RESHAPING THE ACADEMIC SELF

CONNECTING EDUCATION & OPEN SCIENCE

BY

Sicco de Knecht
Martijn van der Meer
Loek Brinkman
Manon Kluijtmans
Frank Miedema

UTRECHT UNIVERSITY
2021

0 — A MANIFESTO

The transition towards Open Science will drastically alter our approach to academic life. It will change the ways in which we reward and recognise university employees and reshape the relationship between education and research. This should be reflected in how a new generation of academics and citizens are educated. Not only through the qualifications our students receive to become productive members of society, but also by dint of the values and attitudes we teach our pupils. The aim of university education should be preparing future graduates to share their (inter)disciplinary knowledge, engage with societal stakeholders, and shape tomorrow's society. Now is the time to explore how.

This manifesto is a thought exercise that explores the (possible) relationships between Open Science and education. It attempts to point out the overlap, parallels, synergy, and possible conflicts between Open Science attitudes and practices, and contemporary views and practices in education. We aim to provoke a perspective on the different aspects of how Open Science relates to education and propose several concrete directions forward and possible corresponding interventions. After explaining why education from an Open Science perspective needs to be explored and strengthened, we differentiate four faces of open education: the Open Science mindset, Open Science skillset, open educational resources, and how these activities should be recognised and rewarded. We subsequently illuminate three possible paths on how to strengthen open education, ranging from content to form and system. We hope that this will spark a broader national and international conversation on the relationship between Open Science and education.

1 — WHAT IS OPEN SCIENCE AND WHY IS IT IMPORTANT?

Open Science aims to make research more accessible and more trustworthy by breaking boundaries. Boundaries, not only within academia, but also between professional scholarship and society. Open Science is transitioning universities to a new standard for academic practice based on the values of transparency, accessibility, reliability, interconnectedness, and inclusivity. Unfortunately, practices reflecting these values—ranging from sharing results, altruistic cooperation, and engaging with stakeholders outside academic institutions—are not the norm in everyday academic practice. We consider the most important reason to be that these Open Science practices aren't generally rewarded in the current academic system. Working in an academic setting has been, and often still is portrayed as 'a calling', even a privilege. However, in reality in our times, it is a job in a competitive professional field with rather scant career options. To advance in the current academic system, academics need to adapt to—and compete in—an environment with incentives and pressures often at odds with the values of Open Science and scholarship. For the sake of brevity, we will henceforth use the term 'Open Science' to include all academic disciplines.

Despite differences in the analysis on how we got to where we are now, open scientists converge around the future they envision for science and scholarship through radical transparency and openness. Coming from all disciplines, they foster a wide range of open research practices. Some focus on open access and public engagement, others on methodological rigor and open data. For Open Science to become the norm, academics need to adopt a reflective and self-critical attitude: to develop an open *academic self*. We believe that this reflection should begin with the premise that scientists should constantly interact with society. Academics ought to be transparent, honest, and modest about how they arrived at scientific claims. They should not be overpromising but be open about the uncertain-

ties and about the institutional, cultural, and social factors influencing their work and the practical reality of 'doing science'. Through experience, reflection, and discussions, we believe that academics are able to transfer and teach the values and attitudes underpinning Open Science to the colleagues with whom they collaborate, but also to the students they supervise and train to make a meaningful contribution to society.

Open Science initially has focused mainly on research. Nevertheless, the realisation is that the Open Science philosophy broadly concerns academic culture and that we should think about what it implies for our education: both for self-development of future graduates as well as more broadly to strengthen the transformative potential of education for society. After all, within academia, education and research are inherently entwined. For universities to become more open and inclusive institutions, we think it is necessary to stimulate the debate on the relationship between Open Science and education, with education playing a pivotal role in shaping the open academic self we envision for our students.

2 — WHY CONNECT OPEN SCIENCE TO EDUCATION?

At its very core, Open Science is an attitude. It is a way of thinking and working, grounded on a thorough understanding of the practical reality of doing science and a vision of the role that science ought to play within society. It challenges the 'Myth' of the infallible 'hard sciences' of indisputable facts and the image of the ethically neutral academic. It starts with the fact that it is people, the community of inquiry and teaching, who make science and academia work, and that they are only human after all.

Unfortunately, scientific literacy, knowledge about what it practically means to do science in the current academic system, and active reflection on the role science and scientists should play in society, are subjects often omitted from university curricula. Surely, in specific fields pertaining to the history, sociology or philosophy of science, students are challenged on these matters, and undoubtedly there are exceptions to the rule. But in most undergraduate programmes reflection on such matters is limited. Yet obtaining a view on how knowledge is created, structured, and viewed within a discipline, is vital to academic formation. Additionally, the current academic curriculum—mostly implicitly but often explicitly—seems to be predicated on idealized representations (the Myth) of science and scholarship. This is primarily pervasive in textbooks on Science, Technology, Engineering, Mathematics (STEM), and Medicine, but also in disciplines such as Economics and the Social Sciences.

Hence, for most students, the Myth will never explicitly be questioned. There is an obvious way to go beyond this. We have to invite and challenge students to reflect on the daily realities of doing research: the ideologies and hierarchies implied by the Myth, and the different alternative perspectives on science, on how hard it is to produce reliable knowledge, what uncertainties there are, and how knowledge is structured and continuously tested in the community of peers. This does not overburden them with problems that are not

theirs yet or will never be. On the contrary: this reflection forms the basis of developing a critical and open academic self. Questioning the Myth of indisputable facts and the image of the infallible and ethically neutral academic only fosters higher standards of integrity. We believe that it also empowers students to make meaningful connections with the world outside of formal academic institutions in adherence to the values of transparency, accessibility, reliability, interconnectedness, and inclusivity.

If the Open Science movement is serious about improving science and its relationships with society, a reform of academic education is indispensable and should be reflected in contemporary educational initiatives that need to be fostered and fuelled. By educating new generations of scientists and scholars and socializing them with the values and attitudes of Open Science, we facilitate and accelerate the transition that simultaneously re-aligns research and education and empowers students for a transformative role after graduation. Not only because some might one day become part of academia, but because by building a reflective and open academic self, they are able to make a meaningful contribution to our global and diverse society, either when working within or outside academia after graduation.

3 — FOUR FACES OF OPEN EDUCATION

To make these ambitions a reality, we first need to dissect the relationships between the overlapping themes of Open Science and Education. In what follows, we first distinguish four perspectives, faces if you will, that clarify the interplay between Open Science and education. Together they illuminate the three roads through which open education can be practically implemented, which we describe in section 4.

The first is the (i) **Open Science mindset** and refers to the students' and teachers' (self-)critical attitude towards the academic system and scientific knowledge. Building on decades of scholarship from historians, philosophers, and sociologists of science, students should be knowledgeable about the origins of late modern academic systems in their historical context and be able to evaluate the extent to which these contextual factors influence and shape academic practices. This scientific literacy enables students to understand the origins of the present-day problems that academia is faced with, such as the replication crisis, counterproductive competition, the distortive power of metrics, and the unrealistic public image of science, resulting in the disconnect with society and decreasing institutional trust. It also serves as a basis for understanding how knowledge claims develop within their specific discipline as compared to other disciplines. Both are prerequisites for developing an open academic self.

This lays the foundations for a curriculum based on the values of transparency, accessibility, reliability, interconnectedness, and inclusivity. Such a curriculum has a greater sensitivity to, and understanding of, the relationship with relevant stakeholders and communities ('publics') outside academia. Academics should be sensitive to and critical of the problems and expectations of society. This needs to be the foundation of curricula that educates future generations of graduates equipped to communicate and collaborate not only across disciplinary and cultural boundaries, but also as democratic citizens

beyond the confined reality of the academy. An open mindset contributes to and is the result of community-engaged learning.

Second, education in Open Science implies training in the **(ii) Open Science skillset.** Training in the hands-on skills that have been developed over the last decade complements the Open Science mindset. Students and employees should be familiarized with and trained in these skills, and should reflect upon the pros and cons of openness and transparency when doing research. Practices such as sharing articles, materials, data and code, preregistration, open lab books, open collections, preprints, and public engagement should not be reserved for a select group at the forefront of the Open Science movement. The FAIR principles, reproducible workflows, open licensing, and creative commons should not remain exotic topics. They should become part of the academic skillset being taught.

By embedding Open Science skills in courses, curricula, and vocational training, researchers will be able to apply Open Science principles to their day-to-day research as well as in future professional roles outside academia. An in-depth discussion of the implications and consequences of open practices creates the opportunity to make ethical and technically oriented discussions part of everyday academic practice. It moreover forces us to think more deeply about the pros and cons of outsourcing, public engagement, and citizen science approaches. Educating open research skills will not only socialize future academics with desired ways of working, but ultimately, it will provide a stimulus for setting the academic agenda in a socially engaged manner. It will educate future citizens to interact with the forms of scholarship that result from putting the Open Science skillset into practice. Future graduates should be able to understand how, for example, a preprint publication should be interpreted, how to interact with societal stakeholders, and how open datasets can be accessed and used by professionals outside the protective walls of the academy.

Third, we will consider **(iii) open educational resources**, referring to an open attitude towards education. Open scientists see knowledge as a commons, rather than a commodity. This not only applies to scientific knowledge but also to educational materials and products of education as produced by teachers and students. We want to stimulate the use of Open-Source materials, sharing educational skills and innovations and diversifying both the content and learning outcomes in academic education. For the benefit of the many, not the few. Openness in educational resources is not limited to sharing lecture slides. It considers many more practices such as open access publishing of textbooks, sharing and reusing assignments, instructional videos and presentations and developing educational resources for both teaching and testing in a more accessible form. A great deal of platforms designed for sharing open educational resources have been developed over the past years. We now should start discussing how to implement and use these facilities in a feasible manner. Of course, this transition which requires reconsidering the use of commercial software and educational platforms and instead considering open-source alternatives that stimulate collaboration, brings down the cost of education, and lowers barriers to participate.

The fourth and final perspective relates to what would realistically incentivize academics to adopt Open Science practices in their daily work: changing the system of **(iv) recognition and rewards.** In the context of new policy choices, academia will soon evaluate academics for more than only research output. The use and continuous development of narratives and meaningful metrics are part of this process. It thus generates opportunities to recognize and reward educational performance within academia, and in terms of sharing and engaging with diverse audiences outside of the protective walls of the university. In the future system of recognition and rewards, we need to consider education as a *team effort* rather than an individual sport and incentivize adequate supervision, collaboration, and leadership in

academia. Also, the wide range of educational roles should be taken into account: much more broadly than mere delivery of education, including among other things, design, innovation and knowledge sharing in education. For these developments to develop into robust and enduring practices, both individuals and teams should be rewarded for this, through personal assessment and accreditation based on the values of transparency, accessibility, reliability, interconnectedness, and inclusivity. In evaluating Open Education, we should measure what we value, rather than valuing what we measure.

4 — THREE PATHS TO OPEN EDUCATION

Ultimately, by considering the four faces described above , the attitude and values underpinning the concept of Open Science should permeate all educational levels. Critical reflection upon one's disciplinary assumptions and practical realities should be a core aspect of *every* undergraduate and graduate curriculum; it should not only be reserved for a select group of students. From first year bachelor students to PhD-candidates to tenured professors, academics should embrace the Open Science mindset and practices and pass this on to their (fellow) students and colleagues. Academics at all levels should be individually recognized and rewarded for their participation in both team-based research and education. Still, the greatest reward would be better education that leads to higher-quality research, higher standards of academic integrity, a multidisciplinary and inclusive mindset, and a stronger and more robust connection with society.

Given the urgency of a more transparent and outward-looking academia, it is unfortunate that we still seem to be far removed from this goal and we recognize that the required transition will not happen overnight. Even when consensus is reached over the common goal, finding the right avenues and perspectives for action will be a challenge. This calls for strategic choices that bridge the gap between ideas and practice. What follows are three potential avenues ranked in order of estimated enthusiasm, preparedness, and effectiveness. These are by no means exclusive or exhaustive but aim to incite enthusiasm and provoke change in the near future.

Path I : Master's and PhD-training It is quite clear that the required skillset of future academics is changing fast. Master's education and PhD-training might very well be the most appropriate starting point for this transition. Increasingly, graduate schools are taking up the notion that PhD-training should not only prepare the candidate for

a research career in academia but must equip them with a robust set of academic values and develop a mature and open academic self in preparation for their future role in society. To prepare graduates with the required attitudes and skills to become an open researcher these attitudes and skills should become an explicit and integral part of the training program. On the level of master's courses, students should get acquainted with the historical and sociological reflection on science and familiarize themselves with Open Science practices relevant to their respective discipline(s). On the PhD-level, Open Science values, skills, and attitudes should become an integral part of the academic training.

In the Dutch setting the curriculum for PhD candidates, courses, or other developmental activities to be followed during the PhD research period, is still largely voluntary. Although many graduate schools have adopted a policy in which a certain amount of training is required for receiving a graduate school diploma, it mostly has no consequence for obtaining a PhD qualification. From the perspective of Open Science and the recognition and reward of all primary domains, we recommend that professional and self-development of PhD-candidates should become part of the required training.

These changes will open up the possibility of widening the range of how PhD-researchers are evaluated and rewarded. A system with an emphasis on development instead of accomplishment will foster a positive environment for change. Depending on the discipline, courses in skills such as data management, version control, and preregistration can rapidly raise the overall level of training in the Open Science skillset. This in turn will boost efforts of universities to address issues such as research integrity, responsible research practices and ethics.

Path II : Lifelong Learning Like in any social system, old habits in academia die hard. Experience can be both a catalyst and a barrier to change. Professionals can suffer from a 'shyness of action', which

can be extremely challenging to overcome. Above all—adaptation, renewing practices, and transition takes time. It is a matter of willingness as much as availability. So even though research professionals must become trained in Open Science practices, it might be one of the biggest hurdles to take.

These characteristics are not by any means unique to academics. However, where many other professionals, such as medical doctors, teachers, lawyers, and accountants, are accustomed to a regime of accredited mandatory vocational training, universities generally do not foster such a stringent or embedded culture of lifelong learning. Regardless of whether such training should be mandatory, the interest in professional training is growing. And there are ample opportunities to extend, enrich or nurture professional development and responsible research conduct in the context of Open Science.

The novel approach to how scientists are recognised and rewarded requires leadership and university administrators at several levels to act. If colleagues are expected to take up leadership roles, personal and team development, and diversity in careers seriously, the university should offer ample opportunity to train professional skills, leadership, and supervision. Subsequently, if teams set goals to improve and open up their education and research, training in the Open Science mind- and skillset should be readily available.

Concurrently universities could play an important role in educating professionals outside of academia (and vice versa). The explicit goal of lifelong learning is to empower the entire workforce to stay up to speed with the latest developments. Many Open Science practices hold great relevance to those working in research, policy, and education outside of academia.

Path III : The Common Curriculum We believe that the principles of Open Science should be embedded in the very core of the university. Only then will Open Science give rise to new and modern academics with a well-developed academic self. This is why the ties

between value-based educational themes of academic integrity, diversity and inclusivity, impact, and Open Science should be strengthened and connected. This self-critical mind- and skillset will enable graduates to responsibly participate in an increasingly global society as responsible, democractic citizens.

In practice, this requires us to reimagine our didactical and pedagogical approach to education. Not in the sense of a complete overhaul of the subject in each curriculum—this should of course be left to disciplinary experts themselves—but in the sense that it provides a new approach to academic teaching. Nowadays the reading of history, philosophy, and sociology of science have become subjects almost exclusively taught in their respective disciplines. We instead believe that they should become commonplace in all university curriculums. Critical reflection will no longer be constrained to what one makes of a certain hypothesis or result, but has to be applied to the method, theory and paradigms of one's disciplinary context. Academic training should move beyond schooling on 'how' to perform research to reflect on 'what' to research, 'why' and with and for 'whom'.

Moreover, through novel formats such as community-engaged learning and mixed classrooms, students need to be educated to critically reflect upon their future role in society as an academic and how the practices of their discipline relate to the challenges raised in society at large. Additionally, every student should be expected to work according to the values of Open Science and be challenged to develop an open academic attitude. A goal that requires targeted training to teach individuals the relevant skills and promote an open attitude. This will be the antidote against an inward-focused university.

Of course, these three paths are just examples of how Open Science can take shape in, and shape, academic education. We hope that our examples challenge others in and outside of Utrecht University to explore different roads towards Open Science. By exploiting the opportunity to connect education and Open Science, we hope

to shift the focus from the qualification function of higher education to the empowerment of our students for a transformative contribution to society. We hope that our graduates will embody the values of transparency, accessibility, reliability, interconnectedness, and inclusivity. Most importantly, connecting Open Science with education should stimulate our pupils to develop an open academic self that is desired both within and outside of academia.

NARRATIVE BIBLIOGRAPHY

This manifesto is the result of many conversations with various experts at Utrecht University. The text also builds on decades of existing scholarship from multiple disciplines. With respect to the role that science and education ought to play in a democratic society and the specific values directing this role, we are specifically inspired by the insights in John Dewey's *Democracy and Education: An Introduction to the Philosophy of Education* (1916), Michael F.D. Young's *The Curriculum of the Future: from the "New Sociology of Education" to a Critical Theory of Learning* (1998), Philip Kitcher's *Science in a Democratic Society* (2011), Martha Nussbaum's *Not for Profit: Why Democracy Needs the Humanities* (2012), and Paul Ashwin's *Transforming University Education: a Manifesto* (2020). Our thoughts on the centrality of self-development in academic training are inspired by Lorraine Daston and Peter Galison's *Objectivity* (2010), and Gert Biesta's *Beautiful Risk of Education* (2016). Our characterisation of late modern science and higher education is primarily indebted to the historical and sociological analyses presented in Thomas Kuhn's *The Structure of Scientific Revolutions* (1961), John Ziman's *Public Knowledge: Essay Concerning the Social Dimension of Science* (1968), Jerry Ravetz's *Scientific Knowledge and Its Social Problems* (1971), Stephen Toulmin's *Human Understanding* (1972), Bruno Latour's *Science in Action: How to Follow Scientists and Engineers Through Society* (1986), Pierre Bourdieu's *Science of Science and Reflexivity* (2003), and builds on the 2013 'Science in Transition' position paper.