

Creating and Safeguarding Excellent Research Practice

Research Integrity
at a glance



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Introduction

Julia Prieß-Buchheit

In the last decades, many research organisations have encountered severe cases of research misconduct. The cases reveal that researchers committed fraud by plagiarising texts, data and graphics; falsifying research materials; fabricating research results; and tampering with equipment. This has damaged the trustworthiness of research results and in some cases has even led to malpractice in drug prescription, mobile apps, nutrition tips etc. Research misconduct cases occur across disciplines, from physics, psychology, medicine and informatics, to pedagogy, law and others. These cases undermine reliability, honesty, respect, and accountability in research.

Under the umbrella of **Research Integrity**, the research community is combining forces to tackle these challenges. Strategies under this umbrella offer guidance for researchers, organisations that perform and fund it, editors, publishers, and others.

These strategies are both highly valuable and worth implementing, because without research integrity, trust in research inevitably fades, leaving society and researchers “vulnerable to misinformation, suspicion and poorly formulated choices”¹. “Failing to follow good research practices violates professional responsibilities. It damages the research processes, degrades relationships among researchers, undermines trust in and the credibility of research, wastes resources and may expose research subjects, users, society or the environment to unnecessary harm”².

In order to benefit from the products of research, such as smart homes, penicillin, de-escalation strategies, space travel etc., society relies on honest researchers. Especially now, as the research landscape faces ethical challenges such as artificial intelligence and big data, research and educational administrations cannot emphasise the virtue of research integrity enough.

¹ Science Europe Working Group on Research Integrity (2015): Seven Reasons to Care about Integrity in Research. Online resource: http://www.scienceeurope.org/wp-content/uploads/2015/06/20150617_Seven-Reasons_web2_Final.pdf. (25.10.2019)

² ALLEA - All European Academies (2017) The European Code of Conduct for Research Integrity, Revised Edition, Berlin, p.8.

Research integrity is a significant benchmark in the pursuit of knowledge, “obtained through systematic study and thinking, observation and experimentation”³. It should be fostered in research procedures and research environments, as well as in education towards research professionalism.

Administrations play a crucial role in fostering research integrity. By emphasising research integrity, they can actively set the highest possible standards while supporting excellence in their organisations. In the following pages, as part of Path2Integrity (www.path2integrity.eu), authors outline how Research Integrity can be supported within various organisations. What is Path2Integrity? – Path2Integrity is a European project, funded by the European Commission, that raises awareness about research integrity and educates on how to argue in favour of responsible research and reliable research results. Path2Integrity offers organisations two approaches supporting research integrity. Using Path2Integrity’s learning cards, organisations can learn more about research integrity. Meanwhile, Path2Integrity’s campaign materials can help organisations raise awareness.

Why is Research Integrity important for your organisation?

As pointed out by the Science Europe Working Group, there are seven reasons why you should emphasise research integrity⁴:

1. Research Integrity Safeguards the Foundations of Science and Scholarship
2. Research Integrity Maintains Public Confidence in Researchers and Research Evidence
3. Research Integrity Underpins Continued Public Investment in Research
4. Research Integrity Protects the Reputation and Careers of Researchers
5. Research Integrity Prevents Adverse Impacts on Patients and the Public
6. Research Integrity Promotes Economic Advancement
7. Research Integrity Prevents Avoidable Waste of Resources.

³ ALLEA - All European Academies (2017) The European Code of Conduct for Research Integrity, Revised Edition, Berlin, p.3.

⁴ Science Europe Working Group on Research Integrity (2015): Seven Reasons to Care about Integrity in Research. Online resource: http://www.scienceeurope.org/wp-content/uploads/2015/06/20150617_Seven-Reasons_web2_Final.pdf. (01.03.2018)





What is your role in research integrity?

Whether research is conducted in a reliable manner is in the hands of researchers; however, it is also influenced by their environment. Research is embedded in large research systems, as researchers work and collaborate with scientific journals, governmental and regulatory agencies, funding agencies, and many others. All these actors play important roles in ensuring that research is conducted responsibly.

The environment in which researchers work is highly influenced by organisational structures as well as by research administrations and can vary greatly. Some researchers conduct their research at their desk at home. Others are part of more complex institutions. One extraordinary research environment, for example, is the CERN institute in Switzerland. To conduct experiments in high energy physics, the CERN built a particle accelerator, the so-called large hadron collider. At 27 kilometres, the large hadron collider represents a very unique research environment, with special requirements for honesty, accountability, transparency and reliability in collaborative work. A completely different environment is the world's largest library for economic literature. The ZBW – the Leibniz Information Centre for Economics in Kiel, Germany, provides economists and related researchers with access to important information and data within their field following the FAIR principles (findable,

accessible, interoperable and reusable data). The organisation fosters FAIR principles with the Go FAIR initiative, which acts through (cultural) change, training (data stewardship) and building (data infrastructure).

Both examples demonstrate that research environments greatly influence what researchers do, as well as how responsibly they do it. The examples also point to the possibility of inducing change by altering environmental factors, for instance by wisely managing incentives, increasing transparency of misconduct cases, making the applicable standards for research integrity explicit, etc.⁵ On top of these environmental factors of change, research organisations can implement educational programmes to foster research integrity.

⁵ See the Bonn PRINTEGER Statement: Forsberg, E.-M. et al. (2018). Working with Research Integrity—Guidance for Research Performing Organisations: The Bonn PRINTEGER Statement. Science and Engineering Ethics. doi:10.1007/s11948-018-0034-4



What is research integrity and why is it important?

Arja R Aro, based on ALLEA: The European Code of Conduct for Research Integrity, revised edition.

What is research?

Research is the systematic and transparent approach to gain knowledge. Knowledge is needed to understand our world, develop technology such as robots, treatments for diseases, or ways to protect the environment. Thus, research is very important to society. Research needs to be trustworthy and carried out transparently. Research knowledge is not only about technology and science; it also needs to consider individual, community, and cultural values. New technology based on

research (e.g. self-driving cars) needs to be carefully evaluated to decide if, where and how it could be used to serve humankind instead of causing additional harm.

Different stakeholders of research

Researchers are not the only actors in research. Those who fund research (private industry or societal actors, organisations) have power over the research topic chosen and can influence it. Research can be done in humans, animals, or the environment; integrity means that they all need to be treated with respect and harm should be avoided. Further, researchers need to act inclusively and respect each other.

¹ The European Code of Conduct for Research Integrity https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf

Most societies have built structures such as research integrity or research ethics committees to safeguard research. While most medical and clinical research is well covered by ethics committees and regulations, as is social and behavioural sciences research using surveys or interviews, technical science and the use of its products (e.g. drones) is seldom covered by these committees. There is an urgent need to establish regulations, institutional review boards and research integrity committees to also guide this kind of research. In addition to the evaluation of research plans, a proper monitoring system should be built to monitor and safeguard the research process and the impact of research in society.

Principles of research integrity

The central principles of research integrity are reliability, honesty, respect, and accountability². Reliability means that the research is done well, with a proper research design, relevant methods, good data analysis, and rational use of resources. Honesty means that research is planned and done, evaluated and communicated transparently, fairly, and without biases. Respect covers colleagues, research participants, the society, ecosystem, culture and environment. Accountability (=responsibility) covers the research process

from conception to publication, management and organisation, training, supervision and mentoring juniors, and managing the wider impact of research.

Good research practices

The research environment should value integrity and deal with violations to good research practice. When research material and management are well organised, research can be reproduced. Training, supervision, and mentoring should aim at good and rigorous research process and methods, relevant integrity and ethics regulations and codes, and it should involve researchers, leaders, supervisors and mentors.

Research procedures need to be based on what is known about the topic already. Careful research process uses resources reasonably, publishes results with correct interpretations, respects the confidentiality of the information, and adheres to the relevant reporting guidelines².

Safeguards cover relevant regulations and codes and deals with research subjects (human, animal, cultural, biological, environmental, physical) with respect and care; considers the health, safety and welfare of the community and collaborators; and is sensitive to age, gender, culture, religion, ethnic origin, and social class.

Data practices and management need to ensure transparency and access to data 'as open as possible, as closed as necessary' and be FAIR (Findable, Accessible, Interoperable, Re-usable) as well as to respect the intellectual property rights (IPR) of research outputs. In Europe, new regulations have been produced for data protection³.

Collaborative working means that all partners take responsibility for research integrity, agreeing on the goals and the need for open communication; on following codes, laws and regulations; and on handling conflicts. All partners are informed and consulted about submitting the research report for publication.

Publication and dissemination: All authors are fully responsible for the content of research publications (unless otherwise stated). Author order is agreed together; authorship needs to be based on significant contributions to the design, data collection, analysis, and interpretation of results. Generally, results should also be openly communicated to the general public both in traditional and social media. All collaborators, funders, and assistants need to be acknowledged; conflicts of interest need to be declared. Negative results (meaning e.g. that the intervention studied did not work) are as valid as positive ones.

Reviewing, evaluating and editing: Researchers take seriously their commitment in refereeing, reviewing, and evaluating research manuscripts, funding or job applications, promotions, and rewards; they carry out these tasks transparently and justifiably, declaring a conflict of interest when relevant.

Violations of research integrity

Failing research integrity and good practices means renouncing one's professional responsibilities; it damages the research process, degrades relationships between researchers, undermines the trust and credibility of research among people and society, wastes resources, and may also bring danger or even harm to research participants, users, the society, or the environment.

Research misconduct and unacceptable practices

Misconduct can happen in writing a research plan, doing research, reviewing it, or reporting it. Fabrication means making up results and presenting them as real. Falsification is manipulating research material, equipment, or the process, or changing, leaving out data or results without justification. Plagiarism happens when someone uses other people's work and ideas without giving proper credit (=referencing) to the original sources, thus violating the IPR of the original authors.

² Reporting guidelines: example: Enhancing Quality and Transparency of Health Research <https://www.equator-network.org/about-us/what-is-a-reporting-guideline/>

³ General Data Protection Regulation (GDPR) <https://gdpr-info.eu/>

Dealing with violations and allegations of misconduct

Violations need to be dealt with transparently and consistently, considering integrity and fairness. Integrity means that investigations of suspected misconduct are fair, confidential, comprehensive and quick. Investigations should be accurate, objective and thorough. Conflicts of interest need to be declared; conclusions should be reached; and whistle blowers need to be protected. Further, the procedures for dealing with violations need to be publicly available and accessible to ensure their transparency and uniformity.

Fairness means that the process is fair to all parties; those accused of misconduct are given full details of the allegations and allowed a fair process for responding to allegations and presenting evidence. Action to those shown to have participated in misconduct has to be proportionate to the severity of the violation. Appropriate restorative action is taken when researchers are freed from suspected misconduct. It needs to be remembered that anyone accused of research misconduct is presumed innocent until proven otherwise.





Dealing with misconduct and unacceptable practices. The organisations' perspective

Nicole Föger, based on the ENRIO Handbook, Recommendations for the Investigation of Research Misconduct

Every institution should have and/or follow a code of conduct and have clear policies regarding how to handle cases of research misconduct and unacceptable research practices. The code of conduct could be the European Code of Conduct, a national

guideline (or law), or – in their absence – local rules. The document should describe and define research misconduct as well as unacceptable research practices. However, it is crucial that those guidelines are actively communicated, accessible (e.g. on the institution's website), and regularly evaluated and revised. In many institutions, adherence to these guidelines are part of employment agreements or funding contracts.

Cases of research misconduct can occur at any institution, so it is important to deal with them properly. There must be clearly written procedures, consistent with national law or regulations, and these should be easily accessible and publicly available. The committee (or similar body) for dealing with research misconduct should have a clear mandate and must be endorsed by the management. It needs clear and transparent rules stating how members are elected, their roles and responsibilities, the length of their term, and their established autonomy and independence. No influence or interference (e.g. political, personal,..) from outside should be allowed to affect the process or outcome of the investigation. Moreover, the institution should do their utmost to protect and support members of such committees or other involved experts from any retaliation or mistreatment.

All individuals involved in investigations need to be objective and unbiased in their review of allegations. Any real or perceived conflict of interest needs to be immediately disclosed and avoided or managed. The disclosure of any conflict of interest among committee members, internal and external experts and others involved in handling allegations must be dealt with and documented in a transparent way.

It is better to have standing committees as opposed to ad hoc committees because it is important to have an experienced group of members and to build up collective knowledge of how to deal with cases. This helps in the long run to guarantee consistency of decision-making.

Often researchers wish to obtain advice on a confidential basis before making a formal allegation at the committee handling cases on

research misconduct. Early career researchers especially are looking for a low-threshold alternative. For this purpose, it is advisable to have an ombudsperson or other designated confidant at the institute.

The possible consequences of raising a concern or making a formal allegation in good faith, and the process for doing so, need to be explained on a publicly available and easily accessible platform, for example on the website. Potential reactions to malicious or bad faith complaints should be mentioned and consequences described, as these acts could also be defined as research misconduct or unacceptable research practice.

Procedures should clearly indicate to whom allegations should be submitted and from whom allegations will be accepted and in what form (oral, written and/or electronic). Are anonymous allegations accepted? What are the further responsibilities and duties of the complainant and does this person need to be protected from potential retaliation?

Procedures and processes regarding possible research misconduct or unacceptable research practices must be fair, detailed, thorough, comprehensive and objective. It is recommended to have clear deadlines for each procedural step; however, balance should be maintained between thoroughness and speed. The investigation also needs to be conducted as confidentially as possible to protect those who raised the allegations as well as the accused and witnesses.

Putative sanctions should be set out and made known as part of the policy, and it should be clarified whether an appeal from a process and

sanctions is available and to whom. The policy regarding dissemination and communication during and after an investigation should also be considered.

The most important question is whether there are systemic problems at the institution. Reasons for research misconduct, its context, and repeated violations of good practices should be evaluated thoroughly. Lessons learnt need to be incorporated into institutional research integrity promoting plans to improve research culture.

It is highly recommended to establish agreements in cross-institutional and cross-border collaborative projects in the very beginning, for instance as part of a consortium agreement. The Montreal Statement and the OECD "Boilerplate for International Collaborative Research Projects" can be used as a basis.

Finally, in line with transparency (e.g. anonymised summaries of investigated cases), sanctions as well as challenges and improvements discussed at the institutional level should be made public on an annual basis to enable institutions to learn from each other.

What institutions can do:

(based on Science Europe working group on research integrity, Recommendations and PRINTEGER Statement)

- ▶ Easy accessible and clear guidelines and policies about research integrity
- ▶ Accessible contact data of responsible persons/committees
- ▶ Make research integrity guidelines part of the employment agreements and funding contracts
- ▶ Collaboration agreements
- ▶ Offer research integrity-training and mentoring throughout professionals' entire career
- ▶ Clear assignments in the supervision process
- ▶ Wise incentive management
- ▶ Facilitation of open dialogues, improvement of work environment, and work satisfaction



Safeguarding the reputation of universities, funding agencies and other research organisations. To do and not to do

Dirk Lanzerath

For more than 50 years, there has been a real boom in ethical debates in research. But is ethics in research an achievement and an enrichment or simply something that's 'nice to have'? Is it a

necessity or a luxury? Does the reputation of universities, funding agencies, and scientific journals even depend on the fulfilment of ethical requirements?

There are numerous reasons why debates on research integrity and research ethics have become commonplace. There are more and more technological achievements that dramatically change human life and social practice (e.g. life sciences, computers) and overcome and shift natural or technical boundaries (e.g. genetic engineering). This raises the question of whether new ethical or legal boundaries are needed to replace the old ones, especially if what has been achieved has negative side effects (e.g. climate change, loss of biodiversity, health risks). In addition, globalised, organised research leads to conflicts over the standards of values and norms when different cultural areas meet in the lab or in the lecture room. In a globally active research environment, this happens all the time and leads to the request for a cross cultural assessment of values.

If research and science are to be understood, not as areas separated from society, but as integral parts of society and as a social practice, then research and science must be measured not only by the methods of its disciplines, but also by compliance with standards of research ethics and research integrity. Individual actors are not the only ones answerable to these; responsibility lies with the entire research infrastructure, from research institutions to funding organisations and the scientific journals that publish the results.

In many cases, it has become common practice for researchers not only to comply with ethical standards when carrying out research, but also to prepare an ethics report for a funding application or to obtain a positive opinion of an ethics committee beforehand. This practice generates mixed results:



On the one hand:

- ▶ Ethics can improve science, which can be more thoughtful if ethical reflection is included from the outset.
- ▶ Ethical considerations can better link research to social needs by stressing that science and research are not the opposite of society, but an integral part of it.
- ▶ It leads scientists to look at their research practice from a different perspective.

But on the other hand:

- ▶ More time for ethical reflection can also cause frustration because more work needs to be prepared.
- ▶ The research preparations involve much more paperwork and bureaucracy.
- ▶ Some scientists clearly state that they are very much in favour of concentrating on a checklist that needs to be filled out rather than articulating the ethical issues themselves.

Therefore, there is always the danger that ethics will degenerate into pragmatic lip service and be perceived as an annoying duty. To avoid this, the infrastructure in which research takes place needs to consider ethics clearly as a quality feature of research that not only incorporates the rules of scientific ethics but also acknowledges its social obligations. That leads to responsible research and science.

In order to guarantee the latter, more and more ethics and research integrity classes are being introduced in courses of study outside medicine, for example in other life sciences, in technology, engineering, economics, and the social sciences. At least the young scientists should be trained in ethical thinking at an early stage. This is in line with the ethos of science that Robert Merton explains in his classical readings. According to his reflections on the core elements of the norms of science and research, the substantial findings of science are a product of social cooperation and belong to the community. They are a common heritage in which the individual producer's own resources are severely restricted. They are not the sole property of the discoverer and his or her heirs. Moreover, scientists should act for the benefit of a joint scientific undertaking and not for personal gain; they should be disinterested in objectives other than scientific purposes. This is true independence. In the truest sense of the concept, science is a common, intergenerational event. Civilisation depends on good practice in science. But in reality, what's often heard is: these are my projects, my data, my laboratory, my promotion, my career, my doctoral student ... this practice is far from Merton's criteria. However, when universities do not fulfil their responsibilities, the researchers may forget what they have learned theoretically and from case studies, falling into the trap of hierarchy, competition, and promotional advancement when they start their careers.

Whatever is taught in the ethics programme will not bear practical fruit unless science and research are embedded in an appropriate infrastructure that takes research ethics concerns seriously. The infrastructure should not act against careers and competition, but these

must be embedded in an ethical environment that is not regulated by ethics checklists, but through correct customs and habits. Ethical habits can only be learned and implemented if there are good practices and learning models in a functioning environment.

Universities, funding organisations and scientific journals bear great responsibility with regard to this field. Together with research ethics committees and research integrity offices, they form the infrastructure for research integrity and research ethics (www.eneri.eu). Without this infrastructure, a single scientist will be lost. This triad of research institutions, funding organisations and publishers can only guarantee that ethics is not green washing for research by working together and improving the culture of ethics throughout the whole system. These actors should avoid turning ethics into a mere formal act, supporting it as a self-evident habit of the entire system. This can be done by supporting ethical education, compliance and reporting mechanisms for cases of misconduct, guarding against negative career impacts on the reporting researcher. This is the only practice that promotes the reputation of scientists and scientific institutions and which cannot be replaced by a stamp that says 'ethically clean'.





Promoting research integrity. Best practices for institutions and systems

Dick Bourgeois-Doyle

The importance of research integrity to a system's reputation raises the question of how individual universities and other research institutions should promote and nurture it within their walls and what research funding agencies might require of those institutions and their staff.

Recognising this, institutional and system best practices have been inventoried in many formal statements such as those issued by the World Conferences on Research Integrity¹, the Scientific Integrity Consortium², and the Secretariat on Responsible Conduct of

¹ World Conferences on Research Integrity Guidance documents (Singapore Statement, Montreal Statement, Amsterdam Agenda) <https://wcrif.org/guidance>

² Scientific Integrity Principles and Best Practices: Recommendations from a Scientific Integrity Consortium (organized by the North American Branch of the International Life Sciences Institute (ILSI North America) and the U.S. National Academies of Sciences, Engineering, and Medicine's Government-University-Industry Research Roundtable (GUIRR)) Science and Engineering Ethics April 2019, Volume 25, Issue 2, pp 327-355, Kretser, A., Murphy, D., Bertuzzi, S. et al. Sci Eng Ethics (2019) 25: 327. <https://doi.org/10.1007/s11948-019-00094-3>

Research (Canada)³. In fact, entire books have been devoted to the relevant issues and practices⁴. Responsible policy specialists and administrators would be well served by intimate knowledge all such works.

But a helpful grouping of key concepts was presented in the 2019 Report of the Mutual Learning Exercise (MLE) on Research Integrity conducted by the European Commission's Horizon 2020 Policy Support Facility. Exemplary best practices drawn from this report and other sources are grouped below under the MLE's four categories.

1. Processes and structures

In order to foster an institutional culture that promotes research integrity, publicly accessible policies and processes should be in place to frame the design, conduct, management, review, and communication of all research activities.

► Clarity of expectations

The expectations set out in policies should be clearly stated to facilitate public, employee, client, collaborator, and stakeholder adherence to requirements

and to engender trust in the institution's scientific activities. These expectations should be grounded in accepted definitions of research integrity and research misconduct that includes a delineation of requirements for authorship, record keeping, and other features of professional science. In this context, it is important for institutions and relevant staff to be highly networked and aware of evolving practice.

► Comprehensive investigation of research misconduct

Policies should be complemented by comprehensive guidelines for the investigation of allegations of research misconduct and other breaches of the policies. This process should permit proportionate measures to address minor breaches and present a roadmap for thorough investigation and resolution of serious matters. The latter should prescribe requirements for investigation committees, allow for appropriate appeals, and recognise that this can be difficult for all parties. Therefore, procedures should balance the need for confidentiality and natural justice and prescribe methods of rehabilitation for all involved.

³ Tri-Agency Framework for the Responsible Conduct of Research (2016) (Canada) <http://www.rcr.ethics.gc.ca/eng/framework-cadre.html>

⁴ Fostering Integrity in Research, National Academies of Sciences, Engineering, and Medicine; Policy and Global Affairs; Committee on Science, Engineering, Medicine, and Public Policy; Committee on Responsible Science. Washington (DC): National Academies Press (US); 2017 Apr 11.

2. Incentives

The issue of incentives is considered a multifaceted challenge for many institutions, as best practices embrace not only measures to promote research integrity, but also measures to avoid incentivising negative behaviours as unintended consequences.

► Positive incentives

Institutions can actively encourage adherence to research integrity policies through formal sanctions and research performance evaluation criteria that penalise behaviours deemed as inconsistent with integrity in research. More widely accepted best practices, however, tend to be positive recognitions of integrity either informally or formally through awards, access to resources, and professional rewards.

► Avoidance of unintended consequences

Performance evaluations and rewards based on research publication rates can create pressure to produce volume, cut corners, and ignore matters that do not directly contribute to scientific output. Recognising that competition is generally a positive force in science and that the issues are complex, a best practice is to design performance evaluation in a way that considers the integrity perspective as well as volume.

3. Dialogue and communications

Though efforts to promote research integrity are sometimes difficult to assess in terms of impact, most experts recognise communication and dialogue as essential tools.

► Promotion of research integrity

To this end, institutions need to establish easy avenues to raise sensitive issues as well as to access basic information on policies, processes, and expectations. These measures would include designating a research integrity officer position whose contact information is well known as well as clear channels to raise issues and concerns in a confidential and safe environment. Communication of the importance of research integrity and expectations by an institution's leadership is vital.

► Learning from breaches

Because incidents of research misconduct and even minor breaches of policy can impact the reputation of institutions and individuals, a strong impulse to minimise communication and discussion of incidents can be expected in many organisations. However, a best practice, founded upon the desire to learn and improve, is to review lessons with all stakeholders and, in fact, to formally communicate the findings of investigations to key parties, such as journals that may need to retract or correct publications. Furthermore, institutions should seek opportunities to share experiences with peer organisations while respecting privacy and legal considerations.

4. Training and education

As awareness and understanding of policies, processes, and expectations are fundamental to the success of any institutional effort to promote research integrity, training and education programmes are important components of any research integrity strategy.

► Modes of training

Institutional training programmes can assume varied formats: online, in-person presentations, role-playing, other interactive approaches, and myriad combinations. Furthermore, training can be prescribed as mandatory for specific employee groups or presented as a beneficial and enjoyable learning opportunity for all. A best practice is to consider the experiences of other organisations and all options, but to adapt training programmes to the specific needs and culture of the institution concerned.

► Assessment

This adaptation may be an iterative process based upon experience in training sessions and their follow-up. It is therefore highly advisable that training and education be subjected to formal assessments: feedback from course participants, testing of knowledge gained and retained, and evaluations of the broader impact on the institutional culture as well as of the behaviour of the recipients of training.



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