in research. Rules must therefore be supplemented by good judgment and a strong sense of personal integrity. The level of research integrity in society depends on successful professional self-regulation, which requires conscientious community participation. This means that researchers must take responsibility for their actions.	Students recognise and internalise rules of research integrity as minimal standards and apply them to small-sample research.	Students are able to defend and judge ethical and moral dilemmas in research, adapt and change their behaviour accordingly and respond with personal responsibility and professional self-regulation to avoid misconduct.	Students know how to face, discuss, and resolve complex ethical and moral dilemmas within their research field and are able to use good judgement in addition to rules. They are able to take prompt action in cases of unprofessional or unethical behaviour, act without consideration of personal gain, resist undue pressure and do not acquiesce to inappropriate personal requests for favours, political pressure, or promise of gain.
	Compliance with the standards of the discipline and legal and ethical provisions	*Understanding the importance of complying with the standards of the discipline and legal and ethical provisions.*	A safeguard for researchers to avoid research misconduct is careful adherence to the codes and regulations relevant to their discipline, the legal requirements in their society, and the ethical regulations in their field of research.	Students can define and explain codes of conduct and regulations within their discipline and apply them to small-sample research.	Students can carefully comply with the codes and regulations relevant to their discipline when doing research under supervision and justify compliance to the codes, regulations, ethical, and legal provision.	Students are able to face and discuss research and ethical standards within their research discipline as well as legal and ethical provisions and are able to act accordingly in an autonomous and independent way.
	State-of-the-art	*Being aware of the state-of-the-art of research ideas and knowledge in the field of research.*	A safeguard for researchers to prevent research misconduct is their awareness of the state of development of research ideas in their research area.	Students are able to find, identify, collect and organise ideas and the most up-to-date knowledge for analysis and decision-making within their field of research.	Students are able to compare and contrast found data for their research assignment, are able to pursue leads for additional sources of information within their research area and can clearly document sources and organise the information according to the research needs.	Students are able to screen out irrelevant and vague information, keeping only the high-quality data. They question the limits, quality, and accuracy of data and are able to search for details and confirm suspect data. They know when more information is needed and when enough has been collected to reach a conclusion. They find the trends and relationships in the emerging fact pattern and identify new or related lines of research that lead to more successful or complete conclusions.
	Training in research (research design, method, analysis, protocols, ethics)	*Understanding the importance of training in research and being able to comply with research protocols.*	In every research discipline, there are established research protocols designed to standardise research and prevent research misconduct. Research protocols thus serve as safeguards, and researchers should follow these protocols carefully. Training in research protocols is an important safeguard to prevent research misconduct.	Students recognise and internalise that knowledge of research protocols contributes to the quality of the research.	Students are able to compare and contrast research protocols, select them accordingly and comply to them in their research projects.	Students have a detailed knowledge of research protocols within their research field and are able to execute research autonomously and independently within these protocols.
	Minimal standards vs desirable level of integrity	*Understanding and showing awareness of the difference between minimal standards in avoiding research misconduct and the desirable level of integrity.*	There is a difference between a minimal standard and a desirable level of research integrity. Avoiding research misconduct is only a minimal standard, meaning that even though majority of researchers do not commit research misconduct, this does not necessarily suggest that the overall level of research integrity is high.	/	Students understand and distinguish between minimal standards in avoiding research misconduct and the desirable level of integrity.	Students are able to face dilemmas and issues in their research regarding the level of integrity in the research field and strive to the highest standards of integrity in their research.
	Managing risks	*Being able to recognise and manage potential risks in research.*	One safeguard to prevent research misconduct is the ability of researchers to identify, anticipate, and manage potential harms and risks associated with their research.	Students can define and explain potential risks in research and respond to them in small-sample research.	Students are able to compare and contrast potential risks in their research and respond to them properly.	Students are able to autonomously and independently anticipate risks and are able to compose proper protocols for avoiding potential misconduct in their research.

Research Practice

Subfield	Competency			Competency Rubric (Behavioural Indicators)		
				Levels of Complexity/Study Levels		
	Competency Name	Competency Definition	Explanation	Basic/BA	Intermediate/MA	Advanced/PhD
Research Environment	*'Good' environment*	*Understanding the criteria for a good research environment.*	A 'good' research environment should provide: 1) Equal treatment (regarding race, gender, sexual orientation, ethnicity etc.); 2) Professional practice (researchers should maintain a research environment that respects accepted practices for conducting research responsibly; trainees learn by example and therefore mentors should maintain a research environment that sets appropriate examples); 3) Training in research integrity.	Students can define and explain the conditions of a good research environment and know how to collaborate when researching with other students and/or teachers.	Students are willing to collaborate and can justify collaboration with junior students and/or teachers regardless of their social status, ethnicity, nationality, and race and, when needed, act as a bridge between junior students and teachers.	Students can motivate others and autonomously and independently establish a collaborative research project with junior and senior researchers.
	The role of leadership and promoting awareness	*Understanding the responsibilities of institution leadership also regarding the promotion of the awareness of research integrity.*	Research institutions and organisations need to provide clear policies on research integrity and how to deal with violations. Research institutions should promote a culture of research integrity.	Students can define and explain the rules and research policies at the university where they study and know where to find them.	Students can defend and justify the rules of their university and other institutions on the national level, know where to find them and are aware of the consequences of misuse.	Students respect research and they know the rules of research policies on different levels (institutional, professional, national) and are able to justify and protect them when improper use is detected.
	Proper infrastructure, research funds and safe use of materials	*Understanding the importance of the proper infrastructure, proper use of research funds, and safe use of hazardous materials in their research setting.*	Research institutions should have infrastructure and funding to manage and protect data and research materials (qualitative and quantitative data, protocols, processes, research artefacts, associated metadata, etc.) necessary for the reproducibility, traceability, and accountability of research.	Students know where they can obtain and properly store research materials at their university (e.g., online archives of the institution) and are aware of hazardous materials.	Students are able to manage storage of research materials on their own. They are able to justify the safe use of hazardous materials in their research.	Students are able to detect possible risks of infrastructure for the storage of research materials. They know how to manage research funds and judge their proper usage in research autonomously and independently.
	Open and reproducible hiring	*Understanding the importance of open and reproducible hiring.*	Research institutions and organisations should provide open and replicable practices in hiring and promoting researchers.	/	Students know the employment policies of their institution.	Students can autonomously and independently select research team members in an unbiased selection procedure (regardless of gender, social, and family background, etc.).
	Data storage, ownership, and protection	*Understanding issues regarding data ownership and protection.*	Public funders, such as governments, oblige research institutions to use data collected with public funds for the public good. Private funders retain the right to use the data commercially. Philanthropic organisations hold or give away property rights, depending on their interests. Before collecting data, ownership issues must be carefully addressed. Before beginning, researchers must answer the following questions: Who will own the research data? What rights will I have to publish the data? Will I incur any obligations as a result of collecting this data? Also, the proper storage and protection of the data regarding damage/loss/theft, confidentiality (personal data and other data protection restrictions, etc.), and retention period must be clearly regulated.	Students know how and where to store collected data.	Students understand the risks of improper data storage and possible misuse. They are able to compare and contrast different protocols of storage and defend their choice.	Students understand complex issues regarding data ownership and protection (e.g., when their data is jointly owned), are able to switch between different protocols and have the ability to treat data accordingly (e.g., EU funding).

Supervision and Mentoring	*Proper mentoring and basic responsibilities of mentors and trainees*	*Understanding the importance of proper mentoring and the responsibilities of individual parties.*	Good mentoring is based on a clear understanding of mutual responsibilities, appropriate supervision, and review, with the intention that the primary purpose of mentoring is to prepare trainees to become successful researchers. Senior researchers mentor their team members and provide guidance and training to develop, design, and structure research activities properly. Interns need to know how much time to devote to their mentor's research, what criteria are used to evaluate their work, are standard operating procedures and research protocols what, and how authorship and ownership are determined. Interns should be conscientious about performing their assigned work, respect authorities, follow research regulations and protocols, and adhere to authorship and ownership agreements.	Students can define and explain the responsibilities and limits of mentoring and students' own work (regarding time, workload, etc.) and can properly prepare when approaching a mentor regarding their research proposal.	Students can justify their choice of mentorship for their research project. They understand the limits and differences of mentorship and authorship (when the mentor is doing the work instead of the student).	Students are aware of possible risks of insufficient references of the proposed mentor and are able to present arguments for having more mentors.
	From supervision and review to independent research	*Understanding proper supervision and what it takes to develop into an independent researcher.*	Mentors must ensure adequate instruction in research methods, promote the development of the intern, provide an understanding of responsible research practices, and carefully review work conducted under their supervision (e.g., reviewing research notes and other data collections; carefully reading manuscripts written by interns; meeting regularly with interns to keep abreast of their work; and encouraging interns to present and discuss data at research meetings). Mentors should routinely check to see if the intern is developing into a responsible researcher.	Students take their mentor' suggestions seriously and apply them as intended.	Students are able to adapt and change their research in line with their mentor's comments.	Students can autonomously and independently decide when they can conduct their research or parts of it without supervision and judge their mentor's feedback on the principles and values of research ethics.
	Misusing seniority	*Understanding and showing awareness of the misuse of seniority as research malpractice.*	When senior researchers induce junior researchers to violate research integrity, they abuse their seniority.	Students know the limits of seniority in the relationship between student and mentor.	Students are able to detect and recognise possible malpractices in different research roles (e.g., misuse of seniority by their mentors and senior researchers).	Students are able to face dilemmas and issues regarding the misuse of seniority. They are able to detect and judge complex malpractices regarding seniority and solve them consensually with other members of the research team.
Research Knowledge	*Research design*	*Understanding research design.*	Research institutions and organisations should ensure that researchers receive rigorous training in research design.	Students know and can explain basic research designs (e.g., qualitative, quantitative) and use them in small-sample research projects.	Students are able to compare and contrast different research designs (e.g., action research, evaluation, etc.) and are able to use them in their research under supervision.	Students autonomously and independently select research designs, judge their effectiveness, and can combine them in new approaches.
	Research method	*Understanding research method.*	Research institutions and organisations should ensure that researchers receive rigorous training in research methodology.	Students know and can explain basic research methods (e.g., sampling, data gathering, etc.) and use them in small-sample research projects.	Students are able to justify and defend their selection of research methods regarding the quality of research and are able to use selected research methods in their research under supervision.	Students autonomously and independently select and design their research method and are aware of risks of the selected method. They are able to judge the effectiveness of different methods and combine them in mixed method research.
	Data collecting	*Understanding data collection.*	Data collection takes appropriate methods, attention to detail, authorisation (permissions) and recording.	Students know and can explain basic qualitative and quantitative data collecting styles (e.g., survey; interview) and use them in small-sample research projects.	Students are able to compare and contrast advanced qualitative and quantitative data collecting styles (e.g., survey, tests; interview, monitoring) and are able to use selected research methods in their research under supervision.	Students are able to choose the data collection style or styles, judge the effectiveness of use and know the risks of choosing an improper data collection process autonomously and independently. They are able to discuss the risks and benefits of an individual data collection style with their peers.

	FAIR principles in data curation	*Understanding FAIR (Findable, Accessible, Interoperable and Re-usable) principles in data curation.*	There are four basic aspects to consider when curating data: Ownership, Collection, Storage, and Sharing. Research institutions should ensure appropriate curation of all data and research materials with secure storage for an appropriate period, recognise data as legitimate and citable products of research, provide access to data as openly as possible, and in accordance with FAIR principles (Findable, Accessible, Interoperable and Re-usable). In addition, some complex issues need to be considered in data curation: complexity (some data are difficult to store); control (in large projects, data control is often a problem); data confidentiality (e.g., national security).	Students know and can explain basic issues regarding data curation (e.g., they must not adjust acquired data to their needs, and the collected data must not be changed in any way) and use them in small-sample research projects. They know how to manage personal data that might appear during the research.	Students are aware of the consequences of changing collected data. They know how their data can be reused or shared and can estimate the threats of using personal data in research.	Students understand complex issues in data curation (e.g., some data are difficult to store; business confidentiality; national security). They take responsibility for their data not to be adjusted in any part of the research process and take responsibility for their data, meaning that all other researchers can with trust use these data for possible further research.
	Research analysis	*Understanding research analysis.*	Research institutions and organisations should provide researchers with training in research analysis (e.g., statistics).	Students know and can explain basic descriptive and inferential statistics (e.g., chi-square) and use them in small-sample research projects.	Students have advanced knowledge of descriptive and inferential statistics (correlations, parametric/non-parametric test, etc.) and are able to compare and contrast them when defending their usage. They are able to use them in their research, under supervision.	Students are able to upgrade the knowledge of statistical analysis autonomously and independently, if needed for their research. They can discuss different statistical analyses with their peers and senior colleagues and know when the analyses are not sufficient for giving hard evidence statements.
Collaborative Working	*Understanding roles and relationship*	*Understanding the role of the principal investigator and other roles in collaborative work.*	Any project with more than one researcher requires collaboration. In collaborative projects, additional responsibilities of researchers come from complex roles and relationships, different interests, management requirements, and cultural differences. Before work begins, everybody should understand the goals of the project, the role each partner will have, data collecting procedures, storage, how data will be shared, how changes in research design will be made, who will be responsible for writing publications, the criteria for ranking authors; how intellectual property rights and ownership issues will be resolved, and how the collaboration may be modified and when it will end. Collaborators must share results within the collaboration and pay attention to the work of partners.	Students can define and explain different roles in research teams.	Students take their role in the research responsibly (but still under mentorship) and know how to relate properly vis-à-vis other researchers in the research team. They understand the principle of not hiding information from lead researchers.	Students can take the role of a lead researcher. They are able to appoint work to other researchers in the research team properly, taking into account their qualifications.
	Responsibility and agreement between all partners and collaboration issues	*Understanding the responsibility of all partners, collaborative work, and common-sense rules.*	All partners in research collaborations should take responsibility for the integrity of the research. All partners should formally agree at the outset of their collaboration on expectations and standards related to research integrity, applicable laws and regulations, protection of collaborators' intellectual property, and procedures for handling conflicts and potential instances of misconduct. When researchers from different disciplines bring different practices or expectations to a project, they should heed two common-sense rules: Don't ignore responsibilities and choose the most challenging option when given the choice to act appropriately. When in doubt, one should strive for the highest, not the lowest, standard of integrity.	Students take their role in a collaborative research team seriously.	Students are aware that approaches in different fields of research must be considered and coordinated in collaborative research. They are able to take responsibility and independently execute a smaller part of collaborative research.	Students are able to manage and lead research in collaboration and coordinate approaches from different fields.
	Data transparency and sharing	*Understanding issues regarding data sharing.*	Researchers, research institutions, and organisations should provide transparency about how their data and research materials can be accessed or used. Data should be made as widely and freely available as possible for other researchers to review and use, while respecting the privacy of participants and protecting confidential and proprietary data. It is widely agreed that research data should be shared, but it is often difficult to decide when and with whom. Researchers should not publish preliminary data, meaning data that have not been carefully reviewed and validated, unless it is of immediate public health importance, or similar.	Students can define and explain the principle of anonymity of presented data.	Students can analyse circumstances and defend their decision on data sharing.	Students can autonomously and independently manage research data and judge the effectiveness of its sharing.

Publication and Dissemination

Subfield	Competency			Competency Rubric (Behavioural Indicators)		
				Levels of Complexity/Study Levels		
	Competency Name	Competency Definition	Explanation	Basic/BA	Intermediate/MA	Advanced/PhD
Authorship	*Authorship contribution, importance, sequence, and responsibility*	*Understanding the authorship contribution and sequence. Understanding the role of the corresponding author and ability to act as one.*	Since researchers are evaluated on the quality and quantity of their publications, the authorship on publications should truthfully represent those responsible for the research. Authors are those individuals who were instrumental in the conception and design of the research, the collection and analysis of data, and the writing of the publication. Authors are listed in order of importance, with the first and last authors often given special weight. All authors must agree on the order of authorship. One author, called the corresponding author, is responsible for all aspects of a publication: the accuracy of the data, the names listed as authors, the approval of the final draft by all authors, and the handling of all correspondence.	Students can define and explain the assignment of authorship with respect to the contribution, importance, and responsibility of each author.	Students can justify the assignment of authorship with respect to contribution, importance, sequence, and the role of a corresponding author.	Students can judge the assignment of authorship with respect to the contribution, importance, and sequence and are able to act as a corresponding author when submitting to the journals within their scientific area.
	Acknowledgements	*Developing and fostering an attitude to acknowledge other contributors and funders appropriately.*	Often, other individuals and institutions (e.g., collaborators, assistants, funders, etc.) have contributed to the research; this should be appropriately acknowledged in the publication.	Students can define and explain the difference between authorship and acknowledgements.	Students can justify the role of other contributors besides authors and are able to decide when to acknowledge them in their research work.	Students are able to face dilemmas and issues regarding the difference between authorship and acknowledgement and are able to deal with them independently and autonomously in their research.
Reporting Research	*Discrepancy between reporting research and actual research process*	*Understanding the discrepancy between reporting research and the actual research process.*	It should be understood that different research designs in different scientific fields may have different organisation and research processes, but scientific papers are uniformly structured and present the research process as linear, although this is often not the case. In the research process, there are often obstacles, interruptions, and similar that are not apparent from the research report. Therefore, the research report should be understood as an idealisation of an actual and often 'chaotic' research process.	/	Students are aware of the discrepancy between reporting research and the actual research process in different scientific areas.	Students are able to face dilemmas and issues regarding the discrepancy between reporting research and the actual research process and discuss them with their peers and the larger scholarly community.
	Elements of a responsible publication	*Understanding the elements of responsible publication and having the ability to use them. Understanding and having an attitude that regardless of the rank the journal has, authors should adhere to the same integrity criteria.*	A research publication of any kind should present a description of the work done, a report of the results, and an evaluation of the results. It should answer the questions: what was done (methods), what was discovered (results), and how are the results relevant and should be interpreted (discussion). The structure of a publication depends on the discipline. Nevertheless, most empirical research is reported according to the IMRAD structure: Abstracts summarise the content of the publication in sufficient detail to allow other researchers to assess the relevance of the publication; Methods allow other researchers to review and replicate the research; Results allow other researchers make their conclusions; Discussion assesses the significance of the results; Annotations, bibliography, and acknowledgements place the publication in context and acknowledge others for their ideas, support, and work. Researchers should adhere to the same criteria whether they publish in a highly ranked journal or in another alternative publication format. A responsible publication should always meet minimum standards.	Students can define and explain elements of responsible publication (e.g., IMRAD structure).	Students can justify how every element of a research report contributes to a responsible publication and are able to use it in reporting their research.	Students can autonomously and independently write a scientific report respecting the elements of responsible publication, can judge different types of publication by ranking and form and know that regardless of the ranking a journal has, authors should adhere to the same integrity criteria.
	Values in reporting research and communicating results (accuracy, timeliness, transparency)	*Understanding and fostering the values in reporting research: open, honest, timely, transparent, and accurate reporting.*	Research should be published in an open, honest, transparent, timely, and accurate manner. In reporting research, nothing important should be concealed or withheld, nor should anything that has not been done be fictionalised.	Students know that basic values of research are relevant also in the process of reporting research and are able to respect these in a small-sample research report.	Students can justify the importance of values in reporting their research.	Students are able to face dilemmas and issues regarding the values in reporting research by giving examples and discussing them with their peers and/or senior researchers.
	Negative results	*Understanding and acknowledging that negative results should also be reported.*	Authors often refrain from reporting negative results that do not confirm the proposed research hypotheses, as most journals prefer positive results. However, negative results should be considered as valid for publication and dissemination as positive results.	Students know that negative results should also be reported.	Students can justify why negative results should also be reported and are able to defend them in their research reports.	Students can independently and autonomously face dilemmas and issues regarding reporting negative results and know how to discuss them with peers and/or senior researchers.

	Corrections and retractions	*Understanding and acknowledging that it is important to correct or retract a publication if necessary.*	In some cases, publications have to be corrected or even withdrawn after publication, despite positive reviews. Authors and publishers issue such corrections or, if necessary, withdraw the work, clearly stating the reason for doing so.	/	Students are able to contrast the pros and cons of correcting or retracting publication. They know how to justify and present corrections of their research work on a basic level and discuss them with their peers.	Students are able to formulate a response when corrections are needed or a publication should be retracted and are able to appropriately defend and present the given case to their peers and senior researchers. They are able to face dilemmas about their published research presented by other researchers and present dilemmas they discovered in other published research.
Reviewing (Peer Review)	*Types of reviews and criteria of proper reviewing*	*Knowing how to write different types of reviews and being able to act within the criteria of proper reviewing.*	Since an average person cannot properly assess the quality and importance of research, peer review is the basis for ensuring that only high-quality research is funded, published, and promoted. Therefore, most important decisions about research depend on peer review: which projects to fund (grant review), which research to publish (manuscript review), which researchers to hire and promote (staff review), and which research is reliable (literature review). Because the quality of research depends on peer review, and peer review is subject to personal biases, peer review depends on the personal responsibility of the peer to adhere to the following criteria: timely, thorough, constructive, free of personal bias, and respecting the confidentiality.	Students can define and explain different types of reviews (e.g., peer review, grant reviews, manuscript reviews, personnel reviews, etc.).	Students can compare and contrast criteria of proper reviewing in different types of reviews and are able to write a simple review of peers' work.	Students can autonomously and independently write different types of reviews and present commentaries in a clear and transparent way.
	Participation, withdrawal, and meeting deadlines	*Understanding the importance of peers participating in review processes. Understanding and acknowledging the importance of withdrawal when facing a conflict of interest. Understanding and acknowledging the importance of meeting deadlines in the review process.*	Because peer review is the foundation of quality assurance in research, researchers should take their obligation to the research community seriously by participating in peer review. If they have a conflict of interest, reviewers should recuse themselves from involvement in decisions about publication, funding, appointment, promotion, or reward. Research is competitive and should, therefore, be reported as soon as possible. Because peer review is usually an unpaid effort, it can easily be given less priority compared to other obligations of researchers. However, if researchers agree to provide peer review, they should find time to meet the deadlines and fulfil the obligation on time.	Students know that review protocol must be taken seriously (e.g., meeting deadlines).	Students can find objectives for peer reviewing and participating in the review process. They are aware that possible conflicts of interest should be properly addressed (e.g., withdrawal).	Students are able to face dilemmas and issues independently and autonomously regarding participating in different types of review (e.g., grant reviews, manuscript reviews, personnel reviews, etc.). They are able to select proper reviewers according to references and avoid potential biases.
	Confidentiality	*Understanding and acknowledging the importance of confidentiality in the review process. Understanding and acknowledging the importance of not abusing ideas, data or interpretations from the research that is being reviewed.*	Confidentiality is one of the most important values in peer review; therefore, reviewers should maintain confidentiality unless prior permission for disclosure has been obtained. Confidentiality is important in peer review of grants and manuscripts to protect ideas before they are funded or published, and in peer review of collaborators to protect personal privacy. Because reviewers and editors are researchers themselves, they often find inspiration in ideas, data, and interpretations they review. However, they should appropriately respect the rights of authors and proposers and not misuse ideas, data, or interpretations presented in peer-reviewed research.	Students understand confidentiality as the most important value in the review process.	Students understand that ideas, data, or interpretations they come across in the review process must not be abused.	Students are able to face dilemmas and judge what is or is not misuse of confidentiality regarding ideas, data, and interpretation in the review process.
	Assessing quality, judging importance, and writing transparent reviews.	*The ability to assess the quality and importance of research in reviews. Understanding and acknowledging the importance of transparency in reviews and an ability to write transparent reviews.*	In peer review, researchers assess the quality of research findings and make judgments about their significance. This involves assessing the quality of all levels of reported research: research methods, results, interpretations, and relevance of the literature. With regard to the significance of the research, reviewers should answer the following questions: Is the research important to conduct? Are the research findings important enough to be published? One of the most important issues in reviewing is to avoid personal bias. Because reviewers are also researchers with personal beliefs and affiliations, it is often difficult to be objective. One way to reduce the impact of bias is to write transparent reviews; 'transparent' means that it is made clear to anyone reading the review how the review was written and how the reviewer may be biased.	/	Students understand how to assess quality and importance in the review process and are able to write simple, transparent reviews of peers' work, avoiding personal biases.	Students are able to assess the quality and importance of different types of reviews in their field of research and are able to write transparent reviews of other researchers' works autonomously and independently.

	Blind vs non-anonymous review	*Understanding pros and cons of blind vs Non-anonymous reviews.*	Reviews can be blind or non-anonymous, both of which have their strengths and weaknesses. Some believe that eliminating anonymous reviewing reduces the effects of bias by holding reviewers more accountable. However, others argue that non-anonymous reviews would reduce the openness and rigour of reviews. Most review processes are anonymous, which places an obligation and responsibility on the reviewer to be fair.	/	/	Students are able to face and discuss dilemmas and issues regarding blind vs. Non-anonymous review within their research field and in different types of reviews (e.g., grant reviews, manuscript reviews, personnel reviews, etc.).
Publishing	*Publishers and publication process*	*Knowing publishers and understanding the publication process in journals within different research fields.*	The publication process takes time and goes through stages that are standardised in scholarly publishing: Submission, Editorial Screening, Peer Reviewing, Manuscript Decision, Publication.	/	Students know and are able to compare and contrast key journals in their research fields and are able to find publicly available information about the publication process and procedure.	Students can autonomously and independently judge the quality of publishers and, as corresponding authors, follow submission procedures in different journals.
	Author guidelines (e.g., writing style and format)	*Understanding and ability to adhere to the author guidelines of journals in different research fields. Understanding different writing styles within different research fields and an ability to use them.*	Each journal or publisher has specific guidelines for authors, stating how a paper should be written, how references should be cited, etc. There are numerous standardised writing styles and formats for scholarly publications that vary by discipline. The most widely used are APA, Chicago, MLA, among others.	Students know and can apply different writing styles (e.g., APA, Chicago, MLA, etc.) and are able to follow authors' guidelines at their university in writing simple papers/reports.	Students are able to apply basic rules of writing styles (e.g., citation and referencing) and are able to follow authors' guidelines of a chosen journal/institution in their research field.	Students are able to apply all aspects of different writing styles (e.g., formatting of tables, figures, etc.) and follow authors' guidelines in writing complex research reports.
	Publishers' integrity policies	*Knowing journals, publishers and understanding their integrity policies within different research fields.*	Publishers have ethical or integrity policies, stated on their websites, which explain that authors should adhere to research integrity standards when publishing with them.	/	Students are able to find, compare, and contrast publicly available integrity policies of journals and publishers within their research field and understand them.	Students are able to autonomously and independently judge and adhere to integrity policies of journals and publishers within their research field.
	Indexation and impact factor	*Understanding the indexation, ranking and impact factor of journals.*	Journals are included in various indexes (Web of Science, Scopus, etc.) and have different impact factors depending on the discipline.	/	Students know that journals are ranked and indexed according to the quality of published papers (e.g., on the basis of citations).	Students are able to judge and confront dilemmas regarding indexation, journal rankings and impact factors and do not blindly accept given rankings as indicators of quality.
	Predatory publishing	*Understanding the issues and dangers of predatory publishing and hijacked journals. Understanding that supporting predatory journals amounts to publication malpractice.*	In contemporary publishing, bogus publishers and journals have wreaked havoc with naive researchers. The establishment or support of predatory journals undermines research quality control and research integrity. Researchers should be especially careful not to become involved in such activities, either intentionally or inadvertently.	/	Students know that predatory publishing in scientific publication exists and threatens the legitimacy and integrity of scientific publication. Students understand that supporting predatory journals is a form of publication malpractice.	Students understand the criteria and face dilemmas of predatory publishing and the difference between predatory and fake or hijacked journals. They are able to identify predatory and fake publishers and journals within their scientific area and report to the proper authority and alert colleagues. They know different white and blacklists of predatory publishers (e.g., Beall's) and are able to face and discuss dilemmas regarding the lists of predatory publishers.

Violations

Subfield	Competency			Competency Rubric (Behavioural Indicators)		
				Levels of Complexity/Study Levels		
	Competency Name	Competency Definition	Explanation	Basic/BA	Intermediate/MA	Advanced/PhD
Research Misconduct	*Blatant misconduct - FFP (Fabrication, Falsification, Plagiarism)*	*Understanding and acknowledging clearly defined and universally accepted rules concerning blatant misconduct such as fabrication, falsification, and plagiarism.*	Guidelines and regulations define research misconduct as FFP: fabrication, falsification, or plagiarism in proposing, conducting, reviewing, or reporting research. This is also established as the legal threshold for proving misconduct. Fabrication is making up results as if they were genuine. Falsification is the manipulation of research materials, equipment, or procedures, or the unauthorised alteration, omission, or suppression of data or results. Plagiarism is the use of another person's work or ideas without properly crediting the original source. Self-plagiarism is the republication of substantial portions of one's own prior publications, including translations, without properly acknowledging or citing the original. The law usually defines that for an act to be considered research misconduct, it must constitute a significant departure from accepted practices, must have been committed intentionally or knowingly or recklessly, and must be supported by evidence. The term 'significant deviation' or 'serious deviations' is found in institutional guidelines, indicating that researchers should be aware of what constitutes such deviations in their area of research.	Students can define and explain fabrication, falsification, plagiarism in research and know how to avoid this in small-sample research.	Students are able to organise their research in such a way that fabrication, falsification, and plagiarism is avoided. They understand 'serious deviations' in their research setting.	Students are able to face dilemmas and issues autonomously and independently regarding fabrication, falsification, and plagiarism in their research. They are able to judge FFP and discuss detected 'serious deviations' with peers and senior researchers.
	Questionable research practices (QRP)	*Understanding and acknowledging that any distorted reporting (playing with numbers/ results, hypotheses, models, authors, etc.), even though not necessarily blatant misconduct, is potentially research misconduct and a questionable research practice.*	Some forms of research misconduct are generally accepted and defined as blatant (such as FFP). Other forms may vary by discipline, country, institution, and/or journal, or even have no rules at all. Questionable research practices (QRP) are therefore not strictly or legally prohibited, but they significantly distort the reporting of research. In the absence of clear rules, the 'reasonable reader' test is the best way to avoid such behaviour. This means that the researcher should put himself in the role of an outside observer and imagine what he would think of himself if he were to engage in such behaviour. Would he see himself as an offender who is embarrassed/unwilling to disclose?	Students can define and explain questionable research practices and how they differ from blatant misconduct and are able to avoid them in small-sample research.	Students are able to compare and contrast blatant practices and questionable research practices and avoid them in their research.	Students are able to face complex dilemmas and issues regarding questionable research practices and are able to decide autonomously and independently on how to avoid them.
	HARKing	*Understanding HARKing (hypothesising after the results are known) in reporting as a questionable research practice.*	Correcting or even creating hypotheses after research has been completed to make them consistent with research is a questionable research practice.	Students know and understand what HARKing is and avoid it in small-sample research.	Students are able to manage HARKing and are able to act accordingly in their research reports.	Students are able to face dilemmas and issues regarding HARKing and are able to avoid it in their reporting autonomously and independently.
	Selective reporting ('cherry picking') and omitting data	*Understanding selective reporting and omitting research data in reporting as a questionable research practice.*	Not disclosing all research findings is a questionable research practice.	Students know and understand selective reporting and omitting data and avoid it in small-sample research.	Students are able to manage selective reporting and omitting data and are able to act accordingly.	Students are able to face dilemmas and issues regarding selective reporting and omitting data and are able to avoid it autonomously.

	Self-plagiarism	*Understanding self-plagiarism in reporting as a questionable research practice.*	Self-plagiarism is a variant of plagiarism in which the researcher takes statements and phrases from his or her previously published work without properly citing the source. Although not as serious as plagiarism by other authors, it should be avoided because it distorts reporting and duplicates research reports.	Students know and understand self-plagiarism and avoid it in small-sample research.	Students are able to manage self-plagiarism and are able to act accordingly.	Students are able to face dilemmas and issues regarding self-plagiarism and are able to avoid it autonomously.
	Overlap with other papers by author	*Understanding overlap in reporting with other reports/papers by the author as a questionable research practice.*	Overlap between different research reports by the same researcher could be considered a form of self-plagiarism.	/	Students are able to compare and contrast their own work and know that excessive overlap in their own papers is considered research misconduct.	Students are able to judge their own work autonomously, and publications and are able to avoid overlap.
	Selective citing	*Understanding selective citing as publication malpractice and knowing how to avoid it.*	Selective citing can mean two things: citing to promote the importance of someone (a colleague, senior researcher, mentor, etc.) or to please editors, reviewers, or colleagues; or not citing ideas or research findings that run counter to one's research ideas and findings.	Students can define and explain what selective citing is and apply their knowledge on reporting on small-sample research.	Students are able to compare and contrast sources and are able to avoid selective citing in research reports.	Students are able to face dilemmas and issues regarding selective citing autonomously and independently and are able to argue against selective citing when appropriate.
	Excessive self-citation	*Understanding hyping and excessive self-citation in reporting as a questionable research practice.*	Researchers often cite themselves to discuss how their currently published research is based on a continuing evolution of their earlier research. Similarly, when authors publish in their journals, publishers prefer that they cite the papers published in their journals to promote their relevance. However, excessive self-citation, which goes beyond the intention of referencing previous research and seems to serve only self-promotion, is a questionable research practice. This is also why self-citations are a separate category when categorising the impact factors of researchers (such as the h-index) and journals.	/	Students know and understand excessive self-citation.	Students are able to face dilemmas and issues regarding excessive self-citation and are able to avoid them autonomously.
	Redundant/trivial or salami and duplicate publication	*Understanding trivial and duplicate publication as publication malpractice and knowing how to avoid it.*	Salami publication is the process of dividing the results of a single research into multiple publications, called Least Publishable Units (LPUs), in order to increase the number of publications. Although this is not necessarily a bad thing, as more publications can improve systematics (journal publications are, in fact, limited in length) and detail of reporting, salami publication often leads to duplicate publications (i.e., multiple publications of the same results).	/	Students know and understand redundant/trivial or salami and duplicate publication.	Students are able to face dilemmas and issues regarding trivial/salami publication and duplicate publication autonomously and independently and are able to independently decide when a research report can be appropriately divided into multiple publications.
	Misrepresenting and/or exaggerating/hyping research achievements	*Understanding and knowing how not to misrepresent and/or exaggerate research achievements.*	Dishonest reporting or misrepresentation of research results, such as exaggerating the significance and practical applicability of results, is a form of publication misconduct.	/	Students understand misrepresentation and exaggeration/hyping of research achievements as publication malpractice and are able to avoid it in their research reporting.	Students are able to face dilemmas and issues regarding misrepresentation and exaggeration/hyping of research achievements and are able to avoid it autonomously.

	Failure to cite or acknowledge others	*Understanding that consciously not referencing other authors that have researched the problem is a questionable research practice.*	When reporting research, the researcher often finds that other authors have already researched the topic. If the researcher deliberately fails to acknowledge and reference this previous research, this is a questionable research practice.	Students understand why failure to cite or acknowledge others is publication malpractice and are able to avoid it in reporting on small-sample research.	Students are able to recognise issues of failure to cite or acknowledge other, are able to manage them and are able to act accordingly.	Students are able to face dilemmas and issues regarding failure to cite or acknowledge others autonomously and independently and are able to autonomously avoid it in their reporting.
	Paraphrasing and citation; sentence lifted without attribution	*Understanding the difference between paraphrasing and citation and that using sentences of other authors without properly citing or paraphrasing them is a questionable research practice, bordering on plagiarism.*	When one cites other authors, it is not enough to provide a reference. Referencing must be done properly. One must enclose the citations in quotation marks and also correctly indicate the page number of the cited document. When paraphrasing, one must reproduce the thoughts of other paraphrased authors in one's own words and style (and not just substitute words from the source with synonyms) to avoid hidden quotes (citations without quotation marks). Improper quoting and paraphrasing borders on plagiarism, which is paraphrasing or quoting without any reference.	Students understand the difference between paraphrasing and citation and that every use of sentences of other authors should be properly attributed through citation or paraphrase.	/	/
	Withholding research results or giving premature public statements	*Not withholding research results or giving premature public statements and understanding this as publication malpractice.*	Withholding research results could be a form of violation of research integrity. Conversely, premature publication of research results may be a violation of research integrity. Researchers should follow standard publication practices when publishing research results and should not make premature public statements about their work before it has been reviewed. There are exceptions, such as early indications of a significant threat to public health or safety, but in general, results should only be published after they have been carefully reviewed and properly prepared for publication.	/	Students understand why withholding research results is publication malpractice.	Students are able to face dilemmas and issues regarding withholding research results and giving premature public statements autonomously and independently. They are able to independently decide and give arguments for withholding research results and are able to avoid giving premature public statements about their research.
	Malpractices in peer review (e.g., fake referees)	*Understanding and refraining from engaging in inappropriate practices in reviewing research.*	Misconduct in peer review includes actions such as: asking students or others to conduct a peer review on your behalf; using information contained in a grant proposal or unpublished manuscript before it becomes publicly available; discussing grant proposals or manuscripts that you are reviewing with colleagues; keeping a copy of the material you review (manuscripts and grant applications should be shredded or returned after the review is completed); discussing personnel and hiring decisions with colleagues who are not involved in the review process.	/	/	Students understand and have the ability not to engage in inappropriate practices when they review research.
	Citation cartels	*Understanding and having the attitude not to engage in citation cartels.*	Citation cartels are groups of researchers, usually colleagues, who collude to cite each other to increase their impact factors (such as the h-index).	/	/	Students are able to face dilemmas and issues regarding citation cartels and are able to make decisions on how to avoid them autonomously and independently.
	Manipulating authorship (obligatory authorship, ghost authorship, gift authorship etc.)	*Understanding and acknowledging manipulating of authorship as publication malpractice.*	Manipulations of authorship include practices such as ghost or honorary authorship, in which individuals who were not involved in the research are listed as authors for other reasons (e.g., because they hold the chair of the department or programme in which the research was conducted; because they provided funding for the research; because they are the lead researcher in the field; or because they served as a mentor to the lead author).	Students can define and explain ghost or honorary authorship.	Students are able to identify differences between co-authorship and ghost authorship in their research field.	Students are able to face dilemmas and issues regarding manipulating authorship autonomously and independently and are able to solve detected dilemmas independently and consensually within their research setting.

Sources of Research Misconduct	*Premeditated dishonesty*	*Understanding premeditated dishonesty as the most severe instance of research misconduct.*	It is one thing to break the rules accidentally or without full consciousness; however, breaking the rules when being fully aware of them is more serious misconduct. The reasons for this can vary, however, from a desperate need to be published for fear of losing one's career, to a belief that since others have gotten away with it, it is acceptable to do it the same way.	Students are aware that every form of premeditated dishonesty is considered research misconduct.	Students are able to compare and contrast actions (their own and others') in terms of premeditated dishonesty in research and act upon it.	Students are able to face dilemmas and issues regarding their own and others' premeditated dishonesty in research and handle detected conflicts in terms of values and principles autonomously and independently.
	Bending the rules	*Understanding that bending the rules can also be considered as research misconduct.*	Bending the rules means being aware of the rules but attempting to push the boundary between appropriate and inappropriate behaviour and exploiting unclear or inconsistent rules for personal gain. Such bending is related to the belief that 'anything goes' and 'anything that is not forbidden is allowed', often accompanied by specious after-the-fact justifications but with evidence of intent and/or covering one's tracks.	Students are aware that even in small-sample research bending the rules is considered as research misconduct.	Students are able to compare and contrast actions (their own and others') in terms of bending the rules and act upon it.	Students are able to face dilemmas and issues regarding their own and others' bending the rules in research and handle detected conflicts in terms of values and principles autonomously.
	Complexity and ambiguity	*Understanding that complexity and ambiguity of the rules is not an excuse for research misconduct.*	Unclear or different rules, editorial guidelines, etc. lead to ambiguity of rules, i.e., to a general awareness of rules on the one hand, but to their being open to interpretation on the other. Complexity problems can arise when, for example, there are many co-authors, but all of them assume that someone else is doing the final review but no one is actually doing it, leading to some errors, inconsistencies, and integrity problems in publication. Individual co-authors may also submit slightly different versions of the manuscript to different journals without knowing each other's intentions.	Students are aware that complexity and ambiguity are not an excuse for research misconduct.	Students are able to compare and contrast actions (their own and others') in terms of complexity and ambiguity and act upon it.	Students are able to autonomously face dilemmas and issues regarding complexity and ambiguity in research, take their responsibility and handle detected conflicts in terms of values and principles.
	Ignorance and sloppiness	*Understanding that ignorance and sloppiness is not an excuse for research misconduct.*	Some integrity issues may be culturally related, which is often an excuse for ignorance in the sense of 'I didn't know that'. However, effort should be made to familiarise oneself with the rules, which may be specific to some milieus. Lack of experience, research skills (e.g., PhD students, junior researchers etc.) can also be used as excuses for misconduct, but such sloppiness should be prevented through mentoring and supervision. However, this should not lead to a situation where the mentor may have intended to fix a problem but 'never got around to it.'	Students are aware that ignorance and sloppiness is considered research misconduct even in small-sample research.	Students are able to compare and contrast actions (their own and others') in terms of ignorance and sloppiness and act upon it.	Students are able to face dilemmas and issues regarding their own and others' ignorance and sloppiness in research and handle detected conflicts in terms of values and principles autonomously.
	Honest mistake	*Understanding that mistakes may lead to research misconduct even if not intended.*	When caught in research misconduct, researchers often claim that an honest mistake has led to it. However, this is highly unlikely and less credible among established researchers and could only be believed if it is not systematic or part of a pattern.	Students know that even honest mistakes can lead to research misconduct and that proper precautions should be taken to prevent mistakes in research.	Students are able to compare and contrast actions (their own and others') in terms of honest mistakes and act upon it.	Students are able to autonomously face dilemmas and issues regarding their own and others' honest mistakes in research and handle detected conflicts in terms of values and principles.
Conflict of Interests	*Bias and managing conflicts of interest*	*Understanding and acknowledging the role of bias in jeopardising the research process. Understanding that to avoid bias, all conflicts of interest must be declared prior to and during the research process and publication. Understanding the procedures to manage conflicts of interest and the ability to manage them.*	Bias can occur, for example, when a researcher allows funders/sponsors to influence the research process or the reporting of results. Therefore, researchers must disclose all potential conflicts of interest when publishing research findings. Prior to conducting research, research institutions must establish administrative procedures for managing conflicts of interest: Reporting significant conflicts before research begins; managing, reducing, or eliminating significant financial conflicts of interest; and providing information on managing conflicts. 'Managing' a conflict means ensuring that interests do not influence research. Some options are fully disclosing all interests so that they are known to others; monitoring the research or reviewing the results for accuracy and objectivity; removing those with the conflict from critical steps in the research process (in interpreting data or participating in review).	Students can define and explain bias in research practice.	Students understand different types of conflicts of interests, know the procedures how to manage conflicts of interest at their university and are able to avoid bias. They are able to avoid situations and actions considered inappropriate or which might present a conflict of interest.	Students are able to face dilemmas and issues regarding conflicts of interest and dangers of bias in research and give reasons against it. They are able to detect and handle conflicts of interests in their research autonomously and independently prior to and during the research process and publication. If needed, they are able to design a protocol for avoiding conflicts of interests in their research field.
	Financial conflicts	*Understanding and knowing how to deal with financial conflicts of interest.*	Financial conflicts of interest create tensions between personal financial gain and adherence to the core values of honesty, accuracy, efficiency, and objectivity. The prospect of financial gain should not influence commitment to truth and honesty.	/	Students understand financial conflicts.	Students are able to face dilemmas and issues regarding financial conflicts and know how to avoid them (e.g., financial gain, double financing).

	Conflicts of commitment	*Understanding and knowing how to deal with conflicts of commitment, allocation of time, relationships and use of resources.*	Conflicts of commitment place competing demands on researchers' time and loyalty. A researcher may work on one or more funded projects, prepare a proposal for a new project, teach, and advise students, attend, and lecture at professional meetings, serve as a reviewer, sit on advisory boards, or work as a paid consultant, official, or employee in a private company. These different roles can conflict with each other. Researchers must be careful to adhere to time-management rules and not use resources purchased with public funds in private research.	/	Students understand conflicts of commitment.	Students are able to face dilemmas and issues regarding conflicts of commitment and know how to avoid them (e.g., proper allocation of time; proper relationship with other research team members; importance of proper use of resources).
	Institutional conflicts	*Understanding and knowing how to deal with institutional conflicts of interest. Understanding and acknowledging the importance of disclosure of affiliations to avoid conflicts of commitment.*	Institutional conflicts arise when institutional work conflicts with private work (e.g., institutional outputs commercialised by researchers in private ventures). Researchers must be careful to separate their institutional work from their private work and disclose all affiliations. They should not inappropriately use their institutional research affiliations to further their private interests.	/	Students understand institutional conflicts.	Students are able to face dilemmas and issues regarding institutional conflicts and know how to avoid them (e.g., importance of disclosure of affiliations).
	Personal conflicts	*Understanding and knowing how to deal with personal conflicts of interest.*	Personal conflicts arise when researchers judge and interpret research results based solely on personal opinion or affiliation rather than scientific evidence. Therefore, researchers should not review grant proposals and publications of close colleagues and students.	Students can define and explain personal conflicts.	Students are able to manage personal conflicts and are able to act accordingly.	Students are able to face dilemmas and issues regarding personal conflicts and know how to avoid them (e.g., not serve as reviewers for grants and publications submitted by close colleagues and students).
	Intellectual conflicts	*Understanding and knowing how to deal with intellectual conflicts of interest.*	Intellectual conflict arises when a researcher has strong personal views about an idea or theory that influence how he or she evaluates the research of other researchers. Such views should be disclosed so that others can take them into account when evaluating the researcher's claims. The same holds for strong moral beliefs that might influence a researcher's scientific opinions.	/	Students understand intellectual conflicts.	Students are able to face dilemmas and issues regarding intellectual conflicts and know how to avoid them (e.g., personal views of ideas, moral and religious convictions).
Dealing with Violations and Allegations	*Stakeholders affected*	*Understanding how different stakeholders (other researchers, students, employers/ institutions, editors/ journals, societal stakeholders) are affected by various types of research misconduct.*	Misconduct in research affects everyone involved, not only the researchers but also employers, journals, investors, etc. Researchers should be aware of the far-reaching effects of their misconduct on others.	Students know and understand other stakeholders can be affected in research misconduct.	Students are able to predict and manage possible implications for other stakeholders in research misconduct.	Students are able to face dilemmas and issues regarding possible implications for other stakeholders in research misconduct and are able to autonomously avoid it.
	Malicious accusations and hampering	*Understanding the inappropriateness and consequences of malicious accusations of other researchers and avoiding it. Understanding the inappropriateness of delaying or hampering the work of other researchers and avoiding it.*	Malicious accusation means falsely accusing someone of misconduct or other violations and delaying or unreasonably interfering with the work of other researchers.	/	Students understand that malicious accusations and hampering may have serious consequences.	Students understand the inappropriateness of delaying or hampering the work of other researchers and avoid such behaviour.

	Ignoring violations or failure to report misconduct	*Understanding the importance of not ignoring violations that one may come across as a researcher and having the ability to avoid such behaviour.*	Failure to report research misconduct can put others at risk and also undermines professional self-regulation. Therefore, ignoring research integrity violations by others or even covering up misconduct is research misconduct in its own right.	Students understand the importance of not ignoring violations and misconduct they come across as researchers. Students are aware that any misconduct should be reported.	Students are able to recognise and discuss issues of ignoring violations or failure to report misconduct, are able to manage them and are able to act accordingly.	Students are able to face complex dilemmas and issues of ignoring violations and not reporting misconduct autonomously and independently. They are able to decide independently when to officially report possible misconduct.
	Fairness, consistency, transparency, and confidentiality; institutional procedures and presumption of innocence	*Understanding and acknowledging the basic principles in dealing with accusations of research misconduct (fairness, consistency, transparency, and confidentiality). Understanding that all investigations of research misconduct must be carried out confidentially and must result in a conclusion. Understanding that punishment for research misconduct must 'fit the crime'. Understanding that anyone exonerated must be restored. Understanding the institutional procedures for investigating research misconduct. Understanding that persons accused of research misconduct are presumed innocent until accusations are proven.*	Investigations of research misconduct should be fair, comprehensive, and expedient without compromising accuracy, objectivity, or thoroughness. Violations of research integrity should be dealt consistently and transparently. Anyone accused of research misconduct should be presumed innocent until proven otherwise. Procedures for dealing with violations should be publicly available and accessible to ensure their transparency and consistency. These procedures must include: the list of persons authorised to receive and investigate allegations of misconduct; provisions for an initial investigation to determine whether the allegations are substantiated; provisions for a formal investigation to reach conclusions; the person authorised to rule on the conclusions reached in the investigation and to impose administrative measures or sanctions or take steps to rehabilitate the accused person; and provisions for reporting findings to other authorities. Individuals accused of research misconduct should be informed of all details of the allegation and must be given the opportunity to respond to the allegations and provide evidence. Research misconduct investigation procedures must be conducted confidentially to protect those involved in the investigation. Investigations must always lead to a conclusion. Action taken against individuals accused of misconduct must be proportionate to the seriousness of the offense. Restorative action should be taken when researchers are exonerated of allegations of misconduct.	Students know procedures of reporting and investigating misconduct at their institution.	Students understand basic principles of dealing with research violations and misconduct (fairness, consistency, transparency, and confidentiality). They understand that all investigations of research misconduct must result in a conclusion and that punishment for research misconduct must 'fit the crime'. They understand that persons accused of research misconduct are presumed innocent until accusations are proven and that anyone exonerated must be restored.	Students acknowledge the importance of basic principles (fairness, consistency, transparency, confidentiality) in dealing with accusations of research misconduct or violations. They are able to present evidence for and against potential misconduct in the investigation procedure. Students know and are able to find procedures for investigating misconduct at other institutions and the national level.
	Protection for whistle-blowers and respondents; Obstruction of investigation and retaliation against whistle-blowers	*Understanding the importance of the protection of both parties, whistle-blowers, and respondents. Understanding that obstructing investigation and retaliating against whistle-blowers is itself a research misconduct.*	It is important to protect both parties (the whistle-blower and the respondent) when investigating research misconduct. Allegations should not be publicly revealed until properly investigated and confirmed. Exceptions from that are those cases when misconduct could pose a threat to public health and safety. In such cases, the names of individuals should remain confidential, but steps must be taken to prevent negative repercussions in society. Those individuals who report research misconduct in good faith in any way, even if the allegations turn out to be unfounded, should not be penalised. As long as they are reporting in good faith, whistle-blowers must be protected and supported, as they play an important role in professional self-regulation. Institutions protect the rights of whistle-blowers during investigations and ensure that their career prospects are not jeopardised. Therefore, obstruction of investigations and retaliation against whistle-blowers are also research misconduct.	Students understand what whistleblowing means and are aware that all parties in a potential misconduct investigation procedure must be treated fairly.	Students understand that obstructing investigation and whistle-blowers is itself a research misconduct.	Students are able to face dilemmas and issues regarding the relationship between whistle-blowers and respondents. They are aware of possibly delicate personal issues and are able to handle them with consideration to all parties.

Competency Profile for Teaching and Learning Research Integrity

Authors

Jurij Selan, Mira Metljak, Sanja Berčnik, Mateja Dagarin Fojkar (UNIVERZA V LJUBLJANI)

Reviewers

Bert Theunissen, Mariëtte van den Hoven, André Krom, Roald Verhoeff (UNIVERSITEIT UTRECHT)

Vratislav Kózak, Josef Fontana (UNIVERZITA KARLOVA)

Mirjam Westerlaken, Eline Borsboom (ELEVATE BV)

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