Challenging techno-solutionism in engineering education.

Ethical and pedagogical reflections for sustainability

Techno-solutionism in engineering education presents important ethical questions and risks to sustainability. It is necessary to reframe the role of technology in engineering education by evaluating the ethical implications of technologies; thus shifting the focus from "is it technically possible to develop this technology?" to the question "should we develop this technology?". Ethical engineering education must foster critical and open discussion on the role of technology in (un)sustainability to challenge techno-solutionism.

Nicola Banwell, *Camille Roelens*

Challenging techno-solutionism in engineering education. Ethical and pedagogical reflections for sustainability
GAIA 33/4 (2024): 357–362 | **Keywords:** education for sustainability, engineering ethics education, ethics instruction, strong sustainability, techno-solutionism

In the face of the ever-worsening ecological crises, universities are criticised for inadequate sustainability action, including propagating techno-solutionism (Stein 2024). Techno-solutionism can be considered both a macro socio-political and an ethical issue in the realm of sustainability. It suggests that technology, driven by human ingenuity can, and should, be used to solve challenges and create a better world without consideration of the broader socio-ecological contexts and their inherent complexity (Danaher 2022, Sætra 2023, Stein 2024). Sustainability is integral to the context of engineering practice; thus, engineers have social responsibilities towards technology users, the wider society, the planet, and other species. We argue that educators within engineering institutions must critically engage with normative debates on the role of technology in sustainability to challenge the use of technology in addressing unsustainability.

Here techno-solutionism is framed as a sustainability problem embedded in complex socio-political contexts. We examine techno-solutionism from an ethics perspective which, in our experience, contributes to a critical investigation of the moral implications, notably the social and ecological ramifications, of prioritizing technological solutions over approaches that address the root causes of unsustainability. We suggest some concepts that can support critical, contextualised, and balanced reflection on the place and the role of technology in sustainability in engineering education. These reflections draw on our teaching experiences from different engineering education contexts in Switzerland and France, and subject areas (ethics, sustainable development, health), as well as the philosophical works of Camille Roelens, the second author of this paper, on techno-solutionism, ethics, and digitalisation (Roelens and Pélissier 2023, Roelens forthcoming). These reflections are not intended to be exhaustive, rather they serve as a starting point for dialogue about supporting reflexivity on techno-solutionism and challenging its place in engineering education in the context of sustainability.

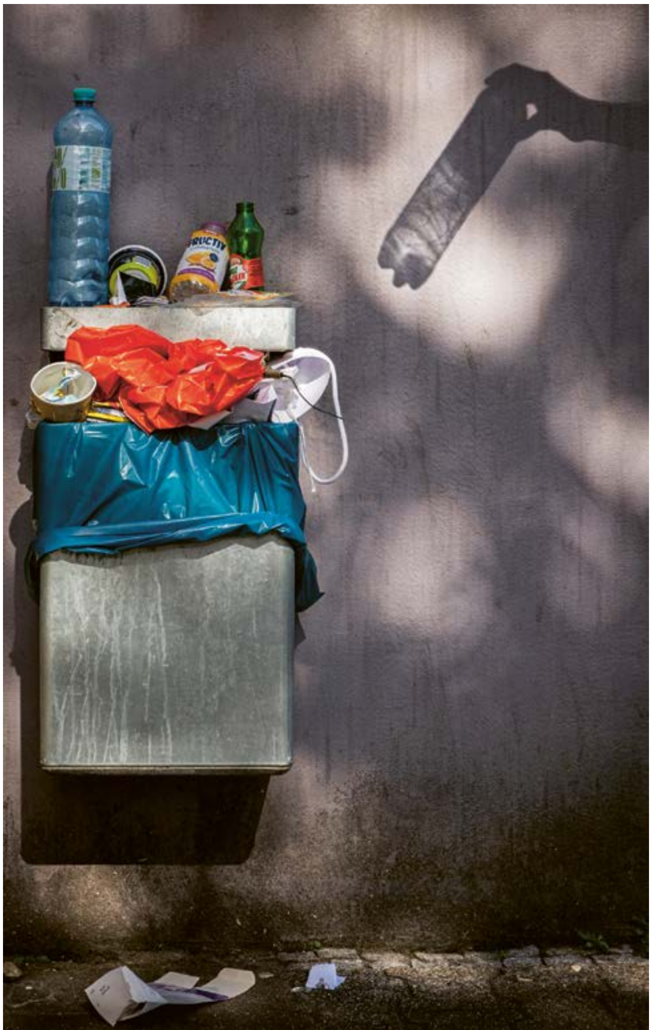
A sustainability challenge embedded in complex social-political contexts

The role of technology in the ongoing ecological crises and the potential to develop a more sustainable future remains heavily debated in environmental politics and sustainability discourse (Brand and Fischer 2013, Sætra 2023). Narratives of industrialisation that emerged in the post-war era (following 1945) resulted in an enduring collective hope in engineering solutions and technologies to address human challenges and drive social progress (Jarrige 2016, Johnston 2017). The evolution of techno-solutionism was, and remains, heavily shaped by national agendas, political and economic interests, and hidden power dynamics driving the development and deployment of technologies. Since the 1970s, there has been a growing understanding of the irrevocable link between dominant western consumerist societies, which are intertwined with narratives of economic growth, and the surpassing of the ecological limits of our planet. This gave rise to a discourse of techno-criticism grounded in ecological activism and anti-nuclear sentiment (Jarrige 2016). Techno-solu- >

Nicola Banwell (corresponding author) | University of Lausanne | Interdisciplinary Centre for Research in Ethics (CIRE) | Lausanne | CH | nicola.banwell@unil.ch

Camille Roelens | University of Lausanne | Interdisciplinary Centre for Research in Ethics (CIRE) | Lausanne | CH *and* Université Claude Bernard Lyon 1 | l'Institut national supérieur du professorat et de l'éducation | Lyon | FR | camille.roelens@univ-lyon1.fr

https://doi.org/10.14512/gaia.33.4.6
Received January 29, 2024; revised version accepted October 26, 2024 (double-blind peer review).



MICHAEL GUSEV 2021
Jeder ist seines Mülls Schmied | Everyone is the master of their own trash

tionism remains a characteristic of modern sustainability debates and policies, such as through the increasing exploration and acceptance of carbon capture and storage (Capasso and Umbrello 2023, Sætra 2023).

The ongoing debate surrounding the role of technology in sustainability, which is often mischaracterized as a mutually exclusive division between techno-solutionism and techno-criticism, gives rise to essential questions such as: What are the roles of technologies in ecological destruction? What are the potential roles of technology as a response to these global challenges? What political factors and power dynamics influence the promotion and uptake of technological responses? What should the relationship be between systemic social and political changes and technological responses?

In the context of contemporary engineering education, such questions are often not given the space they merit, nor are the nuanced responses to such questions discussed or debated in the classroom (Lemaître 2003, 2007). This oversight perpetuates the cultivation of a techno-solutionist mindset, which in turn poses important challenges and risks to sustainability. For example, a techno-solutionist approach can result in the oversimplification of *wicked problems* by concealing their complexity (Fabre 2021, 2022, Stein 2024). Driven by incorrect assumptions that all problems have clearly identifiable and discreet solutions, the causes of ecological crises are superficially diagnosed as technical insufficiencies (Stein 2024). Thus, the aim of sustainability action becomes to solve these problems with technological and scientific advancement (Stein 2024). Such an approach obscures the need to identify and address the root causes of unsustainability that are embedded in complex social, cultural, and economic contexts. This results in the failure to adopt more complex and nuanced responses to environmental and social crises (Stein 2024).

An ethics perspective

Ongoing debates on the role of technological innovation in sustainability are heavily politicised and normative[1]. For example, geoengineering technologies, such as carbon capture, use, and storage, are highly controversial (Capasso and Umbrello 2023) and influenced by power dynamics and vested interests linked to commercial investment and government funded research (Corner and Pidgeon 2010). This shows that techno-solutionism is an ongoing macro social-political issue, which engenders important ethical implications and considerations. Ethical issues that arise include unintended human and ecological consequences due to the widespread implementation of emerging technologies, the treatment of the symptoms rather than the underlying causes of unsustainability, responsibilities to future generations, and the perpetuation of the domination over cultures and nature (Pamplany et al. 2020). A techno-solutionist approach can endorse a disregard for social and cultural contexts and norms, and even a blindness to the unintended consequences of technologies. This has been demonstrated by numerous technological failures due to the export of Western technology to countries in the Global South, in the name of neoliberal development (Evans and Musvipwa 2017). This tendency is embedded in complex geopolitical histories and agendas, and has important ethical implications for the "beneficiaries" of these technologies, including but not limited to, the export and continued dominance of foreign perspectives and values in the form of neocolonialism (Schopp et al. 2019).

We propose that an ethics perspective can contribute to reframing the design, use, and role of technology in engineering education for sustainability, by shifting the focus from "is it technically possible?" to evaluating the ethical implications of these technologies by asking the question "should we develop this technology?". It does so by questioning the ethical implications, notably the social and ecological ramifications of (blindly) prioritiz-

1 See also Nutas (2024, in this issue).

ing technological solutions over more radical changes that address the root causes of unsustainability. This invites questions regarding the fundamental purpose for the development and use of technology, the means by which they are developed and propagated, and their ecological and social impacts. Finally, an ethics perspective facilitates critical reflection on whether the development and use of a particular technology is aligned with principles of environmental responsibility and long-term ecological well-being.

Open, critical, and reflexive discussions of the normative aspects of technology and the values associated with technological innovation as a response to unsustainability is highly unfamiliar terrain in the classrooms of engineering universities. Denis Lemaître has clearly shown that the plurality of positions of contemporary designers and thinkers of human engineering education stems from differing opinions about *the project of modernity*[2], specifically whether this project should be upheld and maintained in its current form, or if it should be transformed (2003, p. 169). Ludovic Bot suggests that "the positivist ideal of scientific training no longer functions in educational terms" despite this ideal being dominant in scientific and engineering institutions (2007, p. 31). One of the major implications of a positivist logic is the attempt to separate facts and values. As a result, the value attributed to the role of technological innovation, as a solution to sustainability challenges, and the techno-solutionist mindset associated with such values, often go unaddressed in the education of future engineers. Rather, techno-solutionism continues to be a dominant discourse, and it is often left to informal education (i.e., through science fiction) to help us imagine the perils of the possible failures of techno-solutionism (Roelens 2022). Therefore, we are now facing a critical moment revealing these hidden problems and developing relevant responses that allow us to move beyond them.

Challenging techno-solutionism

Based on our teaching experiences[3], we identify three themes that we believe can support critical and pluralist reflection on the role of technology in sustainability in engineering classrooms, thereby challenging techno-solutionism.

Systems thinking

Conceiving unsustainability through the lenses of *wicked problems* and systems thinking facilitates the development of a complex and integrated understanding of sustainability challenges (McCune et al. 2021). In undertaking systems thinking approaches, it is critical to go further than understanding the systemic structures, but to also understand the mental models and underlying causes which are at the root of unsustainability (Monat and Gannon 2015)[4]. In our teaching we have used collective mapping exercises in various settings to invite students to explore a specific sustainability problem they are working on. For example, in an extracurricular weeklong summer school on climate change ac-

ALBRECHT KÖNIG 2021
Wer war das? | Who did that?

The graffiti created by Looven (Johannes Blinkle) is part of the *We make Tübingen more colourful* campaign, initiated and funded by Stadtwerke Tübingen (SWT).

2 Here we refer to the project of modernity as the collective attempt to advance and improve society through technological and social progress.

3 These experiences were gained in a range of institutions in both Switzerland and France, at both the undergraduate and masters levels, spanning various subject areas (e.g., ethics, sustainability, philosophy and health) and formats (i.e., a disciplinary seminar, three interdisciplinary courses that were a combination of lecture-based and project-based formats, and two interfaculty extracurricular summer schools in the form of a weeklong project-based workshop). The combination of these experiences amounts to contact with more than 350 students. These experiences also draw on the research of Camille Roelens, focusing on the literary representation of these issues (forthcoming), and numerous philosophical works on the nexus between ethics and digitalisation (Roelens and Pélissier 2023).

4 Systemic structures refer to the interrelated social, cultural, and political features of a socio-ecological system, while mental models refer to the culture, values, and paradigms underlying a system and its elements.

>

STEFAN MODERAU 2021
Stadtreinigung im Einsatz | Urban cleaning at work

tion, teams of five students mapped out a specific sustainability challenge (e. g., the behaviours of overconsumption linked to fast fashion or household objects). We used *Root Cause Analysis* and the *Five Whys*[5] (Monat and Gannon 2015) to enable students to have a deeper understanding of the problem and its causes before beginning to brainstorm solutions. In this example, systems thinking was foundational for developing a comprehensive understanding of a problem and highlighting underlying causes. This made it possible to contrast technological solutions with the sustainability problem and highlight the inadequacy of technological fixes to problems rooted in social, political, and cultural contexts. By fostering a deeper understanding of causal factors through examining system dynamics, students can avoid falling into the trap of applying overly simplistic solutions (Stein 2024), like relying solely on technological innovations that might only address symptoms rather than root causes.

Co-benefits, trade-offs, and unintended consequences

The concepts of co-benefits, trade-offs, and unintended consequences provide additional perspectives to support a refined analysis of the potential impacts or benefits of technology as responses to sustainability challenges. Co-benefits, or positive synergies, refer to win-win situations where an intervention aimed at one objective also has a positive effect on another objective (IPCC 2023). Trade-offs emerge as a result of competition between varying objectives related to social and ecological sustainability when courses of action create gains in a particular objective but result in losses in another (IPCC 2023). We consider trade-offs to be different to unintended consequences (also known as adverse side effects) as trade-offs involve known and conscious choices, whereas unintended consequences arise unforeseen. It has been demonstrated that insufficient understanding of such dynamics has led to incoherent sustainability policies, adverse impacts, delayed outcomes, and missed opportunities for co-benefits between social and environmental objectives (Mainali et al. 2018). New technologies aimed at addressing specific issues often give rise to unintended consequences across diverse areas (e. g., dichlorodiphenyltrichloroethane, or DDT, causing cancer or combustion engines contributing to greenhouse gases; Jonsson and Mósesdóttir 2023) or rebound effects where consumption patterns increase as a result of the implementation of more efficient or sustainable technology (e. g., increased energy consumption or water use after the implementation of efficiency increasing technologies; Galvin et al. 2021).

In our experience, teaching such concepts in engineering education can caution against overly optimistic reliance on technology and promote a more thoughtful approach to addressing sustainability challenges by considering the broader implications of proposed solutions. We have used real-world case studies, developed in partnership with stakeholders from non-government organisations from the Global South. Each case study focused on a specific problem that students, working in groups, proposed a solution for, such as identifying appropriate approaches for water quality monitoring for a lake undergoing biodiversity rehabilitation in an urban location in India. In order to challenge the students' assumptions and provide them with context-relevant knowledge, the students were coached by a contact point from the non-government organisation and the teacher. Co-benefits, trade-offs, and unintended consequences served as criteria to guide the students to critically reflect on and evaluate the potential solutions they identify. Upon the introduction of these concepts, we observed that the solutions proposed by the students were evaluated not only based on their technical merits, but through a more critical approach based on their broader social and environmental implications, and suitability to the context.

5 *Root Cause Analysis* is a type of systems thinking approach that seeks to identify the root causes of a problem. The *Five Whys* is an exercise that involves asking "why" multiple times to facilitate the identification of the root causes of the problem that is being examined.

Social, environmental, and climate justice

Environmental justice concerns equal distribution of natural resources, and the rights, obligations, and burdens that are associated with anthropogenic environmental change. This change does not cause equitable impacts among groups, particularly as environmental and climate justice are inextricably linked with social justice (Lee 2022). In our teaching we have designed an exercise where students examine the life cycle of a given technology (e.g., smartwatches, facial recognition software, or digitised health records) in order to identify and discuss social, environmental, and climate justice issues in its design, development, production, use, and disposal. Examining justice over the lifecycle of a technology can support a more comprehensive view of the interdependencies within a system and how these are impacted by a specific technology (Hoffman 2017). Students are requested to identify: 1. justice issues over the lifecycle of a given technology, 2. who is responsible for these injustices (the designer, manufacturer, end-user, etc.), and 3. what should be done to remedy the injustices. These questions are then discussed in class, which, in our experience, gives rise to the expression of a plurality of opinions and implicit values that students hold about the role of technology in contributing to or addressing unsustainability. For example, in class discussions with engineering bachelor students, the question often arises as to whether it is "good" to develop a certain technology, particularly if the injustices created by the development and use of the technology outweigh the purported benefits. Here justice provides an alternative perspective to examine and challenge students' ideas about the use of technology and its social and ecological impacts, as well as encourage participants to discuss subjects which are often taboo in the classroom (i.e., "should we develop this technology?").

Conclusion

Educators and engineering institutions must critically engage with normative debates on the role of technology in sustainability to shift the focus in engineering education from technical capabilities to a broader consideration of the consequences and values associated with technological choices. Ultimately, the challenge for contemporary educators is to support future engineers to navigate concurrent crises in a world characterised by increasing complexity and uncertainty. Educators must equip students with greater reflexivity and the tools to critically question and reshape the role of technology in this context.

We are perhaps touching on the fact that previously, when it came to the meaning of school knowledge (Roelens 2023) and the contribution of knowledge to human progress, teachers could step forward, resolute, with the feeling that they had more answers to give students than questions to ask themselves. Contrastingly, today's challenge for teachers is to do their job in a problematic world (Fabre 2011), less confident in the future, and more critical of the effects of their own actions. What will my students do with what I teach them? This is certainly not a new question, but it is now being asked with unprecedented gravity and frequency. Teachers in engineering universities must encourage critical, contextualised, and pluralist reflection on the role of technology in the face of unsustainability, by reinforcing a nuanced and holistic understanding of the root causes of unsustainability, the place of technology in environmental destruction, and the unintended consequences and injustices that technology causes. While we have suggested some concepts here that can be helpful for this, there are undoubtedly many others that merit to be explored and tested. A central feature of the ideas presented here is the emphasis on exchanging in group settings to give rise to plurality in discussions and allow for the normative aspects of these to emerge. As such, ethical teaching practices in this context involve encouraging open and pluralist views and critical reflection on the place of technology in sustainability.

Many other elements of a heuristic for an "ethical" education of engineers in technology and sustainability deserve to be developed in future work. For example, if we approach the latent techno-solutionism in engineering today as a degradation of the optimistic spirit and its ideal of unlimited progress once science has been perfected, it would be possible to analyse the effect of positivist beliefs of national education policy creators (e.g., Louis Legrand in France), and their inherent limitations in the face of environmental crises. Universities also have a crucial role in designing programmes that provide engineers with ample learning opportunities to better understand and critically reflect on the context and impacts of addressing unsustainability with technology. Finally, accrediting bodies for engineering institutions should evaluate what constitutes education for sustainability in engineering programmes and emphasise the need for an in-depth examination of how technology impacts (un)sustainability.

As a persistent mindset that remains ingrained in engineering practice and education, techno-solutionism may not be changeable through ethical or normative debates alone. Such a question merits future interdisciplinary inquiry. Future work is also crucial to delve into the powerful historical, economic, and political interests driving techno-solutionism to identify how these aspects can be further integrated into engineering education. This includes the elective affinities between techno-solutionism (often aligned with a "business as usual" model of sustainability) and the political agendas and other forms of power which perpetuate its existence in society. Education in an academic environment can contribute to empowering students to resist the pressures of techno-solutionism in their future professional work. However, challenging techno-solutionism extends beyond engineering education alone and necessitates a profound cultural shift within the engineering profession and, more broadly, a societal discussion around the normative value attributed to technological solutions in striving for a sustainable future.

Acknowledgements: We would like to thank the Interdisciplinary Centre for Research in Ethics (CIRE), the University of Lausanne, and the Institut national supérieur du professorat et de l'éducation, Université Claude Bernard Lyon 1 for their support of this work. We would also like to thank two anonymous reviewers of this work.

>

Funding: This work received no external funding.
Competing interests: The authors declare no competing interests.
Authors' contributions: *NB, CR:* conceptualization, methodological reflection, drafting, and editing.

References

Bot, L. 2007. Eléments d'une crise "post-moderne" dans la formation scientifique des ingénieurs. *Les Sciences de l'éducation – Pour l'Ère nouvelle* 40/3: 31–57. https://doi.org/10.3917/lsdle.403.0031.

Brand, R., J. Fischer. 2013. Overcoming the technophilia/technophobia split in environmental discourse. *Environmental Politics* 22/2: 235–254. https://doi.org/10.1080/09644016.2012.730264.

Capasso, M., S. Umbrello. 2023. Sustainable climate engineering innovation and the Need for accountability. In: *Technology and sustainable development.* Edited by H. S. Sætra. New York: Routledge. 35–52. https://doi.org/10.1201/9781003325086-4.

Corner, A., N. Pidgeon. 2010. Geoengineering the climate: The social and ethical implications. *Environment: Science and Policy for Sustainable Development* 52/1: 24–37. https://doi.org/10.1080/00139150903479563.

Danaher, J. 2022. Techno-optimism: An analysis, an evaluation and a modest defence. *Philosophy and Technology* 35: 54. https://doi.org/10.1007/s13347-022-00550-2.

Evans, H.-C., R. Musvipwa. 2017. The *Sustainable Development Goals,* the *Paris Agreement* and the *Addis Agenda:* Neo-liberalism, unequal development and the rise of a new imperialism. In: *Knowledge for justice: Critical perspectives from Southern African-Nordic research partnerships.* Edited by T. Halvorsen, H. Ibsen, H.-C. Evans, S. Penderis. Cape Town: African Minds Publishing. 37–56.

Fabre, M. 2011. *Éduquer pour un monde problématique: La carte et la boussole.* Paris: Presses universitaires de France. https://doi.org/10.3917/puf.fabre.2011.01.

Fabre, M. 2021. *Un avenir problématique: Éducation et responsabilité d'après Hans Jonas.* Dijon: Éditions Raison et Passions.

Fabre, M. 2022. *L'éducation au politique: Les problèmes pernicieux.* Paris: ISTE. https://doi.org/10.51926/ISTE.9781784058890.

Galvin, R., E. Dütschke, J. Weiß. 2021. A conceptual framework for understanding rebound effects with renewable electricity: A new challenge for decarbonizing the electricity sector. *Renewable Energy* 176: 423–432. https://doi.org/10.1016/j.renene.2021.05.074.

Hoffman, J. 2017. Environmental justice along product life cycles: Importance, renewable energy examples and policy complexities. *Local Environment: The International Journal of Justice and Sustainability* 22/10: 1174–1196. https://doi.org/10.1080/13549839.2017.1329285.

IPCC (Intergovernmental Panel on Climate Change). 2023. Annex II: Glossary. In: *Climate change 2022 – Impacts, adaptation, and vulnerability. Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.* Edited by H.-O. Pörtner et al. Cambridge, UK: Cambridge University Press. 2897–2930. https://doi.org/10.1017/9781009325844.029.

Jarrige, F. 2016. *Technocritiques: Du refus des machines à la contestation des technosciences.* La Découverte. https://doi.org/10.3917/dec.jarri.2016.01.

Johnston, S. F. 2017. Technological parables and iconic illustrations: American technocracy and the rhetoric of the technological fix. *History and Technology* 33/2: 196–219. https://doi.org/10.1080/07341512.2017.1336851.

Jonsson, I., L. Mósesdóttir. 2023. Techno-solutionism facing post-liberal oligarchy. In: *Technology and sustainable development.* Edited by H. S. Sætra. New York: Routledge. 229–247. https://doi.org/10.1201/9781003325086-17.

Lee, W. L. 2022. *This is environmental ethics: An introduction.* New Jersey: Wiley-Blackwell.

Lemaître, D. 2003. *La formation humaine des ingénieurs.* Paris: Presses universitaires de France.

Lemaître, D. 2007. La formation des ingénieurs en France: entre logiques académiques et logiques professionnelles. *Les Sciences de l'éducation – Pour l'Ère nouvelle* 40/3. https://shs.cairn.info/revue-les-sciences-de-l-education-pour-l-ere-nouvelle-2007-3?lang=fr (accessed November 27, 2023).

Mainali, B., J. Luukkanen, S. Silveira, J. Kaivo-oja. 2018. Evaluating synergies and trade-offs among *Sustainable Development Goals (SDGs):* Explorative analyses of development paths in South Asia and Sub-Saharan Africa. *Sustainability* 10/3: 815. https://doi.org/10.3390/su10030815.

McCune, V., R. Tauritz, S. Boyd, A. Cross, P. Higgins, J. Scoles. 2021. Teaching wicked problems in higher education: Ways of thinking and practising. *Teaching in Higher Education* 28/7: 1518–1533. https://doi.org/10.1080/13562517.2021.1911986.

Monat, J. P., T. F. Gannon. 2015. What is systems thinking? A review of selected literature plus recommendations. *American Journal of Systems Science* 4/1: 11–26. http://article.sapub.org/10.5923.j.ajss.20150401.02.html (accessed November 27, 2023).

Nutas, A. 2024. AI solutionism as a barrier to sustainability transformations in research and innovation. *GAIA* 33/4: 373–380. https://doi.org/10.14512/gaia.33.4.8.

Pamplany, A., B. Gordijn, P. Brereton. 2020. The ethics of geoengineering: A literature review. *Science and Engineering Ethics* 26/6: 3069–3119. https://doi.org/10.1007/s11948-020-00258-6.

Roelens, C. 2022. L'éducation en train de vivre une expérience post-apocalyptique. Approche herméneutique du film Snowpiercer (Bong Joon-ho, 2013). *Annuel de la Recherche en Philosophie de l'Éducation.* Volume 2. www.sofphied.org/IMG/pdf/l_education_en_train_de_vivre_une_experien_-_camille_roelens.pdf (accessed November 27, 2023).

Roelens, C. 2023. Quels sens pour les savoirs scolaires en démocratie? Approches, lectures, défis. *Recherches en éducation* 50. https://journals.openedition.org/ree/11549 (accessed November 27, 2023).

Roelens, C. Forthcoming. (Dé)formation d'ingénieur, imaginaire romanesque et heuristique du monde social. Expérience hypermoderne et comtisme paradoxal chez Michel Houellebecq. *Les Sciences de l'éducation – Pour l'Ère nouvelle.*

Roelens, C., C. Pélissier. 2023. *Éthique, numérique et idéologies.* Paris: Presses des Mines.

Sætra, H. S. 2023. Introduction: The promise and pitfalls of techno-solutionism. In: *Technology and sustainable development.* Edited by H. S. Sætra. New York: Routledge. 1–9. https://doi.org/10.1201/9781003325086-1.

Schopp, K., L. Schelenz, J. Heesen, M. Pawelec. 2019. Ethical questions of digitalization in the Global South: Perspectives on justice and equality. *TATuP – Zeitschrift für Technikfolgenabschätzung in Theorie und Praxis* 28/2: 11–16. https://doi.org/10.14512/tatup.28.2.s11.

Stein, S. 2024. Universities confronting climate change: Beyond sustainable development and solutionism. *Higher Education* 87: 165–183. https://doi.org/10.1007/s10734-023-00999-w.

Nicola Banwell
PhD in health risks from disasters and climate change, background in public health and sustainability, and experience working in sustainability education. Research fellow at the Interdisciplinary Centre for Research in Ethics (CIRE), University of Lausanne, CH. Research interests: interdisciplinary ethics and sustainability focusing on health, education for sustainability, and values in collective action for sustainability.

Camille Roelens
PhD in education and training (political philosophy of education on authority in democracy), French "Habilitation à Diriger les Recherches". Currently, Maitre de Conférences at the Université Claude Bernard Lyon 1, FR. Research interest: understanding democratic issues in modern Western societies (e.g., citizenship and autonomy) to inform a theory of democratic individualism to guide 21st century education.