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Transparency and Innovation: The Potential of Open Data in Modern Educational Research

Erich Svecnik
Affiliation, erich.svecnik@iqs.gv.at, ORCID 0000-0001-7245-6195

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Open Data, in combination with Open Access and Open Materials, constitutes an established component of contemporary Open Science practices. In educational research, Open Data is widely expected to enhance transparency, reproducibility, and innovation. However, empirical evidence indicates a persistent gap between normative commitments to data sharing and actual data availability in the field. Drawing on recent studies and illustrative examples, this contribution examines the role of Open Data in strengthening transparency and scientific integrity, particularly with regard to reproducibility, verification, and the prevention of questionable research practices. Beyond transparency, the paper highlights Open Data as a catalyst for innovation by enabling data reuse, large-scale collaborations, and methodological advances that extend beyond the scope of individual studies. At the same time, it critically discusses ethical, legal, and methodological risks associated with Open Data, including data protection, challenges for qualitative research, and potential misuse. Against the backdrop of European Open Science policies and infrastructures, the paper concludes by outlining key challenges and future prospects for embedding Open Data responsibly and sustainably in educational research practice.

Keywords: Open Data, Education Research, Research Transparency and Reproducibility

1 Introduction

Open Data, alongside Open Access and Open Materials, has become a core component of contemporary Open Science practices. In educational research, the promise of Open Data lies in its potential to reshape how knowledge is produced, validated, and accumulated. This includes not only improvements in transparency and reproducibility, but also several distinct forms of innovation: (a) analytical innovation through the application of new methods to existing datasets, (b) collaborative innovation through large-scale and cross-institutional research designs, and (c) epistemic innovation by enabling new research questions that extend beyond the scope of the original data collection.

By enabling independent verification, reuse, and extension of empirical work, openly available research data enhance transparency, support methodological and theoretical development, and contribute to the cumulative advancement of scientific knowledge. These expectations regarding both transparency and innovation are increasingly embedded in research policies, funding requirements,

and international frameworks that promote openness as a cornerstone of scientific integrity. In particular, research funding bodies play a pivotal role in translating these expectations into practice by introducing data sharing requirements, mandating Data Management Plans, and linking compliance to funding decisions. Taken together, these developments highlight the broader role of Open Data as an infrastructure for innovation. From this perspective, innovation can be understood in terms of data reuse, knowledge recombination, and cross-disciplinary collaboration as key drivers of scientific progress (Klebel et al., 2025). Consistent with this view, empirical evidence shows that sharing research data not only enhances reproducibility but also increases the likelihood of reuse and scientific impact, thereby facilitating cumulative and innovative knowledge production (Piwowar & Vision, 2013; Colavizza et al., 2024). However, the extent to which these potentials are realized in educational research remains an open question.

Despite this normative consensus, empirical evidence suggests that the actual availability of research data in educational science remains strikingly low. Studies examining declared data availability reveal a substantial gap between stated openness and effective access. Acciai, Schneider, and Nielsen (2023), for example, report that among publications indicating that data were "available upon request," only 54 % of authors responded to data requests, while merely 14 % ultimately shared or expressed willingness to share all or parts of their data. Even more restrictive patterns have been documented in educational psychology journals, where openly available research data constituted only 3.85 % of publications overall, despite a gradual increase from 0.32 % in 2018 to 7.16 % in 2020 (Huff & Bongartz, 2023). In a recent study, Miske et al. (2026) found that among 600 randomly selected articles in the social and behavioural sciences, only 20 % included full details of data and code, while this proportion was only 5.5 % in the field of education. These figures underscore that Open Data, while frequently endorsed in principle, is still far from being a routine practice in large parts of educational research.

Research into the reasons behind this limited data availability further illustrates the structural nature of the problem. Tedersoo et al. (2021) show that the failure to provide data as promised varies considerably across disciplines and is rarely attributable to a single factor. The three reasons most often mentioned include lack of time (29.2 %), loss of data (27.7 %), and privacy or legal concerns (23.1 %). Importantly, these obstacles often emerge even in cases where authors express a positive attitude toward data sharing. As a result, the problem in many cases appears less rooted in a fundamental resistance to openness than in insufficient infrastructure, unclear responsibilities, and missing institutional support. The systematic use of established repositories and standardized workflows for research data management could already mitigate many of these challenges.

Taken together, these structural barriers point to the need for a broader conceptualization of Open Data within Open Science. Open Data must therefore be understood as a central—though not isolated—element of the broader Open Science movement. Open Science comprises a set of interrelated practices, including Open Access, Open Materials, and Open Methodology, all of which aim to enhance transparency, reproducibility, and accessibility in research (Borgman, 2012; Krammer & Svecnik, 2020; Murray-Rust, 2008). The UNESCO Recommendation on Open Science (UNESCO,

2021) conceptualizes openness as a means to foster inclusivity, collaboration, and engagement with society and diverse knowledge systems. Within this framework, Open Data plays a pivotal role in bridging transparency gaps and enabling collaborative and innovative forms of inquiry.

Overall, the existing evidence points to a clear tension between the normative commitment to Open Data and its limited realization in educational research practice. Still, the rationale for openness remains compelling. This innovation potential is particularly relevant in the context of educational research. The field is often characterized by context-dependent findings, limited sample sizes, and fragmented research infrastructures. Openly available datasets enable the integration of data across contexts, support secondary analyses with larger and more diverse samples, and facilitate the development of cumulative evidence on educational processes. Moreover, educational research benefits from data reuse as it allows researchers to address new questions—such as equity, longitudinal development, or institutional effects—without repeatedly burdening participants with data collection.

Among the various promises associated with Open Data, transparency occupies a particularly prominent position. Transparency is widely regarded as a foundational principle of scientific practice, as it enables the inspection, verification, and critical evaluation of research processes and outcomes. In light of ongoing concerns about reproducibility and scientific integrity, the capacity of Open Data to strengthen transparency warrants closer examination. The following section therefore examines how Open Data fosters transparency and, crucially, different forms of innovation in educational research, and why these dimensions are central to the credibility and advancement of the field.

2 Transparency, Innovation, and the Added Value of Open Data for Educational Research

Open Data in educational research is commonly associated with enhancing transparency, but its contribution to innovation is equally significant. It enables independent verification of findings, replication of analyses, and critical scrutiny of methodological decisions. In educational research, this function is particularly important, as empirical results frequently inform policy decisions, institutional reforms, and instructional practices. The absence of access to underlying data severely limits the ability of the scientific community to evaluate the robustness of published claims.

The relevance of transparency becomes particularly evident in cases where its absence has led to severe scientific and societal consequences. The now-retracted study by Wakefield (1998), which claimed a causal relationship between the MMR vaccination and autism, demonstrates how opaque data practices can delay the detection of flawed or fraudulent research, with far-reaching societal implications. Similarly, the case of Diederik Stapel, who fabricated data in at least 30 peer-reviewed publications in social psychology, highlights how restricted access to datasets can allow questionable or fraudulent work to persist unchecked. While these cases do not originate directly in educational research, they underscore a general vulnerability of the social sciences that Open Data practices are explicitly designed to address by enabling communal oversight and verification (Makel & Plucker, 2014; Munafò et al., 2017; Rost & Bienefeld, 2019).

Beyond the prevention and detection of misconduct, Open Data addresses more subtle and widespread challenges associated with reproducibility and analytical flexibility. Large-scale replication efforts have revealed substantial rates of non-replication in psychology and related disciplines (Open Science Collaboration, 2015; Nosek et al., 2015; Nosek et al., 2022), raising concerns that also extend to educational science. By making datasets openly available, researchers enable others to probe the sensitivity of results to alternative analytical choices, to distinguish exploratory from confirmatory analyses, and to assess the generalizability of findings across samples and contexts. In this sense, transparency through Open Data strengthens scientific integrity not only retrospectively but also prospectively, by encouraging more careful and accountable research practices (Krammer & Svecnik, 2020).

Beyond enabling transparency, Open Data also serves as a key driver of innovation in educational research by enabling new forms of data reuse and collaboration. A prominent example is provided by a large-scale multi-site collaboration such as ManyClasses (Fyfe et al., 2021), which investigated instructional effects across a wide range of higher-education contexts. This form of collaborative innovation relies on the aggregation and secondary analysis of openly shared datasets and demonstrates how Open Data enables research questions that would be difficult or impossible to address within single studies. These collaborative designs enhance statistical power, improve external validity, and allow the systematic examination of contextual moderators relevant to educational practice.

This potential is also evident at the methodological level, particularly in the form of analytical innovation. Openly shared datasets enable researchers to apply novel analytical techniques that were not available or established at the time of the original study. For example, data from an openly accessible study on applicant faking in personality inventories in higher education admissions (Krammer, 2020) have subsequently been reused in methodological innovation papers. These secondary analyses introduced and evaluated advanced modeling approaches, such as combined confirmatory and exploratory factor analysis models to detect aberrant responding (Cao et al., 2024) or bifactor models to identify faking behavior in personality questionnaires (Hendy et al., 2021). In these cases, Open Data did not merely add transparency to an existing study but served as a shared empirical resource that enabled methodological progress extending beyond the original substantive research question. Taken together, these cases suggest that Open Data shifts the epistemic function of data from study-specific evidence to a reusable infrastructure for cumulative and interdisciplinary knowledge production.

These examples highlight how Open Data fosters interdisciplinarity by allowing researchers from statistics, psychology, and educational science to engage with the same empirical material from different perspectives. This form of reuse supports a cumulative research culture in which data function as lasting scientific assets rather than as ephemeral by-products of individual projects. Empirical evidence further suggests that studies with openly available data receive more citations and have a broader scientific impact, reinforcing incentives for data sharing (Piwowar & Vision, 2013; Colavizza et al., 2020; Colavizza et al., 2024).

In addition to its effects on research practice, Open Data offers broader advantages for educational science as a field. Open datasets can be integrated into higher education curricula and researcher training, allowing students and early-career researchers to work with authentic data and to develop methodological literacy and critical data skills (Fleming et al., 2021). Moreover, Open Data supports public accountability and equity by enabling access to publicly funded research outputs and reducing disparities in research resources across institutions and regions (Rodriguez-Flores et al., 2021).

Taken together, these examples demonstrate that Open Data in educational research not only enhances transparency but also systematically enables analytical, collaborative, and epistemic forms of innovation, thereby strengthening the overall credibility, impact, and cumulative development of the field. When implemented responsibly, it strengthens transparency by enabling verification and replication, drives innovation by facilitating new analytical approaches and collaborative designs, and enhances the overall credibility, impact, and inclusivity of the field.

At the same time, the very features that make Open Data a powerful instrument for transparency and innovation also generate new ethical, legal, and methodological risks. Sharing educational data raises fundamental questions about participant protection, privacy, responsibility, and potential misuse that cannot be resolved by openness alone. To ensure that Open Data strengthens rather than undermines scientific integrity, these challenges must be addressed explicitly. The following section therefore examines the ethical considerations, unintended side effects, and risks associated with Open Data in educational research.

3 Ethical Considerations, Unintended Consequences, and Risks of Open Data in Educational Research

While Open Data offers substantial benefits for transparency and innovation, its implementation in educational research raises a series of ethical, legal, and methodological challenges that require careful consideration. Educational data are often sensitive, as they relate to learners, teachers, and institutions, and may contain information that is personal, contextual, or potentially identifiable. Consequently, ethical Open Data practices must balance openness with the protection of participants' rights, data privacy, and the responsible use of shared resources.

A central ethical requirement concerns compliance with data protection regulations, most notably the General Data Protection Regulation (GDPR) in the European context. Openly sharing educational data necessitates robust anonymization or pseudonymization procedures, informed consent that explicitly addresses data reuse, and clearly defined access conditions. To operationalize this balance, many data infrastructures differentiate between Public Use Files (PUF), which are freely accessible and highly anonymized, lacking contextual data that could possibly threaten privacy, and Scientific Use Files (SUF), which provide richer data under controlled access conditions to qualified researchers. As illustrated by institutional examples such as the IQS Data Library and large-scale educational studies like NEPS, this differentiation allows for openness while safeguarding parti-

cipant confidentiality (American Psychological Association [APA], 2020). Licensing frameworks, for instance Creative Commons licenses (e.g., CC BY-SA), further clarify permissible forms of reuse and help prevent ambiguous or unintended exploitation of data.

Beyond legal and procedural safeguards, ethical challenges also emerge at the level of data accessibility and usability. The FAIR principles—Findable, Accessible, Interoperable, and Reusable—provide a widely accepted framework for ensuring that research data can be meaningfully reused (Wilkinson et al., 2016).

Qualitative educational research presents additional, discipline-specific challenges for Open Data. Due to the narrative, contextual, and relational nature of qualitative data, anonymization is often more complex and risks stripping data of essential meaning. Concerns about re-identification, misinterpretation, and the loss of contextual integrity are particularly salient in interview- or observation-based studies (Chauvette et al., 2019; Lamb et al., 2024). Dedicated infrastructures such as Qualiservice (https://www.qualiservice.org/) have emerged to address these challenges by providing tailored support for archiving, documenting, and sharing qualitative data in ethically responsible ways. These developments underscore the need to ensure that Open Data practices do not systematically privilege quantitative paradigms or marginalize qualitative approaches within educational research.

In addition to ethical concerns related to data protection and accessibility, Open Data may also produce unintended methodological side effects. While transparency can mitigate questionable research practices, it may simultaneously facilitate behaviors such as HARKing (hypothesizing after the results are known), p-hacking, or superficial reanalyses detached from theoretical grounding (Kerr, 1998; Head et al., 2015). Furthermore, the reuse of existing datasets without sufficient conceptual reflection may contribute to jingle and jangle fallacies—erroneous assumptions that similarly named constructs are equivalent, or differently named constructs are distinct—thereby threatening conceptual clarity and theoretical pluralism (Munafò et al., 2017; Hanfstingl et al., 2024).

Finally, Open Data may be subject to misuse by actors outside the academic community. High-profile cases such as the Cambridge Analytica scandal demonstrate how ostensibly legitimate data sources can be repurposed for political manipulation and commercial exploitation (Berghel, 2018). More recently, concerns have been raised about the use of openly available datasets for training generative artificial intelligence systems without the consent of original participants or data producers (Baack et al., 2025). These examples highlight a fundamental tension: while Open Data aims to democratize access to knowledge, it may also expose educational research data to forms of extraction, commodification, and manipulation that undermine ethical research principles.

Taken together, Open Data in educational research offers substantial benefits, but only when embedded in robust ethical frameworks, appropriate infrastructures, and supportive policies. This makes the broader European strategy—aimed at reconciling openness with responsibility—crucial for determining the future trajectory of Open Data practices.

4. Future Prospects and Conclusion: Charting the Way Forward for Open Data in Educational Research

Over the past two decades, Open Data has evolved from a marginal ideal into a central element of research policy and infrastructure, particularly within the European context. Initiatives such as Horizon Europe, the European Open Science Cloud (EOSC), and national funding agencies have increasingly adopted the principle of "as open as possible, as closed as necessary". This approach reflects a deliberate attempt to reconcile the normative commitment to openness with legitimate ethical, legal, and contextual constraints (European Research Council / ERC, 2017). A visible expression of this shift is the growing requirement for Data Management Plans (DMPs), which oblige researchers to justify not the sharing of data, but rather the reasons for restricting access.

This policy-driven development signals a broader cultural transformation in educational research. In this context, research funders are key drivers of change, as they not only formulate Open Science policies but also shape incentives, responsibilities, and implementation practices through funding conditions, evaluation criteria, and support for infrastructures (Mabile et al., 2025; OECD, n.d.). By linking openness to eligibility for funding and by investing in data infrastructures, funders actively contribute to normalizing Open Data practices in educational research. Open Data is no longer framed primarily as an optional good practice but increasingly as an expected standard of responsible research conduct. At the same time, the analysis presented in this contribution makes clear that the potential of Open Data can only be realized if adequate infrastructures, competencies, and governance structures are in place. Sustainable implementation requires long-term investment in repositories, standardization of metadata and documentation, and institutional support for researchers throughout the research lifecycle.

Looking ahead, the future of Open Data in educational research will be shaped less by abstract commitments than by how effectively openness is embedded in everyday research practice. This includes addressing persistent challenges such as the ethical handling of sensitive educational data, the inclusion of qualitative research paradigms, and the prevention of unintended side effects or misuse. Crucially, Open Data should not be implemented in isolation but as part of a coherent Open Science ecosystem that integrates Open Access, Open Materials, and transparent methodological reporting. Only in such a combination can openness contribute simultaneously to rigor, innovation, and pluralism.

In conclusion, Open Data represents both an opportunity and a responsibility for educational research. It offers powerful tools to enhance transparency, enable innovation, and strengthen the integrity and societal relevance of the field. At the same time, it demands careful ethical reflection, methodological accountability, and supportive policy frameworks. In this sense, Open Data exemplifies the broader challenge articulated in the ECER 2025 conference theme "Charting the Way Forward: Education, Research, Potentials and Perspectives". Charting this way forward requires not only technological solutions and regulatory mandates, but also a shared commitment within the educational research community to balance openness with responsibility. When approached in this reflexive and integrated manner, Open Data can serve as a key driver in shaping a transparent, innovative, and sustainable future for educational research.

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AI Statement

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