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"We Are the Invasive Species": Democratizing Knowledge and Pedagogical Design as Acts of Resistance in the Public Classroom

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Abstract

This essay challenges the hierarchical and disciplinary structures of traditional science education through a critical reflection on a pedagogical sequence conducted in a public elementary school in Israel. At the center of the discussion stands a fifth-grade student's insight, "We are the biggest invasive species", which represents a rupture from the mandated scientific narrative and a crack in the classroom power arrangement. The essay argues that the shift from a "pedagogy of transmission" to the design of learning environments that invite uncertainty, intergenerational dialogue, and activism is not merely a didactic improvement, but a political act that undermines institutional standardization. Through an analysis of practices such as "mock trials," community hackathons, citizen science, and AI-based digital creation, a model of "scientific citizenship" is presented that restores students' agency and builds an environmental identity sustained decades after the experience.

Keywords: *Power Relations, Democratization of Knowledge, Critical Pedagogy, Socio-Scientific Issues, Eco-humanism.*

Introduction

Power Relations and Scientific Authority: The Moment the Standard Was Cracked

The moment that fundamentally transformed one educator's understanding of the politics of science teaching did not occur in a prestigious laboratory or an higher education, were I have been teaching since 2009, but in an entirely ordinary fifth-grade classroom in a regional school in northern Israel, where I have been teaching since 2004. In the midst of a "mock trial" addressing invasive species, a process in which students were required to represent different stakeholder positions: from the "invasive" species itself (the common myna and rose-ringed parakeet), through local species (the Lesser Kestrel), and extending to farmers and the Nature and Parks Authority, a student raised his hand and said quietly, yet with complete confidence: "We are the biggest invasive species." This statement did not appear in the teacher's presentation, was not part of the measurable academic objectives of the Ministry of Education, and was certainly not within the planned curricular "mandate".

At that moment, the essential gap was laid bare between organized, disciplined knowledge and authentic systemic and moral thinking. The central question is not whether young children are capable of complex understanding of reality, but rather whether we, as pedagogical designers, allow the power structures within the classroom to shift in ways that permit such thinking to surface. Public schools like "Falcon School" (pseudonym) operate under rigid constraints - a packed timetable, heterogeneous classes, and a standardized national curriculum that often encourages a model of "banking education" in which information flows from the textbook to the notebook (Dunlop & Rushton, 2022; Nir et al., 2024; Sabag & Cohen, 2022; Sarid & Levanon, 2023). The transition to inquiry-based learning around socio-scientific issues (SSI) constitutes an act of resistance to the existing order, for it compels the teacher to relinquish their status as sole "gatekeeper" of truth in favor of a joint construction of meaning (Aloni & Veugelers, 2024; Ariza et al., 2021; Bader et al., 2023).

The deviation from the pedagogical norm at Falcon School did not stem from exceptional resources or the selection of "gifted" students, but from a political decision to transform the classroom space into a site of inquiry rather than a site of dictation. Traditional science education often succeeds in transmitting facts, yet fails to cultivate argumentation skills and moral deliberation in complex issues, because it marks the

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boundaries of inquiry in advance (Berland et al., 2016; Kinskey & Zeidler, 2024). When a student challenges the dry biological definition of "invasive species" and applies it to the human species, they are in fact performing a deconstruction of the power relations between humanity and nature. This act transforms the science lesson from an arena of passive knowledge consumption into an arena of critical civic participation, in which students experience themselves as legitimate agents of change (Kinskey & Zeidler, 2024; Mbah, 2024; Muccione et al., 2025).

The Teacher as Agent of Democratization: From Information Management to Intellectual Responsibility

The professional identity of the teacher within the classroom power arrangement undergoes profound transformation when the classroom becomes a site of transformative learning. In the prevailing model, the teacher's power derives from the ability to hold the "correct" answers, whereas a pedagogy of uncertainty demands that the teacher relinquish this form of power in favor of a "power with students". This shift in professional stance is not merely a matter of teaching style, but a recognition that the teacher is not the sole arbiter of discussion (Grund et al., 2024; Leite, 2024). At Falcon School, teachers adopted the role of facilitators and mentors who enable students to contend with "wicked problems", problems that have no single clear solution, thereby redistributing epistemic authority within the learning space. Contending with such complexity fundamentally dismantles the myth of the 'correct answer', forcing a move from vertical authoritarianism to horizontal collaborative inquiry (Kinskey & Zeidler, 2024; Sarid & Levanon, 2023)

This process rests upon the concept of the "disorienting dilemma," in which students are exposed to painful ecological reality, such as extinction or mortal danger to life in their community (Gerits et al., 2024; Grund et al., 2024). The emotional confrontation with the Lesser Kestrel's helplessness in the face of the invasive myna is not merely a lesson in zoology, but a moment of ethical processing that awakens the need for activism. The teacher, rather than silencing the emotional tension in the name of "scientific objectivity," uses it as a catalyst for consciousness transformation. The building of nesting boxes or the management of a hackathon thus become not merely technical actions but acts of care (Ethic of Care), challenging the traditional scientific detachment from the object of inquiry (Grund et al., 2024; Willing, 2022).

The deliberate use of innovative technologies, such as artificial intelligence for comic creation or GIS applications based on mobile phones, serves as a tool for expressing the student's subjectivity within the mechanical public system. However, this digital shift exposes internal power gaps, such as socio-economic inequality in device access, necessitating pedagogical sensitivity to prevent new forms of exclusion. Creating visual narratives with AI assistance enables students to externalize their critical reflection and transform it into visible, shared stories, a move that challenges the monopoly of the written scientific text. This 'visual agency' enables students to curate their own environmental counter-narratives, transforming artificial intelligence from a technical tool into a medium of ideological expression. The integration of "head" (knowledge), "hands" (action), and "heart" (emotion) produces a holistic learning experience that undermines the dichotomy between formal and informal learning, and prepares students for intellectual responsibility in a world of uncertainty (Doulami, 2025; Grund et al., 2024).

Citizen Science and Eco-Humanism: Dismantling the Narrative of Control and Exclusion

Traditional science education sometimes tends to replicate narratives of control and dominance, particularly in the context of invasive species, where the terminology of "good" and "bad" echoes social approaches of marginality and rejection of the "other" (Steele & Pienaar, 2023; Willing, 2022). The adoption of the eco-humanistic approach in the public classroom allows students to move from a conception of "control" over nature to one of "compassion" and shared responsibility (Aloni & Veugelers, 2024). Rather than viewing invasive species as offenders to be eradicated, students at Falcon School learned to identify human responsibility in creating ecological imbalance, a move that shifts blame from the victim (the invasive species) to the system (human action). This ethical reframing, wherein students move from initial hostile reaction toward systemic and empathetic moral reasoning, was documented in the mock trial context, where students declared: "Humans are the ones to blame" and "We brought the invasive species, and now we blame them for what they do to survive". This act is not merely a rhetorical exercise, but a deconstruction

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of human privilege, positioning the student as a moral agent responsible toward the non-human 'other (Willing, 2022).

Students' participation in citizen science initiatives provides a living laboratory for the democratization of public space. Although the quality of data collected by children may be statistically partial, the social and political contribution of the move is unprecedented: students become stakeholders who influence decision-makers in their community. They do not merely "study" the environment; they investigate the homes of their neighbors, conduct dialogues with adults, and propose non-invasive technological and ethical solutions. Citizen science here is not merely a tool for gathering information for scientists, but a practice of "environmental citizenship" that grants students a political voice within a rigid age-based hierarchy (Albanesi et al., 2023; Ballar et al., 2024; Gerits et al., 2024).

This dynamic finds vivid expression in the hackathon, where students worked alongside high-tech experts and ornithologists as equal partners in problem-solving. The standard power relations, in which the adult is the source of knowledge and the child is the consumer, were replaced by a model of reciprocal intergenerational learning. Students demonstrated critical thinking when they challenged traditional ecological approaches advocating eradication and proposed humanistic alternatives, thereby proving that the classroom can be an arena for the production of new knowledge that is morally superior to existing institutional knowledge. This process demonstrates how critical pedagogy can transform the public school into a space in which civic consciousness is built, a consciousness that recognizes the human as part of one integrated system, not its exclusive owner (Aloni & Veugelers, 2024; Leite, 2024; Willing, 2022).

Beyond the Classroom Walls: The Long-Term Reverberations of Power and Identity

Among the most striking findings in research on the Lesser Kestrel program is that its impact is not measured in the retention of scientific facts, but in the construction of identity and agency that endures decades after graduation. Graduates of the program, now in their thirties, do not remember the detailed life cycle of the bird, but they vividly recall moments of empowerment when they built nesting boxes with their own hands or guided audiences of hundreds of adults on "Lesser Kestrel Day". This memory does not concern "curricular content," but rather the shift in power relations experienced in childhood: the moment the adult system believed in them and granted them genuine responsibility for the fate of a species in danger of extinction (del Mar del Pozo Andrés, 2023; Mbah, 2024; Roberts, 2024).

This process illustrates how experiential and values-based learning produces a "muscle memory" of self-efficacy that influences graduates' life choices and values (Grund et al., 2024; van de Wetering et al., 2022). Many report continued environmental involvement and community responsibility, indicating that science education that grants the child the role of an active "gatekeeper" succeeds in breaking through the temporal boundaries of the curriculum. The power acquired in fifth grade was not the power to accumulate grades, but the power to influence the physical and social reality of the community. This finding resonates with a broad body of literature led by Louise Chawla, demonstrating that significant life experiences in childhood, especially direct, positive encounters with nature and the presence of supportive adult role models, are key factors in the development of environmental awareness, values, and lifelong commitment to environmental stewardship (Ardoin et al., 2023; Jordan & Chawla, 2022).

A parallel model emerges in the climate change education curriculum documented among elementary school students in northern Israel, where teachers described children gaining agency to influence parental behaviors and embedding sustainability values across home and community systems. This intergenerational ripple effect, from students outward to families and communities, represents precisely the kind of "expanded circle of influence" that transforms a school-based program into a generator of sustained civic and environmental identity. This expansion proves that when children acquire epistemic power, they cease to be passive subjects and become 'trusted messengers' who reshape the moral landscape of their families (Trott, 2022). Research on intergenerational learning in environmental education consistently demonstrates that the process is not unidirectional, but reciprocal: children can significantly influence their parents (reverse socialization), especially when emotionally engaged or actively involved in educational initiatives (Mbah, 2024; Trott, 2022).

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Conclusion: The Political Boundary of the Possible

The boundary between "ordinary" and "extraordinary" learning in science education is a political boundary that has been constructed to preserve institutional order and discipline. Falcon School proves that when there is willingness to relinquish the narrative of control and unidirectional transmission, an opening is created for an education of intellectual liberation. The central challenge of education in the twenty-first century is not the development of new technologies, but the political willingness to change pedagogical design such that it can contain the critical voice of students as equal partners in shaping the future. The question remains before us: are we prepared to allow power to pass from the institutional mandate to the hands of those who will inherit the ecological crisis?

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