VIRT2UE

Training the Trainer

Deliverable 5.4: Capacity building road map

WP5: Training programme organization and dissemination

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Abstract

This deliverable is the capacity building roadmap of the VIRT2UE project. It outlines how the project can support research policymakers across Europe in promoting a culture of research integrity by improving training and education. Based on four case studies of countries with different levels of capacity (Finland, Austria, Italy, Latvia), we construct and elaborate a decision chart in order to help policymakers detect capacity gaps and identify how VIRT2UE and the Embassy of Good Science can reinforce capacity building efforts. Although VIRT2UE focuses primarily on the level of individual researchers and research integrity trainers, the roadmap also analyzes the institutional and national realm because capacity building ideally should occur consistently across all levels of the research system. The deliverable concludes with a brief outlook on the role capacity building shall play in the embedding strategy of the project.

1. Introduction

When asked how to promote research integrity, many experts, especially those in research performing organizations, emphasize the importance of proper training for researchers at all career levels.[1] However, the capacity to make training a pillar for research integrity promotion varies between European countries. This variation is partly due to differences in the availability of appropriately qualified trainers and up-to-date teaching materials of high quality. Other causes relate to systemic factors because national research systems may or may not provide incentives conducive to establishing cultures of research integrity. Moreover, in some countries research integrity continues to be regarded as a second-order issue related to research ethics rather than being viewed as an integral dimension of research excellence.

In recent years and in the wake of a number of highly publicized scandals, a number of projects and initiatives have started to actively promote research integrity. One of them is the VIRT2UE project which focuses specifically on improving research integrity education across Europe. The project has developed an innovative train-the-trainer program on research integrity that departs from the hitherto common focus on compliance and instead takes a virtue ethics approach. Unlike the majority of other programs, VIRT2UE seeks to support researchers in cultivating character traits conducive to research integrity, and thus helps fostering cultures of research integrity by changing conduct on the individual level.

[1] Labib, K., Mokkink, L., Bouter, L., Widdershoven, G., Evans, N., Tijdink, J., Scepanovic, R., Marusic, A. (2019): Report on the rounds of the Delphi procedure, Deliverable 3.4, version 1.0, SOPs4RI project ("Standard Operating Procedures for Research Integrity"), pp. 24-27. https://www.sops4ri.eu/deliverables/ (last accessed 22 September 2020)

The present deliverable is a capacity building roadmap that outlines how the VIRT2UE project can contribute to capacity building efforts and thereby ultimately help improve research systems. The major result of the deliverable is a decision chart that can help policymakers design capacity building policies. Although building capacity for research integrity training is arguably most important in countries and at institutions that currently lack training programs, neither roadmap nor the decision chart are focused on a specific subset of countries or institutions. Instead, we start from the premise that all systems of research integrity governance, including well-developed ones, can be improved, and thus examine what improvements would be desirable and how VIRT2UE could potentially contribute. Consequently, the roadmap in general and the decision chart in particular are of interest to a broad audience of research policymakers.

The remainder of the roadmap is structured as follows: firstly, we provide a brief summary of the VIRT2UE program for readers not familiar with the project. Thereafter, we explain the concept of capacity building in more detail and describe how it relates to research integrity training. We proceed with four case studies of different national research integrity systems. Two of the cases, Finland and Austria, have elaborate research integrity systems and overall high capacity, whereas the other two, Italy and Latvia, tend to lack capacity. Based on the needs and possible contributions of VIRT2UE identified in the case studies, we then move upward on the ladder of abstraction by introducing a decision chart that can help policymakers identify ways to improve capacity. Finally, we conclude with a brief overview of how the capacity building roadmap is related to the embedding strategy of the project that strives to ensure sustainability.

2. The VIRT2UE project in a nutshell

The VIRT2UE project, funded by the EU's Horizon 2020 research and innovation program, has developed an innovative blended learning train-the-trainer program on research integrity which provides participants with the knowledge and skills to conduct a research integrity course. Trainers are taught how to foster reflection on scientific virtues in researchers, and how to promote understanding of the ALLEA European Code of Conduct for Research Integrity.[2] The VIRT2UE program is based on three pillars: 1) a virtue ethics approach to research integrity, 2) a blended learning format, and 3) a toolbox approach that facilitates adaptability to different contexts.

[2] ALLEA (2017): The European Code of Conduct for Research Integrity, revised edition. https://www.allea.org/wp-content/uploads/2017/05/ALLEA-European-Code-of-Conduct-for-Research-Integrity-2017.pdf (last accessed 22 September 2020)

2.1 A virtue ethics approach to teaching research integrity

The VIRT2UE train-the-trainer program has an aspirational approach and focuses on what it means to be a good and virtuous researcher. Instead of teaching about rules and norms, the training focuses primarily on promoting reflection on personal attitudes and behaviors. Participants learn how to train others to reflect on concrete cases and moral dilemmas in research, and to use tools to foster reflection in others. This will strengthen skills that enable trainees to integrate the European Code of Conduct for Research Integrity in their day-to-day professional practice.

2.2 Blended learning

The VIRT2UE train-the-trainer program combines online and face-to-face components. Online materials are designed for individual learning and reflection and provide an introduction to the main topics and philosophical concepts related to research integrity. The face-to-face training develops participants' teaching skills and provides opportunities for interactive, reflective and case-based group activities. The online and face-to-face parts of the program courses are complementary. Online preparation is required for the face-to-face exercises, and the online exercises need to be supported by experiences provided in the face-to-face meetings.[3]

2.3 Adaptability

To enable contextualized research integrity teaching across Europe, the VIRT2UE train-the-trainer program provides adaptable course material. The exercises represent a toolbox from which trainers can build their own courses tailored to the needs of their students. Trainers are encouraged to adapt the materials and modules, as long as the underlying virtue ethics approach and learner-centeredness are maintained.

The VIRT2UE toolbox is open source and available on the Embassy of Good Science, an online wiki-platform which serves as a hub for 'good science'. The platform's wiki functionalities allow for a high level of flexibility because trainers can access materials directly online, suggest changes, and build new modules and share them with a community of trainers.

3. Capacity building

In general, capacity building refers to helping individuals or organizations obtain, improve and retain skills, knowledge, tools, equipment and other resources with the intention to improve their ability to

[3] Due to the consequences of the COVID-19 pandemic, the project has developed online formats of all exercises. While the program thus can be taught without face-to-face sessions, the original version with two face-to-face meetings is to be preferred whenever circumstances permit.

perform their jobs competently.[4] Different levels of capacity can be distinguished, three of which are of particular relevance for this capacity building roadmap: 1) individual capacity, 2) organizational or institutional capacity, and 3) national or systemic capacity. The three-level framework helps guiding our analysis because the levels mirror potential loci of capacity building in the current research system: 1) the level of the individual researcher or educator, 2) the level of the university, research institute, research-intensive company etc. (research environment), and 3) the level of the national research system.

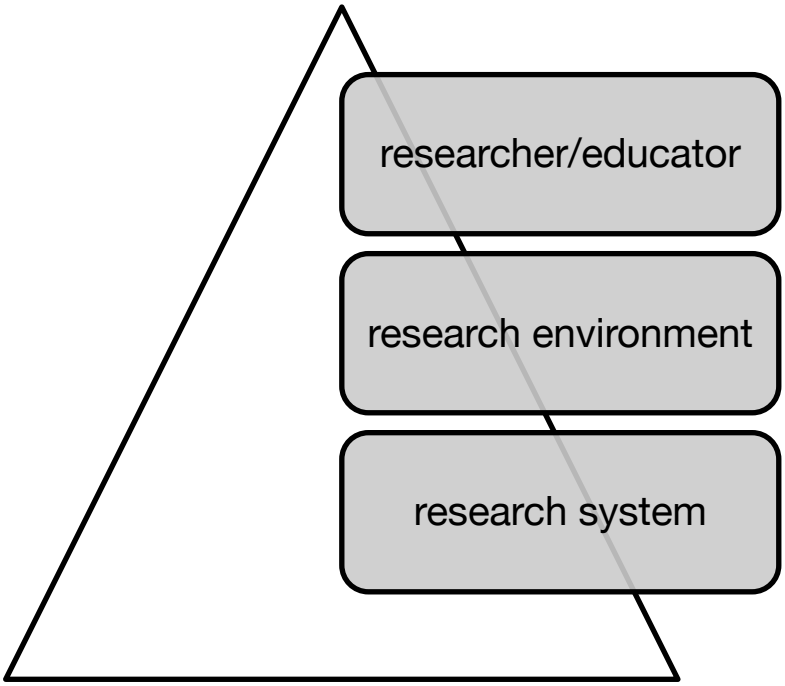

Figure 1: Levels of capacity

Individual capacity refers to knowledge and skills individuals possess and the values they endorse. To act with integrity, researchers need to both know relevant norms and guidelines, and command skills that enable them to follow rules in a reflected manner. To genuinely cultivate the virtues related to research integrity, researchers moreover need to endorse and internalize the values underpinning these virtues. Once knowledge, skills and values are aligned, researchers will habitually act with integrity and thus help foster a research culture based on integrity. To be effective teachers, research integrity trainers need additional knowledge, skills, and values. In particular, they need to know didactical strategies that facilitate learner-centered instruction and be able to apply pedagogical skills to turn strategies into actual teaching practice. Ideally, they should also recognize teaching as inherently valuable and strive to act as role-models that may inspire others.

[4] See e.g. United Nations Development Programme (n.d.): Capacity development: a UNDP primer. New York. http://www.undp.org/content/dam/aplaws/publication/en/publications/capacity-development/capacity-development-a-undp-primer/CDG_PrimerReport_final_web.pdf (last accessed 22 September 2020).

Organizational or institutional capacity refers to the capacity of a collective entity to perform effectively. The ALLEA Code of Conduct for Research Integrity emphasizes that research institutions and organizations are responsible for creating a research environment conducive to promoting awareness and ensuring a prevailing culture of research integrity.[5] With regard to training, supervision and mentoring, the code explicitly states:

- "Research institutions and organisations ensure that researchers receive rigorous training in research design, methodology and analysis.
- Research institutions and organisations develop appropriate and adequate training in ethics and research integrity to ensure that all concerned are made aware of the relevant codes and regulations.
- Researchers across the entire career path, from junior to the most senior level, undertake training in ethics and research integrity.
- Senior researchers, research leaders and supervisors mentor their team members and offer specific guidance and training to properly develop, design and structure their research activity and to foster a culture of research integrity."[6]

To fulfill these obligations, research institutions and organizations across Europe thus need to develop sufficient training capacity and ensure that trainers receive continuing education in order to guarantee that educational interventions follow state-of-the art practice, both in terms of relevant codes and guidelines and in terms of didactical and pedagogical approaches.

National or systemic capacity refers to aspects of the wider governance system that support or exacerbate capacity building efforts. Research institutions and organizations are embedded in national research governance systems that affect how research integrity promotion and training can be realized. More specifically, initiatives to promote and embed research integrity training are partly dependent on whether or not research integrity is recognized as an integral dimension of excellence in the national research system and whether or not the prevailing research culture supports or at least does not hinder efforts to build capacity. If, for example, systems provide few incentives to comply with research integrity norms while breaches typically remain undetected, initiatives to promote research integrity face considerably larger obstacles than in systems where incentive structures reinforce norm internalization.

Creating a culture of research integrity, the ultimate goal most research integrity promotion initiatives aspire to, presupposes sufficient capacity on all three levels. Research systems should reward compliance with research integrity norms and guidelines, research institutions and organizations should ensure appropriate research environments and training capacities, and individual researcher should strive to cultivate virtues supportive of research integrity.

[5] ALLEA (2017), p. 5, section 2.1
[6] Ibid., p. 5, section 2.2

Since VIRT2UE is a train-the-trainer program and accordingly focuses on the individual and institutional level, the remainder of this roadmap addresses the national or systemic level in somewhat lesser detail than the other two levels. However, as a culture of research integrity only can be sustained if all three levels reinforce each other, the case study section and the decision tree refer to all three levels and point out how VIRT2UE can support building and retaining capacity.

4. Case studies

The following case studies analyze research integrity systems in Finland, Austria, Italy, and Latvia, and identify areas for capacity building to improve performance. Whereas Finland and Austria both have elaborate research integrity systems, including long-standing national research integrity offices, Italy and Latvia face more significant capacity gaps. Although case studies do not allow us to generalize our findings, focusing on heterogenous cases enables us to show how VIRT2UE can reinforce capacity building efforts in very different settings and thus illustrates the broad impact the program can have.

The country report cards developed by the EnTIRE project are a useful resource to analyze further research integrity systems across Europe. The cards will be made available on the Embassy of Good Science in Fall 2020.

4.1 Case study Finland

4.1.1 Infrastructure and policies

In Finland, research integrity governance is based on a self-regulation model by the scientific community rather than on legislation.[7] Responsibility for safeguarding research integrity is shared among higher education institutions and research performing organizations and a national research integrity office. While primary responsibility for promoting research integrity and investigating cases of alleged research misconduct lies with the former, their efforts are guided and supported by the Finnish National Board on Research Integrity (TENK).[8]

[7] See Spoof, S. K. (2018): A framework for self-regulation in research integrity: the Finnish model, step by step. https://vastuullinentiede.fi/en/planning/framework-self-regulation-research-integrity-finnish-model-step-step (last accessed 22 September 2020)
[8] TENK (2012): Guidelines of the Finnish Advisory Board on Research Integrity: Responsible conduct of research and procedures for handling allegations of misconduct in Finland, p. 28. https://www.tenk.fi/sites/tenk.fi/files/HTK_ohje_2012.pdf (last accessed 22 September 2020)

TENK was established in 1991 by decree from the Ministry of Education and Culture to help safeguarding good scientific practice and to promote research integrity.[9] Its *Guidelines of the Finnish Advisory Board on Research Integrity* adopted in 2012 are the central national reference document for research integrity. They have been signed by all Finnish universities and universities of applied sciences, as well as the vast majority of other publicly funded research organizations, the Academy of Finland, Business Finland and the Prime Minister's Office.[10] Consequently, they apply to the vast majority of researchers in Finland.

In recent years, TENK has established a network of research integrity advisers to raise and reinforce awareness about research integrity. The main role of advisers is to provide neutral advice to researchers and staff seeking information on matters related to research integrity, especially regarding the investigation of suspected research misconduct.[11] According to the latest data available, the network includes 124 advisers from 64 institutions.[12]

4.1.2 Incidence of misconduct and questionable research practices

Well-known difficulties of measuring misconduct notwithstanding, TENK's annual reports shed some light on the prevalence of misconduct and questionable research practices. In 2019, 34 new allegations of misconduct were reported to TENK, 13 of which concerned master's theses in universities of applied sciences, compared to 40 new allegations in 2018, 16 of which concerned mater's theses in universities of applied sciences. Significantly lower numbers were reported for 2017 (21), 2016 (20) and 2015 (24), yet it seems plausible to assume that the increase after 2017 is primarily related to the inclusion of master's theses in universities of applied sciences in the statistics from 2018 onwards. Finalized investigations found misconduct to have occurred in 13 cases in 2019 (nine of which refer to master's theses in universities of applied sciences), in 12 cases in 2018 (seven of which refer to master's theses in universities of applied sciences), in one case in 2017, in two cases in 2016 and in four cases in 2015.[13] Disregard (i.e. gross negligence and carelessness during the research process) was found in six cases in 2019 (four of which refer to master's theses in universities of applied sciences), in seven cases in 2018 (none of which refers to master's these in universities of applied sciences), in four cases in 2017, in one case in 2016 and in three cases in 2015. Among investigated cases, no misconduct was found in 21 cases in 2019 (six of which refer to master's theses in universities of applied sciences), in 15 cases in 2018

[9] https://tenk.fi/en/tenk (accessed 19 July 2020)
[10] TENK (2020): Finnish Advisory Board on Research Integrity TENK Annual Report 2019, p. 3. https://tenk.fi/sites/default/files/2020-06/TENK_annual_report_2019.pdf (last accessed 22 September 2020)
[11] TENK (2018): Activities of Research Integrity Advisers., p. 1. https://www.tenk.fi/sites/tenk.fi/files/TENK_Research_Integrity_Advisers_2018.pdf (last accessed 22 September 2020).
[12] TENK (2020), p. 3
[13] Note that a number of finalized investigations have been started in a prior year.

(none of which refer to master's theses in universities of applied sciences), 17 cases in 2017, 16 cases in 2016 and 17 cases in 2015.

With regard to the prevalence of student misconduct, a study of the IPPHEAE project published in 2013 provides some insights. Based on surveys, focus groups, structured interviews, documentation and online evidence, Glendinning, Michalska and Orim found that plagiarism was a rather widespread problem among students, and that cases of plagiarism in student work were often not dealt with appropriately.[14] Moreover, an analysis by Moore of referencing and patterns of plagiarism in bachelor and master theses indicates that academic misconduct among students is somewhat common.[15]

4.1.3 Training

TENK offers annual training for research integrity advisers to ensure their adequate qualification.[16] However, it is important to note that advisers are not responsible for offering research integrity training for researchers or students.[17] Their primary role consists in serving as a link between researchers and TENK. This reflects the approach to research integrity education prevailing in Finland, namely that responsibility for educating and training researchers and students rests with higher education institutions and research performing organizations.

Higher education institutions are expected to integrate research integrity education into graduate and postgraduate programs, while all research performing organizations are expected to offer adequate research integrity training for their staff. Furthermore, every research training unit is expected to cover all relevant aspects of research integrity within its research training program. As a result, "(…) to guarantee the practice of responsible conduct of research, universities and universities of applied sciences should offer continuing education in research integrity to their teachers, to supervisors of theses, researchers, heads of research programmes and to other experts."[18]

Research integrity training in Finland typically refers to the TENK guidelines (available in Finnish, Swedish and English) as central reference document, and therefore usually focuses on the following core principles: integrity, meticulousness and accuracy in conducting research, and in recording,

[14] Glendinning, I. with Michalska, A. and Orim, S.-M. (2013): Plagiarism Policies in Finland. http://plagiarism.cz/ippheae/files/D2-3-10%20FI%20RT%20IPPHEAE%20CU%20Survey%20FinlandNarrative.pdf (last accessed 22 September 2020)
[15] Moore, E. (2014): Accuracy of referencing and patterns of plagiarism in electronically published theses. In: International Journal of Educational Integrity, 10 (1), 42-55. https://doi.org/10.21913/IJEI.v10i1.933
[16] TENK (2020), p.3
[17] Ibid., p. 2
[18] TENK (2012), p. 31

presenting and evaluating the research results.[19] To support the training efforts of higher education institutions and research performing organizations, TENK's website includes section on teaching materials that, however, only contains links to YouTube videos on the investigation of research misconduct and ethical review procedures in the human sciences in Finland.[20] The advice and materials section of the website, while not specifically designed for education and training, provides access to further guidelines, templates and other resources that might help researchers navigate the research integrity landscape. Further information, albeit also not specifically designed for education and training, is available in the articles section on the website of the Federation of Finnish Learned Societies into which TENK's website is embedded.[21]

4.1.4 Needs analysis

In general, research integrity training and education in Finland is certainly better organized than in most other countries, yet it could nonetheless benefit from additional capacity. While especially the system for investigating misconduct and available guidance seem in good shape, teaching capacities are less developed. Unless these capacities are enhanced, there is a risk that a proactive approach that seeks to help researchers navigate the maze of good scientific practice and avoid misconduct is more difficult to implement than guidance documents assume. Moreover, broader proactive education may help empowering researchers to join deliberations about future developments in ethics and research integrity and thereby co-shape updating processes of existing codes in light of new challenges.

Hyytinen and Löfström in a study of teachers at research intensive universities in Finland found that many of them felt that they could benefit from pedagogical training.[22] Thus, offering training for trainers is likely to meet a demand as teachers in higher education seem in general aware of the importance of research integrity and recognize that its teaching should be based on appropriate pedagogy and didactics. Moreover, teachers could benefit from access to a richer variety of teaching materials. TENK's nascent efforts to share materials via its website and other communication channels could be expanded to support teachers more comprehensively.

Currently, teaching conceptions and understandings of how integrity should be fostered through education vary, from reactive approaches that emphasize the investigation and punishment of misconduct to proactive approaches that seek to actively prevent misconduct through targeted interventions, with the latter being considered more promising overall. A further dimension of variation

[19] Ibid., pp. 30-31
[20] https://tenk.fi/en/advice-and-materials/teaching-materials (last accessed 22 September 2020)
[21] https://vastuullinentiede.fi/en/articles (last accessed 22 September 2020)
[22] Hyytinen, H. and Löfström, E. (2017): Reactively, Proactively, Implicitly, Explicitly? Academics' Pedagogical Conceptions of how to Promote Research Ethics and Integrity. In: Journal of Academic Ethics, 15 (1), 23-41. https://doi.org/10.1007/s10805-016-9271-9 (last accessed 22 September 2020)

related to whether research integrity should be taught explicitly (e.g. through courses) or implicitly (e.g. through role modelling), with most participants seeing value in using both approaches.[23] As the VIRT2UE program not only helps trainers to improve their explicit teaching skills, but also seeks to motivate them to act as role models and help trainees identify suitable role models, it addresses both.

As regards learners, a significant minority of students, including a remarkably high number of graduates from universities of applied sciences, does not seem to have internalized research integrity values. Innovative teaching that emphasizes virtues and aims to enthuse participants about research integrity rather than a reactive approach that emphasizes punishment might help students recognize why research integrity is an ideal worth striving for and caring about.

As institutions are responsible for ensuring proper research integrity education, there is a constant need to upskill lecturers in order to ensure that teaching meets highest standards. Here the VIRT2UE program could make a valuable contribution. Due to the growing internalization of research staffs of Finnish higher education institutions and research performing organizations and increasing student mobility, research integrity education across all levels of seniority has become ever more important in recent years in order to maintain the high standards Finland is known for. Perhaps it is worthwhile considering whether regularly attending research integrity trainings should be made mandatory for faculty of all career levels, including supervisors. Due to its flexibility, the VIRT2UE training offers a design that is suitable to address the needs of different target groups and can easily be adapted to focus on the specific challenges faced by, for example, supervisors.

The recent spike in misconduct investigations and findings of misconduct documented above seems largely driven by the inclusion of universities of applied sciences in the reporting scheme. Apparently, there is thus a clear need to increase research integrity training at these institutions, especially among master's students. Offering trainings based on a virtue ethics approach could supplement the recent expansion of the misconduct investigation system to master's theses at universities of applied sciences by a proactive, positive and aspirational approach.

Also, the unsatisfactorily high amount of academic misconduct among students could be addressed on the institutional level. Since responsibility for educating students about research integrity lies with higher education institutions, the amount of misconduct suggests that at least some commonly used approaches to teach good scientific practice are at best partially effective. Therefore, modifications of curricula to include new methods to teach research integrity, like a focus on virtues, could help to improve the situation.

[23] Ibid.

The TENK guidelines on research integrity have two pillars: responsible conduct of research and the investigation of alleged research misconduct. However, while procedures to investigate alleged research misconduct have been aligned across institutions, no complementary framework exists to align research integrity education and to share best practices among institutions. Consequently, Finland's research integrity governance framework could perhaps benefit from a national model curriculum to teach research integrity and an educator and trainer network to share good practices. In this way, a strong complement to the misconduct investigation framework and the research integrity adviser network could be created to ensure that the research integrity promotion pillar of TENK becomes as strong as the investigation pillar.

	NEED
Individual level	• Upskill pedagogical competences of lecturers • Internalize research integrity values among students and researchers
Institutional level	• Upskilling lecturers in research integrity • Provide mandatory research integrity trainings for faculty • Improve training at universities of applied sciences • Modify curricula on the undergraduate and graduate level
National level	• Focus on teaching research integrity to complement misconduct investigation framework • Supplement research integrity adviser network by a trainer and educator network

Table 1: Needs assessment Finland

4.2 Case study Austria

4.2.1 Infrastructure and policies

Like Finland, Austria has a central national contact point for all matters concerning research integrity, the Austrian Agency for Research Integrity (OeAWI). Established in 2008, OeAWI now has a membership of more than 45 institutions, including all Austrian public universities. Further members are various universities of applied sciences, research centers not affiliated to universities and research funding agencies.[24] Member institutions pay fees to ensure that OeAWI is adequately funded to perform its mission. Thus, it seems fair to state that OeAWI is well-anchored in Austria's higher education and research and innovation system.

[24] An overview of member institutions can be found at https://oeawi.at/en/members/ (last accessed 22 September 2020)

The agency is governed by a board of six members and it has a permanent office in Vienna (one managing director, four employees), which gives advice on matters related to research integrity, offers training, and serves as first point of contact for cases where research misconduct is suspected. Responsibility for investigating cases of suspected research misconduct rests with a specialized commission of OeAWI. Hence, its main tasks are twofold: 1) the investigation of suspected research misconduct and the provision of advice, and 2) raising awareness for standards of good scientific practice, both through training and other measures.

The central guidance document on research integrity in Austria is published and disseminated by OeAWI, the *Austrian Agency for Research Integrity Guidelines for Good Scientific Practice* (effective as of April 2015).[25] Development of the guidelines occurred in close cooperation with member institutions, which through their membership of OeAWI pledge to safeguard good scientific practice and to promote research integrity. Hence, responsibility to foster research integrity is shared between OeAWI and its members. The guidelines specify standards of good scientific practice and procedures for investigating research misconduct, thereby contributing to transparency and alignment of expectations. They also are a core reference document for the training of researchers as well as trainers.

4.2.2 Incidence of misconduct and questionable research practices

In general, a summary of all finalized cases investigated by the *OeAWI Commission for Research Integrity* are published in annual reports in anonymized form and can be accessed in the download area at the homepage of the OeAWI.[26] Since the start of data collection in June 2009 until the end of 2019, the commission handled a total of 166 inquiries, nine cases in 2015, 14 cases in 2016, 25 cases in 2017, 22 cases in 2018, and 14 cases in 2019.[27]

Among those, the highest number of cases dealt with plagiarism (79 cases) and authorship conflicts (35). Moreover, there were a number of cases regarding the use of others' ideas (19), data fabrication (16), and obstructing research activities (14). Less frequent cases of research misconduct or questionable research practices concerned creating a disadvantage to a researcher's career (5), inaccurate information in grant proposals (3), inadequate data management (3), unjustified refusal to access data (2), sabotage (1), and conflicts of interest (1).

[25] The guidelines can be accessed online at https://oeawi.at/en/guidelines/ (last accessed 22 September 2020)
[26] https://oeawi.at/en/downloads/ (last accessed 22 September 2020)
[27] OeAWI Commission for Research Integrity (2020): Annual Report 2019, p. 3. https://oeawi.at/wp-content/uploads/2020/07/Annual-Report-2019-final.pdf (last accessed 22 September 2020)

In the preface of the annual report of the commission for 2019, it is noted that almost half of the cases dealt with in that year concern intellectual property or scientific accuracy. It is also noted that these conflicts frequently concern established researchers.[28]

4.2.3 Training

In general, research integrity training offered at higher education institutions and research performing organizations in Austria varies in main focus, depending primarily on specific needs of students and researchers in different disciplines. Overall, the issues covered most extensively in curricula and as extracurricular courses are:

- Research ethics, especially in disciplines where studies often involve humans or animals as study participants, like e.g. the biomedical sciences
- Academic integrity and the prevention of plagiarism, both of which are important across all scientific and scholarly disciplines

The format of training varies from seminar to academic writing tutorial, and no typical or standard format seems to exist.

Besides these curricular and extracurricular trainings, member institutions frequently invite lecturers from OeAWI to deliver lectures, seminars, or workshops on research integrity and good scientific practice, primarily for PhD students.[29] Usually students can choose whether or not to attend these courses. Some institutions, however, have made them mandatory parts of doctoral training.

In order to increase the capacity of member institutions to conduct high quality research integrity training, upon their request OeAWI has developed a train-the-trainer program in 2018.[30] In a two-day interactive workshop, future research integrity trainers are instructed in the fundamentals of research integrity, the avoidance of research misconduct, and unacceptable research practices. Special attention is paid to didactic methods to facilitate research integrity and to foster good scientific practice. After being trained as a research integrity trainer, participants are granted access to plenty of materials for their own subsequent instructional use (case studies, role plays, instructions, PowerPoint presentations, etc.) at a dedicated repository on the homepage of the OeAWI. So far, three train-the-trainer courses have been offered (two in German, one in English), with 52 participants in total. Elements of the VIRT^{2}UE train-the-trainer program have been implemented in one of the train-the-trainer workshops.

[28] Ibid., p. 2.
[29] An overview of trainings OeAWI offers can be found at https://oeawi.at/en/training-overview/ (last accessed 22 September 2020)
[30] Cf. https://oeawi.at/en/training-train-the-trainer/ (last accessed 22 September 2020)

4.2.4 Needs

On the whole, during the last decade many positive developments towards capacity building for research integrity training could be witnessed in Austria. Yet, as Nicole Föger, managing director of the OeAWI, noted in 2015,[31] one seminar on good scientific practice may not be sufficient to safeguard good scientific practice. Thus, additional measures could improve research integrity education and ensure that positive developments are reinforced.

Instead of attending just one or a few seminars, researchers of all disciplines and career levels must constantly strive towards the integrity of their research, as well as of their teaching and learning. Therefore, it might be more sustainable to deploy research integrity training not as an additional or even extracurricular offer, but to develop a comprehensive strategy to make research integrity an integral and explicit constituent of higher education curricula. This would require specific training of university lecturers on how to integrate research integrity in their regular classes.

Due to its flexible toolbox approach, the VIRT2UE train-the-trainer program provides a good opportunity for interested lecturers and curriculum designers to learn more about integrating research integrity topics into regular classes. Over the long term, quality assurance measures could incentivize participation in VIRT2UE or related programs by evaluating teaching and research with a more explicit focus on research integrity. If teaching and research is also evaluated by its adherence to the highest standards of good scientific practice, this may contribute significantly towards a research integrity culture at higher education institutions in Austria and presumably also other countries.

Since supervisors and senior researchers play a significant role in introducing PhD students into research culture,[32] it would be beneficial if not only young researchers, but also supervisors were to attend specific training in research integrity, perhaps with a specific focus on how to promote research integrity through supervision and role-modelling. In the long term, making research integrity training an integral and mandatory practice for all supervisors, junior and senior alike, could contribute significantly towards a research integrity culture. Since train-the-trainer courses on research integrity are specifically designed to foster competences for facilitating exercises on the responsible conduct of research, the VIRT^{2}UE training may be an adequate measure to support supervisors in their attempts to promote research integrity among their more junior colleagues.

[31] Cf. Föger, N. (2015). Der österreichische Weg zur wissenschaftlichen Integrität [The Austrian way towards research integrity]. *GMS Medizin - Bibliothek - Information, 15*(1–2), Doc06. https://doi.org/10.3205/mbi000333 (last accessed 22 September 2020)
[32] Cf. Wellcome Trust (2019): Research Culture | Quantitative Phase, report by E. Lauchlan, p. 44. https://wellcome.ac.uk/sites/default/files/what-researchers-think-about-the-culture-they-work-in-quantitative-research.pdf (last accessed 22 September 2020)

	NEED
Individual level	• Obtain information regularly on how Standards of Good Scientific Practice are interpreted in one's discipline or institution • Attend specific research integrity training (at all career levels)
Institutional level	• Raise awareness for research integrity issues and create advanced research integrity training opportunities for all career levels • Provide mandatory research integrity training for PhD students and supervisors
National level	• Make research integrity an integral and explicit constituent of higher education curricula (undergraduate and postgraduate level) • Develop and deploy quality assurance measures for research integrity teaching

Table 2: Needs assessment Austria

4.3 Case study Italy

4.3.1 Infrastructure and policies

Italy does not currently have a central research integrity office, although the National Research Council's (CNR) research ethics and bioethics committee may evolve into that role in the future.[33] The committee has adopted *Guidelines for Research Integrity* in 2015, which have since been revised in 2019.[34] The guidelines are based on five core principles: 1) dignity, 2) accountability, 3) fairness, 4) rectitude and 5) diligence. To support the realization of these principles, the guidelines emphasize that while researchers have the duty to inform themselves about relevant policies and regulations on research integrity, research institutions are responsible for supplying this information in an easily accessible way and, in particular, for offering training on research integrity. Following this obligation, the committee has started to offer a bimonthly training program for its research staff in 2019.

[33] Van Buggenhout, M. and Christiaens, J. (2016): Research Protocol: The extent and incidence of misconduct, PRINTEGER Deliverable 3.1, p. 15. https://printeger.eu/wp-content/uploads/2016/10/D3.1.pdf (last accessed 22 September 2020)
[34] https://www.cnr.it/sites/default/files/public/media/doc_istituzionali/ethics/guidelines-for-research-integrity-2019.pdf (last accessed 22 September 2020)

4.3.2 Incidence of research misconduct and questionable research practices

A study by Parlangeli et al. suggests that breaches of research integrity occur frequently among non-tenured researchers.[35] While its findings cannot be extrapolated to tenured researchers, it should be noted that the number of researchers working on fixed-term contracts in Italy has increased from 18,000 in 2003 to 32,000 in 2013.[36] Consequently, it is reasonable to argue that breaches of research integrity are a significant problem in Italy, regardless of its prevalence among tenured faculty. The fact that researchers worry about breaches of research integrity, as reported by Mabou Tagne et al.,[37] tentatively suggests that research misconduct is perhaps rather common also on a more general level, although the absence of any central registry for identified misconduct cases complicates assessing its prevalence.

Focusing on student rather than research misconduct, the IPPHEAE project ranked Italy as 25th of 27 European countries in terms of academic integrity maturity in 2013. The same report also lamented a lack of interest in the topic of academic integrity because recruiting interviewees proved very difficult due to an apparent reluctance to talk about the topic.

4.3.3 Training

Most higher education institutions and research performing organizations apparently lack both clear and well-known research integrity policies and effective and consistently applied sanction mechanisms that researchers and research managers are aware of, according to a study by Kennedy et al. conducted within the PRINTEGER project.[38] This is echoed by Mabou Tagne et al., who report that between 16,9 per cent and 30,8 per cent of respondents indicated "don't know" to items related to research and ethical climate at their workplace, operationalized primarily as referring to the effectiveness of institutional rules and procedures for reducing misconduct.[39]

[35] Parlangeli, O., Guidi, S., Marchigani, E., Bracci, M. and Liston, P. (2019) Perceptions of Work-Related Stress and Ethical Misconduct Amongst Non-tenured Researchers in Italy. In: Science and Engineering Ethics, 26, 159-181. https://doi.org/10.1007/s11948-019-00091-6 (last accessed 22 September 2020)
[36] Ibid., p. 163
[37] Mabou Tagne, A., Cassina, N., Furgiuele, A., Storelli, E., Cosentino, M. and Marino, F. (2020): Perceptions and Attitudes about Research Integrity and Misconduct: a Survey among Young Biomedical Researchers in Italy. In: Journal of Academic Ethics, 18, 193-205. https://doi.org/10.1007/s10805-020-09359-0 (last accessed 22 September 2020)
[38] Kennedy, M.-R., Ampollini, I., Breit, E., Bucchi, M., Deans, Z., ter Meulen, R., Seppel, K. and Vie, K. J. (2018): Investigating the workfloor: experiences of research integrity and misconduct through focus groups, PRINTEGER Deliverable 4.3,p. 121 and pp. 133-134. https://printeger.eu/wp-content/uploads/2019/01/D4_3-Investigating-the-work-floor_experience-through-Focus-groups.pdf (last accessed 22 September 2020)
[39] Mabou Tagne et al. (2020)

There are no formal educational programs on research integrity or other topics related to the responsible conduct of research on the national level, apart from intra-institutional trainings offered by the CNR that, however, hardly qualify as genuine national level trainings.[40] In a similar vein, Demoliou in the context of the IPPHAEA project[41] found hardly any evidence for systematic academic integrity training for either students or teachers at higher education institutions in Italy. However, references to academic integrity in general and plagiarism in particular were found in a number of ethics codes.[42] While it should be considered that the IPPHAEA project collected its data in or before 2013 so that it might not anymore reflect the current situation accurately, data from the PRINTEGER project suggests that no fundamental changes have occurred because junior researchers in focus group interviews pointed out that to their knowledge students are usually not taught what misconduct is.[43]

This overall somewhat dire picture notwithstanding, not only the CNR but also some universities have taken steps to improve the research integrity culture. As regards improvements in education, the University of Insubria, for example, has offered a school on methodology, ethics and integrity in biomedical research in 2014 and 2018.[44] Furthermore, the University of Milan has adopted a new code of ethics in 2019 that explicitly covers research integrity. The dissemination of the code will be complemented by measures to improve research integrity education at all levels of study and research.[45] Thus, it seems that at least some research institutions, policymakers and researchers are aware that the current integrity governance system needs improvement, with education and training having been recognized as one mechanisms to spur change.

4.3.4 Needs

Laudable recent initiatives notwithstanding, Italy's research integrity governance system continues to lack capacity in many regards, including training. Good news is that existing shortcomings have been recognized by at least a few important players so that capacity building initiatives may fall on more fertile ground than in the past.

On the individual level, lecturers need to be educated about how to effectively teach research integrity. As the subject has not played a prominent role in the past, the majority of them is unlikely to command

[40] Ibid., p. 194
[41] http://plagiarism.cz/ippheae/ (last accessed 22 September 2020)
[42] Demoliou, C. (2013): Plagiarism Policies in Italy, http://plagiarism.cz/ippheae/files/D2-3-15%20IT%20IPPHEAE%20CD%20Survey%20Italy%20Narrative.pdf (last accessed 22 September 2020)
[43] Kennedy et al. (2018), pp. 133-134
[44] See Mabou Tagne et al. (2020), p. 195. The article include links to YouTube videos of most classes.
[45] The intention to adopt these measures is reported in Lerouge, I. and Hol, A. (2020): Towards a Research Integrity Culture at Universities: From Recommendations to Implementation, LERU Advice Paper No. 26-January 2020, p. 34. https://www.leru.org/files/Towards-a-Research-Integrity-Culture-at-Universities-full-paper.pdf (last accessed 22 September 2020)

the respective skills. Here the VIRT2UE program could make an important contribution by enabling lecturers to become effective research integrity trainers.

Effective training and the long-term internalization of values presuppose awareness of policies and regulations. Hence, institutions should ensure that relevant guidance documents are promoted, e.g. in the context of awareness-raising campaigns. Besides, they should support lecturers interested in becoming research integrity trainers through appropriate incentives to ensure that needed training can also be supplied. In the long run, it could be desirable to make research integrity training mandatory for faculty members to ensure awareness on all levels. Such efforts would benefit from being embedded in and relying on codes of ethics that specify training obligations institutions have to fulfil towards staff and students, and obligations of researchers, research leaders and research managers. Codes could be developed either at the national or the institutional level. In the latter case, efforts should be coordinated at the national level to avoid fragmentation.

Furthermore, research integrity education should be integrated into all curricula at all levels of study, as the CNR guidelines suggest. Initiatives could be reinforced by developing a national framework or model curriculum for research integrity training and the establishment of a network of research integrity trainers to exchange good practices and continuously improve teaching, perhaps under the auspices of the CNR.

All in all, some institutions in Italy have made some steps in the right direction, with the CNR leading efforts, yet a long path still lies ahead of the country to catch-up to countries like Finland and Austria. The VIRT2UE program has the potential to serve as one building block on that road.

	NEED
Individual level	• Upskill pedagogical competences of teachers • Raise awareness of policies and regulations and their meaning for research practice • Internalize research integrity values
Institutional level	• Train research integrity trainers • Provide mandatory research integrity training for faculty members • Integrate research integrity explicitly into all curricula at all levels of study
National level	• Develop codes of ethics that specify 1) training obligations institutions have to fulfil towards staff and students, 2) obligations of researchers, research leaders and research managers

	• Build a national framework for research integrity training • Develop a network of research integrity trainers to exchange good practices and continuously improve teaching

Table 3: Needs assessment Italy

4.4 Case study Latvia

4.4.1 Infrastructure and policies

Unlike Finland and Austria, Latvia does not have a national research integrity office. Accordingly, higher education institutions and research centers are responsible for offering training on research integrity themselves, without assistance from a coordinating body. The main governance tools for implementing research integrity policies other than training are ethics committees and codes of academic ethics.[46]

Currently no national level institutions or research integrity officers are established by the law. The Law on Higher Education Institutions provides a general framework stating that "higher education institutions shall implement their internal quality assurance systems"[47] which indirectly covers research integrity issues. Additionally, standards and guidelines for quality assurance in the European Higher Education Area[48] are applicable to Latvia.

4.4.2 Incidence of research misconduct and questionable research practices

While there are not many studies on research integrity policies and their implementation in Latvia, the available evidence gives some background data on the level of effectiveness of the current research integrity governance system.

A study published in the context of the IPPHEAE project in 2013 collected data by using online questionnaires filled in by students, teachers, and senior managers (although the number of respondents was low). The results of the study showed that at that time only one university in Latvia provided teachers with access to plagiarism detection tools.[49] The study also demonstrated that most of the survey

[46] The report issued by the World Bank Reimbursable Advisory Service on Higher Education Internal Funding and Governance in Latvia is available online. See p. 47. https://www.izm.gov.lv/images/izglitiba_augst/Pasaules_Banka/LV_2nd_HEd_RAS_Ph1_Status_Quo_Report_EXT_FINAL_13Feb17.pdf, p. 47 (last accessed 22 September 2020)
[47] https://likumi.lv/ta/en/en/id/37967-law-on-higher-education-institutions (last accessed 22 September 2020)
[48] https://enqa.eu/wp-content/uploads/2015/11/ESG_2015.pdf (last accessed 22 September 2020)
[49] Stabingis, L. with Sarlauskiene, L. and Cepaitiene, N. (2013): Plagiarism Policies in Latvia. http://plagiarism.cz/ippheae/files/D2-3-

participants "were unable to identify a clear case of plagiarism provided in a set of scenarios, which suggests both teachers and students in Latvia may be inadvertently committing plagiarism".[50]

The recommendations of the study directed at reforms on the national level included using state funding for the creation of repositories for collection and storage of students' written assignments and theses, systematic use of plagiarism detection tools, and development of national level academic integrity guidelines for educational institutions. The recommendations for higher education institutions included developing procedures for handling academic integrity cases and improving academic integrity education both for students and teachers. One of the most important conclusions was that "[t]o some extent the apparent culture of denial and secrecy about plagiarism, based on fear of reputational damage, may be hampering progress on developing sound strategies for addressing cases of plagiarism and academic misconduct",[51] which highlighted the need to change the culture of academic integrity in the country.

A status quo report on governance in Latvian higher education institutions funded by World Bank and published in 2017 addressed, among other things, academic integrity, albeit not research integrity training.[52] The report showed that regarding the use of plagiarism detection tools the situation has improved since 2013, not least because higher education institutions must ensure their availability to be eligible for state-funded study places.[53]

A 2018 study on academic integrity policies in two Baltic states (Latvia and Lithuania) led to conclusion that the practice of academic integrity in higher education institutions is still not optimally managed and the universities have "minimal organisational (i.e. ethical committee) and technical tools (i.e. text-matching software) for supporting academic integrity policy", universities in Latvia follow a punitive approach in academic integrity policies, and mainly individual responsibility is addressed in the institutional regulations.[54]

18%20LV%20EX%20IPPHEAE%20ASU%20Survey%20Latvia.pdf (last accessed 22 September 2020)

[50] Ibid., p.3

[51] Ibid., p.5

[52] World Bank report

[53] Ibid., p. 47

[54] Anohina-Naumeca, A., Tauginienė, L., & Odineca, T. (2018). Academic integrity policies of Baltic state-financed universities in online public spaces. In: International Journal for Educational Integrity, 14(1), p. 8. https://doi.org/10.1007/s40979-018-0031-z (last accessed 22 September 2020)

4.4.3 Training

There are no specific national regulations on research integrity training for students and/or faculty members in Latvia, and relevant law does not include direct provisions regarding research integrity education.

In practice, all universities have developed ethics codes, established academic ethics committees and provide research integrity courses or include research integrity topics in different courses for all study levels; however, the content of these courses and research integrity training for faculty members is not standardized. There is also lack of data about quality of research integrity education. The number of experts with specific education and expertise in research integrity is very small. Currently there are only couple of textbooks in Latvian including research integrity topics, and no publicly available collection of teaching materials in Latvian. Useful materials for teaching purposes are Latvian translations of *General Guidelines for Academic Integrity*[55] and *Glossary for Academic Integrity*[56] developed by the European Network for Academic Integrity (ENAI). Nevertheless, most lecturers when teaching research integrity use materials that are in English or translate them into Latvian themselves.

Since 2019 several higher education institutions take part in a project funded by European Social Fund aiming to ensure better governance of higher education institutions, and this project includes clearly defined activities covering research integrity topics: harmonization of institutional normative documents and research integrity standards, development of training materials and research integrity courses for faculty members.[57] Several Latvian universities are actively collaborating in this project. The project will finish in 2021, and hopefully will significantly improve availability of teaching materials and further education for research integrity trainers.

4.4.4 Needs

Since Latvia does not have a well-established research integrity governance system, needs are manifold. To improve the research integrity education system, it is necessary to enhance training skills and to integrate training into curricula. Unlike in countries with better developed research integrity governance systems, such changes are unlikely to be sufficient. Instead, they must be embedded into broader efforts directed at cultural change to stand good chances to become sustainable.

[55] http://www.academicintegrity.eu/wp/wp-content/uploads/2019/10/RED_Guidelines_RTU_VS_amended_v2.pdf (last accessed 22 September 2020)
[56] http://www.academicintegrity.eu/wp/wp-content/uploads/2019/07/GLOSSARY-LV-FINAL.pdf (last accessed 22 September 2020)
[57] https://likumi.lv/ta/id/296514-darbibas-programmas-izaugsme-un-nodarbinatiba-8-2-3-nbspspecifiska-atbalsta-merka-nodrosinat-labaku-parvaldibu-augstakas (last accessed 22 September 2020)

On the individual level, both teachers and learners would benefit from broadly available information about research integrity in Latvian. Relying on English materials exacerbates effective teaching because by far not all learners are highly proficient in English. Thus, creating and disseminating materials in their native language is a precondition for enabling them to internalize research integrity values in the longer term.

On the institutional level, it is imperative to increase the number of research integrity experts among faculty members. A train-the-trainer program like VIRT2UE is well-designed to address this need because participants are upskilled not only as regards their own knowledge and skills, but also as regards their competence to train others and to become capacity builders themselves. In the longer term, it might be helpful to make research integrity training mandatory for faculty members in order to ensure that relevant knowledge and skills are shared throughout all departments and levels of hierarchy. With regard to teaching students, institutions need to assess the quality of current research integrity teaching in order to systematically improve contents and teaching methods.

These measures, ideally if complemented by improvements in the overall research integrity governance system, have the potential to eventually change institutional ethics cultures from a punitive approach to proactive approach that relies on education and prevention. The VIRT2UE could support these efforts by promoting an approach to research integrity that is aspirational rather than centered on sanctions. Moreover, the necessary change should also foster a culture of transparency and openness and replace the currently dominant culture of denial and secrecy.

On the national level, it would be desirable to develop and deploy quality assurance measures to ensure proper research integrity education. Also, public discussions about research integrity should be encouraged to mobilize broader support for cultural change. In addition, the development of teaching materials in Latvian should ideally be coordinated on the national level to ensure efforts are aligned and to avoid duplications. The same holds true for making research integrity an integral part of curricula: If possible, a coordinated effort at the national level is to be preferred. To support and guide these efforts, national regulations for research integrity training for both students and faculty members should be developed, and a national research integrity office akin to TENK in Finland and OeAWI in Austria should be established.

While the VIRT2UE program alone certainly cannot address all of the identified needs, it can be an important pillar of a wider strategy for change.

	NEED
Individual level	• Provide broadly available information on research integrity in Latvian • Internalize research integrity values
Institutional level	• Increase the number of research integrity experts among faculty members • Provide mandatory research integrity training for all faculty members • Assess quality of research integrity teaching for students and improving the content and methods of teaching • Change institutional ethics culture from using punitive approaches to application of educational and preventive mechanisms • Change institutional culture of denial and secrecy regarding research integrity issues to culture of transparency
National level	• Develop and deploying quality assurance measures for research integrity teaching • Encourage public discussions on research integrity • Develop teaching materials in Latvian • Make research integrity an integral part of higher education curricula (on undergraduate, graduate and PhD level) • Develop national regulations on research integrity training for students and faculty members • Establish national level research integrity office

Table 4: Needs assessment Latvia

	FINLAND	AUSTRIA	ITALY	LATVIA
Individual level	• Upskill pedagogical competences of lecturers • Internalize research integrity values among students and researchers	• Obtain information regularly on how Standards of Good Scientific Practice are interpreted in one's discipline or institution • Attend specific research integrity training (at all career levels)	• Upskill pedagogical competences of teachers • Raise awareness of policies and regulations and their meaning for research practice • Internalize research integrity values	• Provide broadly available information on research integrity in Latvian • Internalize research integrity values
Institutional level	• Upskilling lecturers in research integrity • Provide mandatory research integrity trainings for faculty • Improve training at universities of applied sciences • Modify curricula on the undergraduate and graduate level	• Raise awareness for research integrity issues and create advanced research integrity training opportunities for all career levels • Provide mandatory research integrity training for PhD	• Train research integrity • Provide mandatory research integrity training for faculty members • Integrate research integrity explicitly into all curricula at all levels of study	• Increase the number of research integrity experts among faculty members • Provide mandatory research integrity training for all faculty members • Assess quality of research integrity teaching for

		students and supervisors		students and improving the content and methods of teaching • Change institutional ethics culture from using punitive approaches to application of educational and preventive mechanisms • Change institutional culture of denial and secrecy regarding research integrity issues to culture of transparency
National level	• Focus on teaching research integrity to complement misconduct investigation framework	• Make research integrity an integral and explicit constituent of higher education curricula	• Develop codes of ethics that specify 1) training obligations institutions have to fulfil towards staff	• Develop and deploying quality assurance measures for research integrity teaching

	• Supplement research integrity adviser network by a trainer and educator network	(undergraduate and postgraduate level) • Develop and deploy quality assurance measures for research integrity teaching	and students, 2) obligations of researchers, research leaders and research managers • Build a national framework for research integrity training • Develop a network of research integrity trainers to exchange good practices and continuously improve teaching	• Encourage public discussions on research integrity • Develop teaching materials in Latvian • Make research integrity an integral part of higher education curricula (on undergraduate, graduate and PhD level) • Develop national regulations on research integrity training for students and faculty members • Establish national level research integrity body

Table 5: Overview of needs

5. Capacity building and VIRT2UE

This section explains how VIRT2UE and the Embassy of Good Science (of which VIRT2UE is a pillar) can contribute to building and improving research integrity capacity. Four realms of capacity building are distinguished: 1) training and education, 2) platform and networks, 3) research environment, and 4) national research systems. These realms are related to the three levels of capacity building that guided our analysis in the previous section. Training and education as well as platforms and networks refer to the individual level because they help trainers and researchers to enhance their skills and knowledge. Research environment refers to the institutional level because institutions are responsible for creating supportive research environments, whereas the national research system realm, as the name indicates, refers to the national level.

The decision chart below (Figure 2) visualizes where VIRT2UE and the Embassy of Good Science may support capacity building. The chart depicts the four realms of capacity building and their most important components. Capacity building efforts can focus on each of the components, though not all components are strictly necessary to achieve a high level of research integrity capacity, in particular in relation to national research systems. There is no reason to believe that a national research integrity body is under all circumstances necessary for a high capacity system, for example. Consequently, the chart should be read as a map that sketches multiple possible ways to build research integrity capacity, rather than as an instruction manual presenting a universally applicable solution.

As the chart shows, VIRT2UE and the Embassy of Good Science can support capacity building in many ways, yet they cannot address all relevant components to the same extent. Since VIRT2UE is a train-the-trainer program, it unsurprisingly can have the most profound impact on training and education, whereas direct effects on national research systems are beyond its scope. Therefore, it often may be desirable to embed measures drawing on VIRT2UE and the Embassy of Good Science into overarching capacity building strategies that increase capabilities consistently across all levels. While the chart explicitly allows taking different routes, efforts should be consistent across levels in order to create a culture of research integrity wherein elements reinforce each other.

The remainder of this section outlines in more detail how VIRT2UE and the Embassy of Good Science can support capacity building initiatives aimed at fostering a culture of research integrity consistent with the values, virtues and norms upon which the European Code of Conduct for Research Integrity is based.

5.1 Training and education

5.1.1 Training trainers

As a train-the-trainer program, VIRT2UE can obviously help train research integrity trainers who subsequently train researchers. Hence, the VIRT2UE project in many regards is a project devoted to capacity building. By continuing to offer trainings after the end of the project and by encouraging trained trainers to not only train researchers but also further trainers, VIRT2UE is well-positioned to have lasting impact on research integrity education in (and perhaps also beyond) Europe. The flexible toolbox approach allows an easy adaptation of the training to different contexts and ensures that it can be integrated into larger capacity building strategies effortlessly.

5.1.2 Training researchers

VIRT2UE's beneficial impact could be reinforced by making regular training in research integrity mandatory for researchers, lecturers and supervisors. As a learner-centered program based on a flexible toolbox of exercises, VIRT2UE trainings can easily be adapted to the needs and demands of different target groups, including senior researchers. Moreover, the Embassy of Good Science allows for sharing trainings adapted to different target groups.

5.1.3 Integrating research integrity into curricula

Ideally, research integrity education should already start with students, if not even earlier. Consequently, explicitly integrating research integrity into curricula on all levels of study would also promote research integrity. However, since students (and sometimes also researchers) in many countries are not sufficiently fluent in English to participate in classes taught in a language other than their own, translating educational materials often would be a pre-condition for the success of curricular integration. VIRT2UE's impact on capacity building thus could be increased by translating training materials and making them available on the Embassy of Good Science.

5.1.4 Lifelong learning

The precise meaning of research integrity and what it means to act with integrity changes over time. While values and virtues tend to remain stable, action-guiding norms typically evolve as the research frontier moves. Thus, researchers on all career levels as well as trainers should regularly obtain information on how research integrity is interpreted in light of new challenges, especially in their respective disciplines and at their institutions. In other words, research integrity education requires a steady commitment to lifelong learning. Consequently, also research integrity trainers should update

their skills and knowledge in regular intervals. As stated above, the Embassy of Good Science provides an excellent platform to share updated training material.

5.2 Platforms and networks

Bottom-up research integrity capacity building initiatives can be supported by creating platforms and networks that facilitate sharing good practices and discussing recent developments. Not least due to its wiki functionalities, the Embassy of Good Science is an excellent virtual infrastructure to help capacity building by fostering mutual learning and serving as a hub for sharing and discussing materials, including newly developed ones. Consequently, it can reinforce capacity building efforts targeted at both trainers and researchers because it has been developed for everyone interested in promoting good science and will be owned by the research community.

5.3 Research environment

5.3.1 Supportive structures and processes

Structures and processes on the institutional level should encourage researchers to act with integrity, among other things by ensuring adequate training. Hence, the VIRT2UE program can help higher education institutions and research performing organizations to develop training programs on research integrity. Besides, the program strives to motivate researchers to act as role models and lead by example. If successful, it thus also supports informal learning processes based on socialization.

However, it is important to point out that offering training is only one of the many issues institutions are responsible for, and that capacity building efforts focused on structures and processes should embed VIRT^{2}UE-based measures into a broader strategy. In isolation, VIRT2UE stands hardly a chance to transform research environments.

5.3.2 Organizational culture and incentive structures

Organization cultures and incentive structures should reward integrity, transparency and openness, and condemn not only outright research misconduct, but also questionable research practices. If organizational cultures and incentive structures fail to reward research with integrity or, even worse, reward violations of integrity, capacity building at other levels will tend to have limited effects. In other words, acting with integrity should not mean having to overcome obstacles regularly.

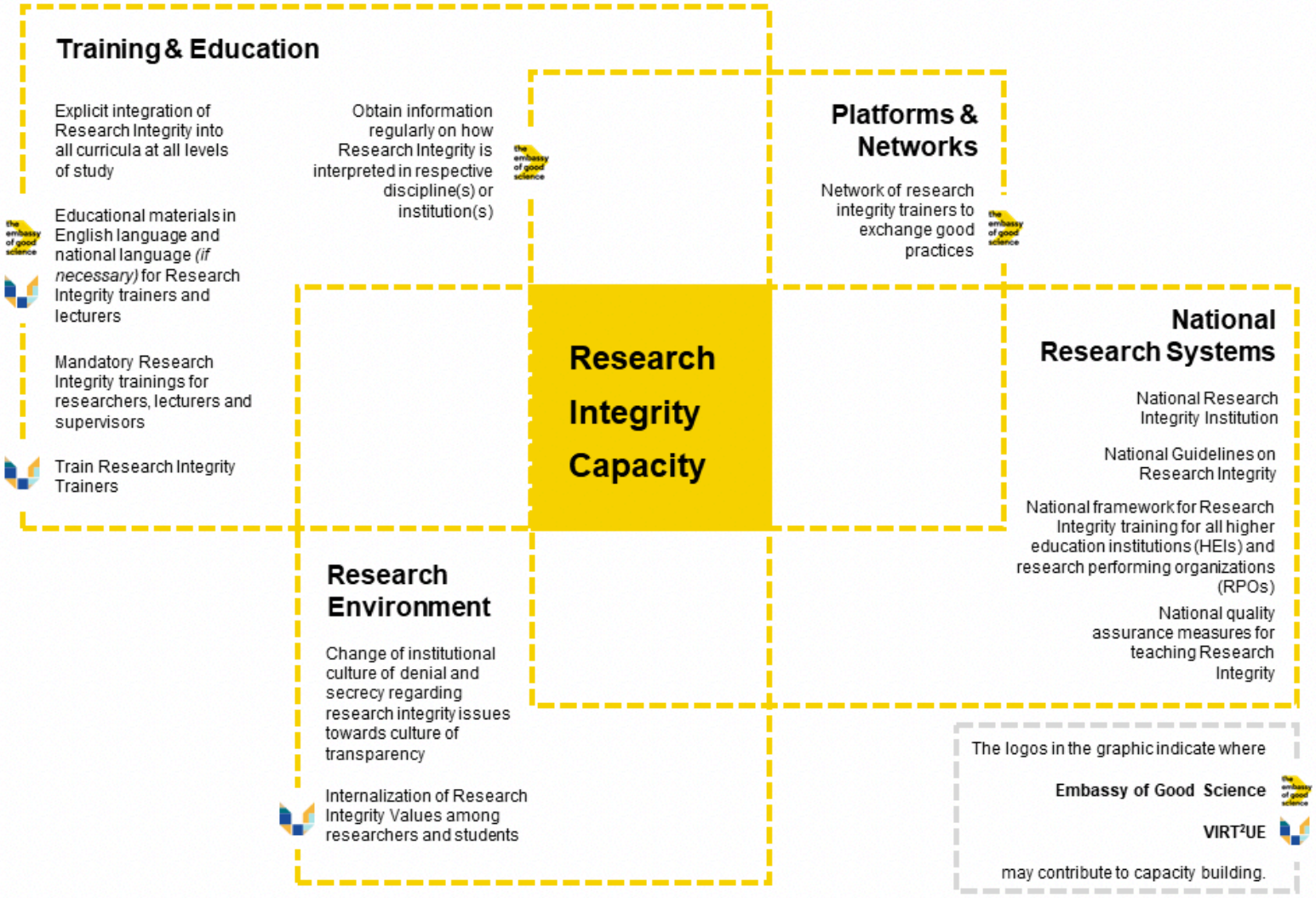

Figure 2: Decision chart

While researchers seeking to cultivate virtues related to research integrity are perhaps more likely to navigate through complex environments and act with integrity even when facing challenges than researchers less attuned to striving for goodness, it is unlikely that even generally virtuous characters will constantly act with integrity in unfavorable environments. VIRT2UE is thus most likely to have a strong impact in environments favorable to research integrity. Nonetheless, the program might also have important impacts in less favorable circumstances because researchers trained by VIRT2UE might be ideal change agents to transform environments. As a result, VIRT2UE's impact in low capacity settings is likely to be strongest if the program reaches people in senior positions, whereas position of program participants is a less important factor in high capacity settings.

5.4 National research systems

Neither VIRT2UE nor the Embassy of Good Science address national or systemic capacity directly. However, to ensure consistency across all levels, capacity building strategies should whenever possible also focus on the system level. National level capacity building may be directed at each of the following components.

5.4.1 National research integrity institution

National research integrity institutions can, inter alia, help harmonize training, the investigation of misconduct and create guidelines. They are potential focal points for other activities on the national level and may thus be drivers of change.

Our case studies suggest that national research integrity institutions are helpful, yet it should be analyzed in detail on a case by case basis whether a national research integrity office fits into the overall research governance system of a given country. If, for example, the most important locus of research governance is regional rather than national, creating an organization on the national level might not necessarily be the best option available.

5.4.2 National research integrity guidelines

National guidelines can help ensuring consistent research integrity governance on the institutional level in a given country, and often serve as an intermediary between the more abstract European Code of Conduct for Research Integrity and more detailed institutional guidelines. To assist capacity building, the Embassy of Good Science could be used as tool to disseminate guidelines.

5.4.3 National framework for research integrity training

Training and education may benefit from guidance on the national level, especially because researchers often move from one institution to another. It can be argued that if national guidelines exist, training and education should also be aligned to actualize their guiding capacity in concrete research practice. Because of its flexible toolbox approach, the VIRT2UE program can be used to inspire the development of national training frameworks, and frameworks could be shared and discussed on the Embassy of Good Science.

5.4.4 National quality assurance measures for research integrity training and education

A logical next step of creating a national training and education framework would be to develop quality assurance measures to both ensure that educational interventions are effective and foster mutual learning as well as the promotion of good practices. VIRT2UE will evaluate its train-the-trainer program systematically before the end of the project and therefore might provide guidance on the design of quality assurance measures.

5.5 The European level

Although neither included in the case studies nor in the decision chart, the European level should not go completely unnoticed. It has not been included more prominently in our analysis because research integrity, like many aspects of research in general, continues to be governed on the national and institutional level, although initiatives like ENRIO (European Network of Research Integrity Offices) and ENERI (European Network of Research Ethics and Research Integrity) have taken important steps towards promoting harmonized practices and mutual learning on the European level. Nonetheless, there is a remarkable incongruence between how research is primarily governed (i.e. nationally), and how it is ever more often conducted (i.e. in cross-national collaborations). Thus, there is no meaningful European level to which the concept of research integrity capacity could be applied in the same way as to the other levels. Instead, it makes more sense to think of the European level as populated by actors (e.g. the European Commission) and networks (e.g. ENRIO and ENERI) that may support or orchestrate capacity building on the individual, institutional and national level. The network building aspects of VIRT2UE reinforce these existing initiatives and the Embassy of Good Science provides them with a new platform that, due to its manifold functionalities, has the potential to engage stakeholders more actively than has hitherto been the case.

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Moreover, the project supports building consistent capacity across Europe because the train-the-trainer program is based on the European Code of Conduct for Research Integrity. Although the flexible toolbox approach of the training allows trained trainers to add national or institutional guidelines to their trainings, the values of the European Code of Conduct for Research Integrity are constitutive elements of the training because the central virtues upon which the training is based have been derived from it.

6. Concluding remarks

This roadmap has outlined how VIRT2UE and the Embassy of Good Science can contribute to building research integrity capacity on the individual, institutional and national level across Europe. Since VIRT^{2}UE and the Embassy of Good Science primarily target the level of the individual researcher and research integrity trainer, it is often recommendable to complement capacity building based on VIRT2UE and the Embassy of Good Science with additional measures on the institutional and national level. Otherwise, there is a risk that capacity is not consistently build across all relevant levels.

The capacity building roadmap will serve as one of the starting points for developing a detailed embedding strategy for the VIRT2UE project. The embedding strategy shall strive to ensure that the project generates lasting impact. Drawing partially on the roadmap, it will examine how VIRT2UE can interact with other projects (e.g. SOPs4RI, Path2Integrity, INTEGRITY) and support ongoing initiatives (e.g. the LERU Research Integrity Thematic Group, the Council for Doctoral Education of the European University Association) to foster a research integrity culture across and beyond Europe.

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