



Emergentist education and the opportunities of radical futurity

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ABSTRACT

Higher education has been criticised for its instrumental character, which constrains possibilities for meaningful change towards sustainability. Drawing on the concept of radical futurity, we develop a conception of education that we call "emergentist education". We integrate literature from futures studies, education for sustainable development, philosophy of education, and bring into dialogue experiences from three futures-facing educational contexts at a Swedish university. We identify three key areas to conceive of emergentist education and its value in practice: disciplinary and institutional norms, convening around anticipatory emotions, and deepening the paradox of sustainability as emergent through radical futurity. We apply a diffractive analysis through these key areas to demonstrate how a reorientation of education as emergentist might allow students and teachers to contest visions of futures. This work helps in approaching the liberation of education to allow young people to come together whole-heartedly around what matters to them.

1. Introduction

What is the relevance of university education in these troubled times (Facer, 2019)? University education's role is commonly viewed as preparing young people to address challenges in the future (Király & Géring, 2019). The future is anticipated and students are taught to develop in corresponding, disciplined ways. Education in this view, does not only prepare students, but it also *makes* futures, and does so based on existing views of the unsustainable present. So, understanding the relevance of university education becomes a question of how we are making and caring for the future in higher education. It is this potential of education that we explore in this paper by engaging with the question:

How do we conceptualise and work towards an education that enables people to anticipate and contest visions of futures and presents in order to 'fight for a viable future for all'?

We develop a concept of education that we call *emergentist education* drawing on literature from futures studies, the field of philosophy of education, and education for sustainable development (ESD). Education is an inherently valuable emergent process (Biesta,

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2020), and as such education can be understood as distinctly non-instrumental. With such a view, we can understand how education has elsewhere been conceptualised as a creatively democratic space that can curate educational interactions with the more-than-known and the possibilities of the not-yet-imagined (Osberg, 2010). These ideas also encourage reflections on practices where education is formalised, standardised, and controlled, which has been found to reduce opportunities for creativity and novelty (Amsler & Facer, 2017a; Mendick & Peters, 2022).

The concept of radical futurity (Osberg, 2010) is valuable to conceive of emergentist education. Radical futurity as an anticipatory approach assumes that the future does not exist yet, but stretches across from the not-yet known, beyond the not-yet possible to the not-yet imaginable. Providing space for radical futurity in education entails trust, a "relaxed form of knowledge and being in the world [...] confident in its capacity to create the conditions of possibility without seeking desperately to secure their outcomes" (Facer, 2016, p. 76).

We propose three themes that help us deconstruct and find the possibilities for emergentist education in higher education. First, we argue that disciplines and institutional cultures need to be reimagined in ways that do not close but open up futures. Briefly, the idea of an open future is an interpretation of futures as "a source of rich possibility" and "not as a known territory to be mapped" (Facer, 2016, p. 69). Second, we argue that emotions have a key role in emergentist education and should be given due space in educational settings. Third, we use the concept of radical futurity to discuss the paradox of sustainability as an emergent concept.

This paper can be considered a provocation. It explores the reorientation of education into something radically different from current mainstream education at universities. It seeks to implement what currently is prevented in the dominant framings of education in the neoliberal university. Encouraged by the concept of radical futurity, we engage with the possibility of the impossible, working towards an education through which one can be open to radically new futures.

2. Research approach and method

This work started in early 2019 with a proposal for a symposium titled "How should universities care for the future?". We met around shared concerns about Swedish university education, coming from three different educational contexts. The contexts are professional development for university teaching staff, complementary sustainability education at university, and disciplinary education in digital technologies for university students. Despite the diversity of contexts, our concerns and ideas resonated with each other. We engage in a diffractive approach to this research, where "diffraction is a method of examining theories through each other and the effects of these interfaces" (Barad, 2007 as cited in Bozalek et al., 2018, p. 111). Diffraction analysis has been proposed by Donna Haraway (1997, 2000) and Karen Barad (2007), as an alternative methodology to reflective analyses and its reductionist ways of thinking. We extend Haraway's metaphor of a reflective mirror, to embrace the diffractive prism. Through one another, by engaging in joint reading and analysis of our own contexts and practices, we generate "inventive provocations" (Dolphijn & van der Tuin, 2012, p. 50 in Bozalek & Zembylas, 2018, p. 51) and creative insights to conceptualise emergentist education. Rather than asking "what does emergentist education mean?" when reading our experiences, a diffractive approach prompts us to ask: What does emergentist education create? (Lenz Taguchi, 2012). We therefore shift our attention to the possibilities for education.

This paper is a result of an iterative learning process rooted in the interest for education and its possibilities for societal transformation. We engaged in two parallel processes:

1. Review and discussion of literature from educational philosophy, education in future studies, and ESD to develop a theoretical framework for what we came to name "emergentist education" during the process; and
2. Collecting and reflecting on observations or data in the three contexts, identifying and grouping questions and themes.

We draw on our own experiences and observations as teachers and educational researchers, engaging with different research communities in the field of sustainability, futures, gender, as well as science and technology education. Each of us has done empirical studies (interviews, ethnographic studies), which we bring into dialogue. We read our contexts - the struggles, affective responses, memories, transcriptions - diffractively in order to come to know them differently (Davies, 2014). The diffractive approach feels true to the spirit of this collaboration in that it is experimental and pays attention to what becomes in moments of encounter - elements that we argue for in emergentist education. In doing so, we try to practice an emergentist process ourselves.

The results of this process are presented as follows: 1) in a synthesis of literature towards emergentist education and radical futurity, 2) through diffractive understandings of the three cases and their possibilities for emergentist education, and 3) three core conceptual themes generated through this literature and cases. We present the cases in this paper (result 2) in the form of vignettes, used elsewhere in education research to learn about research participants' beliefs and perceptions of phenomena (Skilling & Stylianides, 2020). We use them here to describe the authors' collective understandings of important events, characters, and situations that problematise current practices in education. While these vignettes are a result of a collective process, we describe them here as distinct personalised accounts of each individual context. Our intention is for these to be read together, told through shared but differentiated points of hope and concern.

2.1. Futures in contemporary education

Education for sustainable development (ESD) has been promoted in worldwide ESD campaigns by the UNESCO and UN Decade of ESD since 2005, with the goal of equipping young people with skills to address sustainability challenges. The assumption that underpins these initiatives is that we can *make* the future sustainable by providing individuals with more sustainability education,

enhancing their capacities to create change towards sustainability (Angeloni, 2020) and take “actions for sustainable development” (UNESCO, 2017). For example, in a recent publication *Envisioning futures for environmental and sustainability education*, the editors ask, “can we reclaim the future as it seems to spin out of control?” (Corcoran et al., 2017, p. 20). Education, it appears, is understood as a tool to capture and control futures. Such a framing relies heavily on the idea of promoting skills and competencies in sustainability education with which to equip students to tackle sustainability challenges. These include, for example, systems-thinking competence, anticipatory competence, normative competence, and strategic competence (cf. Pacis & VanWynsberghe, 2020; Wiek et al., 2011). These competencies all offer meaningful and important entries into sustainability education, dependent upon their framing, but have problematic assertions about futures embedded within.

ESD and Education for Sustainable Development Goals (ESDG) are underpinned by goals which prioritise social and economic considerations (business-as-usual) at the expense of ecological issues, framing sustainability or sustainable futures as ones where humans successfully manage natural resources (Huckle & Wals, 2015; Kopnina, 2020). Such an outcome-oriented trend is not unique to sustainability education; education is typically characterised with three common orientations towards futures (Facer, 2019). For one, students can be “optimised” through education to make the best choices and act towards realising a foretold future. Alternatively, a colonisation orientation assumes that the future is empty and can be filled, where education instils values in students who will then realise a desirable future based on these predetermined values. Finally, a contingency orientation recognises the unknowability of the future and sees the role of education as equipping students with the tools to navigate these unknown, and anxious, futures. Holfelder (2019) places these orientations in the context of ESD and describes them as reproductive, or education as “training” (see also Jickling, 1994). These common approaches to education have been problematised elsewhere as framing education as an “instrument designed to achieve a predetermined socio-political product” (Biesta, 2020, p. 6). The assumptions of and orientations towards futures limits the purpose of education to being an instrument to reach outcomes defined by those in power (c.f. Bussey, 2012).

Disciplinary cultures fill futures in ways that uphold power structures, if not reflected upon to open up for alternatives. Research on norms, values, or identities in science and technology education suggests that education in those fields emphasises the rational or objective over empathy or compassion and the technical, mathematical, or logical over the social, cultural, or societal (c.f. Avraamidou & Schwartz, 2021; Ottemo et al., 2020). This positioning of education is co-produced with gender and hegemonic masculinity. Much of the research on norms, values, and gender in higher education has been conducted in male-dominated fields within natural science and technology education, physics and engineering or IT (see e.g. Gonsalves & Danielsson, 2020; Ottemo et al., 2020; Salminen-Karlsson, 2011). However, within fields with a more balanced gender representation, such as biology, masculine norms and values are also found to be dominant (Günter, 2022). Education hence reproduces patriarchal societal structures and masculine ways of doing science and technology (c.f. Faulkner, 2001; Harding, 1986). The culture in education may not be recognised as a culture, as it is assumed to be objective and value-free. Those involved believe they follow unproblematic scientific recipes, which does not require making explicit subjective assumptions and choice of focuses. This practice has been termed a “culture of no culture” (Traweek, 1988).

What education is to achieve and become is captured in curricula. Education has increasingly become equated with curricula (Osberg & Biesta, 2021). Curricula are important means to the ways in which universities today are governed, on the basis of quantified and categorised descriptions of the present (Amsler & Facer, 2017a; Mendick & Peters, 2022). Education, its contents and purposes, are standardised through projects such as Bologna, that have imposed “narrowly instrumentalist, capitalist, Eurocentric epistemologies and criteria of value on the entire world” (Amsler & Facer, 2017a, 2017b, p. 11; see also Barnett, 2018). With such an output-oriented focus on evidence-based pedagogies, more experimental and imaginative learning processes are devalued and marginalised (Holfelder, 2019).

These critiques have been explored elsewhere by Milojevic (2005), who argues that modern structures of education have been transformed into more business-like and consumer-oriented institutions, dominated by hegemonic narratives of prediction and determinism. These conceptions of education, and subsequent practices, circumvent opportunities for novelty because there are no or few opportunities to engage openly and experimentally with ideas about futures. Mainstream “education for sustainable development”, maintains rather than challenges existing systems of exploitation and violence (Stein et al., 2022). Such an approach places a heavy burden of responsibility on young learners, who have been found to feel powerless and overwhelmed by the current state of the world (Ojala, 2017). Such a framing of education is not apolitical (Osberg, 2010); rather the making of sustainable futures has been depoliticized and disembodied through such universalities as governance by global goals of sustainable development (for a summary see Biermann et al., 2017), which closes opportunities to explore questions of power and participation towards more open futures (Knappe et al., 2019). A challenge of education is therefore to “unmask” these futures, i.e. to reveal the beneficiaries and who is disadvantaged in prevalent futures (Milojevic, 2005).

2.2. Towards a conceptualisation of emergence and radical futurity in education

Moving away from orientations fixated on control and closure, Osberg (2010) employs Derrida’s “logic of emergence” as an invitation to an open-ended, experimental orientation that *cares* for futures. It entails leaving futures “radically open” (p. 162), always, however, taking responsibility. Herein lies a paradox and Osberg suggests thinking of it as “non-normative normativity”. Taking care of futures involves exceeding existing rules or norms. This conception of education may also be understood as “symbiotic anticipation”, a mode of engagement which is not vision-based and which does not extrapolate from existing knowledge where “education is understood as the very site in which the radical as-yet-unrealised excess of the present in both the world and the child is made visible” (Facer, 2019, p. 10). Osberg elaborates that.

“Because the relationship is in excess of each component organism’s immediate needs (i.e., it is not strictly necessary), the call to generate a symbiotic relationship is a call to *play with the possibility of what is not yet ‘needed’* [...] symbiosis embodies a logic of ‘togetherness in difference,’ such togetherness can be understood as an expression of the boundless, incalculable possibilities of life: an expression of surplus” (Osberg, 2017, p. 14).

This open-ended approach to futures creates conditions for a response-ability - the capability to respond (Haraway, 2016) - where the learner and the world emerge together since what each emerging relationship brings cannot yet be imagined. Symbiotic anticipation precludes any form of moral or political colonisation and may be considered as a non-colonising form of moral, political, and ecological action in itself (Osberg, 2017). It is an orientation that allows an abundance of possibilities in the future (Facer, 2016) and which responds to the call to expand learning modes that transgress “taken-for-granted norms, existing ethical and epistemological imperialism in society and higher education, and provide possibilities for engaged, lived experience of transformative praxis for all of our students” (Lotz-Sisitka et al., 2015, p. 78).

These framings of education provide foundations for learning capabilities necessary for encountering futures (Lotz-Sisitka et al., 2015) and offer important insights into how educators meet students and into the educational process itself. Biesta (2020) conception of education as subjectification supports elaboration of the conditions that enable open-ended encounters with futures. Subjectification concerns the student as subject rather than object in educational interventions, a student is brought “into play” and granted the freedom to agree or not agree, to act or to refrain from action (Biesta, 2020). Subjectification cannot be *produced* in education, Biesta and Winter (2011) argues, but it can easily be prevented through institutionalised orientations towards the future. An orientation towards subjectification in education has the potential to bring something new into the world because it allows the individual to reflect on and critique existing orders and power relations. In alignment with Latourian approaches to factual matters and matters of concern, subjectification occurs through the novel relational “attachments” with ideas and material (Latour, 2004), which are particularly amplified in the collective. For Masschelein (2019), this can be observed in higher education settings that contextualise the learning in relation to the local and with close interaction with worldly matter. Stein et al. (2022), in their conceptualisation of “education for the end of the world as we know it”, also refer to Biesta and subjectification, when they argue that education needs to support individuals to act in “grown up ways”, divesting from harmful ways of being. Masschelein (2019) adds that emergent ideas are those that no single person would have held individually but come into being through collective interactions. The idea of emergent collective meaning-making takes the orientation of education away from a predetermined outcome, such as curriculum, and instead opens up for the possibilities of new understandings to emerge through the facilitation of interactions. These are orientations of education that cultivate an imagining of abundance (Jardine et al., 2006).

Conceiving of education as something that emerges allows us to see futures as “construction site[s]” (Amsler & Facer, 2017b). Students have the freedom to imagine or make futures, education is not confined to reproduction or training (Biesta, 2015; Holfelder, 2019). Education thus becomes a place that is intentionalistic. Therein lies a unique possibility for education: education has the potential to take care of the future as it can become a place in which futures are made without the constraints of having to implement them (Osberg, 2010). It can be a domain that allows students to experiment and invent new rules using the guidance of the past - experimenting with the possibility of the impossible, of radically open futures. Reaching this potential requires engagement with futures in complex and open-ended terms. The educator’s role could be to maintain a space in which, as Arendt put it, “freedom can appear” (Biesta and Winter, 2011).

Futures, while open, are not empty, and exist in the form of anticipation (Miller, 2018). There are futures on the horizon that can be terrifying, which is one example for how futures affect our imagination and actions in the present. Educators struggle to work with futures in hopeful ways and in ways in which freedom can appear (Gough, 1990; Hicks, 2012; c.f. Slaughter, 2003). Senses of urgency are being coupled with optimism in framing the matter being taught, despite the worry in teachers behind the scenes (Norgaard, 2011). Norgaard argues that this optimism contributes to a socially constructed sense of denial, where one reality is socially acceptable and another might be hidden. Norgaard’s observation is elaborated upon by Bryan (2020) who describes emotions in the classroom as psycho-social constructs, whose landscape remains under-theorised in otherwise “affective pedagogies”. It has been found that there are four generalised responses to climate change, including apathy, denial, withdrawal, and active engagement (Davidson & Kecinski, 2022). These emotional responses are part of the cognitive reception to information but depend upon the ways in which information is framed and experienced, and how it can be subsequently interpreted. In the context of the classroom, then, the more-than-cognitive experience shapes the relationship students and staff may associate with the meanings being generated. The affective messages that are carried with the content of climate change, and other futures narratives, have implications for the ways in which students interact with them. Education needs to allow those engaged to explore their hopes and fears (Hicks, 2014).

Navigating the emotional responses to troubling subjects such as climate change and futures thus becomes a concern for educators. Many researchers (Bryan, 2020; Facer, 2019; Hicks, 2014; Ojala, 2017) have argued that unpicking the emotions triggered by climate change futures in education, including consequent denialism, can help to transcend barriers to action and support transformative learning. Ojala (2016, 2017) research speaks to dealing critically with emotions such as hopelessness and pessimism in relation to anxious futures in education. Ojala finds that critical hope can be carefully curated through temporarily closing the future, in order to negotiate ideas of desirability of futures, and then reopening the future with possibilities for more desirable alternatives. Such a process requires a trusting and caring environment, which for the classroom means reorienting the learners into “democratic fellowship” where justice and care frame a shared responsibility for better futures (Fielding, 2011). Critical hope is thus not a “form of magical thinking” that provides a convenient escape from reality, but is a “state that is achieved precisely through acknowledging fear, failure, loss and grief” (Facer, 2019, p. 8). As a form of “educated hope”, students acknowledge difficult and uncomfortable realities, such as humans’ role in accelerated climate change (IPCC, 2022) yet may choose to act despite overwhelming odds. Educated hope

complements Biesta's view of subjectification as not imposing self, nor withdrawing from the world. Education should provide students with opportunities to relate to and interact with challenging and emotionally loaded ideas of the future without freezing in fear (Biesta, 2019).

The above approaches to education offer a reframing of education as emergentist: an open, democratic, more-than-cognitive process, through which ideas about futures, the world, and the student within it can emerge. It is unclear whether the characteristics of emergentist education can, in fact, be implemented in contemporary education institutions or if education as more than training, simply remains an ideal for education. A condition for opening alternative futures is the freedom to think and act differently (Osberg, 2010) which is not given when underlying societal structures, rules, and logics (e.g. economic growth and competitiveness) are considered "natural" and set. As such, we also struggle to imagine the non-normative character of education in practice. It is through an emergentist framing that we try to take this imaginative leap. By engaging in a diffractive reading of our current practices we strive to understand where shades of emergentist properties may be observed, where this can help deepen understanding of our current practices, and where we may be closing ourselves off from opportunities of radical futurity.

2.3. Vignettes of educational initiatives at university

Our concerns and questions about emergentist education evolved by learning from and through our experiences and involvement in three different educational contexts at a Swedish university. In the following we present three vignettes to share insights into those contexts that we synthesised and learned from. Here, we write in the first person where "I" refers to the specific author in that educational context.

2.4. Professional development for university teachers - The Change Project

Universities in Sweden are mandated by law to work with "sustainability", and many try to profile themselves around that idea(l). As such, our centre had recently been funded with strategic financing to develop sustainability research and education on a specific campus. This project funding was interpreted by many colleagues as the "low hanging fruit" of choosing a small (less than 200 teaching and research staff), geographically separated campus that would help build the greater university's reputation without having to interfere with faculties on the main campus. As such, I found myself on this diminutive campus, organising a professional development course for university teaching staff around ESD. There were a couple of things noticeably different than when working on the main campus, where teaching staff seemed more burdened (and even irritated) than buoyed by having to engage with ESD in pedagogical development courses. The first thing was that on the small campus, people *wanted to* engage with sustainability; there was curiosity. The second thing was that a number of teachers, from a variety of disciplines, were *already engaged* in working with sustainability in some way in their teaching and research. In this first iteration in Spring 2019, the course attracted 11 participants from six departments: cultural anthropology and ethnography, business and economics, engineering sciences, archaeology and ancient history, media and communications, and wind energy. Teachers engaged with ESD via a "change project" through a series of five three-hour workshops over an academic semester (see Mandikonza & Lotz-Sisitka, 2016) for another example of a change project process). It served as an iterative process for educators to have a collegial meeting space to discuss sustainability in relation to teaching and research and design a reflexive change process within their university working context. Course meetings consisted of written and oral reflections, literature-based discussions, acting as critical friends for each other's evolving projects, and presentations of change projects. Outside course meetings, participants read literature, developed their change projects, and wrote a final reflection paper.

These course meetings became an important part of my continuous reflections on the purpose(s) of education. Students and teachers on campus were calling for tools and methods to learn our way out of and through the converging sustainability crises. Hope for better futures and frustration at the difficulties experienced in education around wicked topics mingled with appreciation for this course as a space to meet colleagues and have time to discuss ideas and challenges. What did sustainability mean? How did we feel about the future? How to be open-ended and non-prescriptive in courses, rather than aim for specific "solutions"? How to meet students' needs for a competitive job market? How to work within the confines of contemporary university education models? These questions and many more occupied us in the course, and I noticed my struggle to provide this group with guidance in these tough issues. It was in this struggle – how are we in education working with these issues of futures that are so "urgent" – that I met Anne and Laila.

2.5. Experiential learning in student-led sustainability education

In a shadowy corner of an Earth Sciences Campus, the poster-plastered walls of a student-led centre for environment and development studies reflects the activist nature of the students and staff who study, teach and connect within. Since the early 1990s, this centre has been exploring new methods for learning about sustainability in university, reinventing the student-staff relationship, and inspiring new fields of research. I was hired in 2018 as a student coordinator to co-administer an elective bachelor level course focused on global challenges and creating sustainable futures. The course, and this centre more generally, attracts international and Swedish students alike. It offers students new ways to understand, imagine and open up futures, while reflecting critically on the sustainability challenges facing the world today.

The 2018 iteration was ambitious. We wanted to push students to explore future scenarios, the global goals for sustainable development, and different futures-visioning exercises to expand students' capacities to re-open the future. Alongside a course-long back-casting based project, and student-led workshop sessions about different global challenges, the students were also examined

through an experiential-learning exercise beyond the classroom to probe their role in global sustainability issues, with an eye on sustainable futures. This long-featured course exercise is known as the 30-Day Challenge (Barrineau et al., 2019) and asks students to challenge themselves to do something differently for thirty days.

It was during this time that I noticed how students were interpreting their role in global challenges and sustainable futures. There seemed to be a self-censoring, or rationing, of lifestyles. It was as if their agency was only or overwhelmingly coupled to their behaviour as a consumer. While some students had more imaginative interpretations of the exercise, through volunteering or planting seeds, most were concerned with their water-, carbon-, and ecological-footprints. I left the exercise feeling a little disappointed: Was this the purpose of sustainability education? To send students into the world rationing their consumption?

Courses at this sustainability centre are elective and, as such, do not strictly adhere to rigid pedagogical structures in “training” education. As a student-led learning institution with more flattened academic hierarchies, these courses are playful, creative, and imaginative. And yet, there are limitations with what education here can do. It was this that led me to ask how sustainability education is related to the future? How are we providing students the capacity to not only engage with the unknown - but to embrace it? With these questions and concerns I met my colleagues and co-authors of this paper.

2.6. Computing education, an example of disciplinary education

I entered the conversation with sincere concerns about mainstream university education, in particular computing education, i.e. education on digital technologies. I was a teacher and researcher at the IT department investigating norms, values, and identities in computing education. Before coming to Sweden, I studied computing at two universities in Germany and struggled to make sense of computing and myself in that field. Digitalisation and digital competence are advocated as having great potential for society and we can see them rapidly transforming the ways we live. There are great hopes that digital technologies can lead to a better society and digital technologies also drive unsustainable ways of living, e.g. consumption. Computing education provides little space to critically and playfully engage in the possibilities and effects of digitalisation. I have found university education in computing to be oppressive. Students are kept ignorant about the state of the world. Education seems to separate students from the troubles that the world is in and deprives them of opportunities to care for the world in “their ways”.

In my PhD research (Peters, 2017, 2018), I followed more than 20 students enrolled in two computing study programmes at a Swedish university through the first three years of their study, conducting interviews. The students were selected so they together had a variety of interests, experiences, and backgrounds, in terms of previous study or working experiences, or spare time activities. I found that the students were made to adapt to narrow, reductionist and technical ways of engaging in computing. They were formed to become, what is called a “back-end” programmer or problem solver, which entails solving the really difficult technical problems that are invisible, hardly noticeable to people outside computing. Students who enter the programme with other interests, e.g. in politics, art, or helping people, struggle finding space to bring in their interests outside technology and connecting dominant ways of participating in the field with their interests.

Since my PhD project, I have explored forces on student development. I conducted observations in computing classrooms and analysed higher education policies (Mendick and Peters, 2022). I find that university education is set up to homogenise students within their chosen disciplines. I am now employed at a different technical university to work with what is called the “integration of” sustainability in education. Analysis of study programmes suggest that many mainstream university programmes in engineering and natural science include nothing or very little on sustainability. Maybe those programmes do more harm than they are useful, depriving students of a possibility to engage with the world as a caring human and in ways that matter to them. Rather than doing small fixes to those programmes, these analyses should give reason to fundamentally question, problematise, and reinvent university education.

3. Three themes for imagining emergentist education and radical futurity

In bringing the experiences of our contexts into conversation, we have identified three themes of common interest to explore more deeply: 1) disciplines and institutional cultures, 2) anticipatory emotions, and 3) the paradox of sustainability as emergent through radical futurity. Using the characteristics that we associate with emergentist education and radical futurity as discussed above as a lens, we explore our own contexts and practices to consider what emergentist education might, instead, create. These three themes are distinct but develop upon each other through the diffractive process.

3.1. Disciplines and institutional cultures - how to open futures?

Education, in its current form, is not only instrumentalised to provide certain competencies, it also produces and maintains disciplinary and institutional cultures. Engaging with and reimagining disciplines and educational institutions is therefore crucial in the flourishing of emergentist education and radical futurity. In the following, we show how disciplinary cultures can inhibit emergentist education, and we end by discussing the possibilities for disciplines and institutional cultures in emergentist education.

We begin by illustrating the impacts of disciplinary cultures through research in the context of the computing programmes (Peters, 2017, 2018). Students with certain technical competencies, “doing back-end programming”, solving the difficult technical problems that are hardly noticeable to anyone, get most recognition from teachers and peers. The students and teachers who show an interest in “fuzzy” societal questions risk being marginalised. For example, a teacher in a course in human computer interaction (HCI), a course about human and societal aspects of developing digital technology in society, was suspected to be incompetent due to his enthusiasm for HCI, as shown in a student account:

“The teacher [of the HCI course] was very enthusiastic about HCI. [...] We thought: ‘He is not a real computer scientist!’ (laughs) But then it turned out that he actually could program and that he was as good as we are, [...] just that he had an interest for that which was a bit fuzzy.”

If a teacher, who is in a power position, can be disregarded like that, students may be even more vulnerable to such questioning. Students who specialise in HCI were described as those who “slip through” the programme, and are accused of being incapable of programming and technical problem solving. The condescension of others for “fuzziness” may not be truly held views, but instead expressed as performances that provide a recognition as someone who knows what is valued, which in turn may help them to be seen as a competent insider.

The students also describe educational processes and artefacts in the university environment that orient the students and teachers to engage in certain ways. For example, the students talked about a book known as “the bible”, passed on between student generations, which contains all that the students need to practice computing. This book contains lists of algorithms and data structures with “only necessary text”. It is one of the tools the students are provided with to become someone that is recognised as competent by others. The students become capable of solving the difficult technical problems and come to find it fun to do so. One of the students reflected “*you become a junkie*”, “*you want to feel the feeling [you get from technical problem solving] again and again*”. The students are oriented to technical, reductionist problem solving rather than engaging in complex societal and systemic dilemmas (Easterbrook, 2014).

Education is political in a way that it forms and constrains or allows for certain students’ performance, orientations, and trajectories. One of the students entered the computing programme after having studied political science. In the beginning the student saw a “*natural connection*” between computer science and politics. In the third year, the student said that they no longer want to engage in politics: *Political science “is about discussion and argumentation without getting anywhere [...] The only way to come to a point of right or wrong is to look at reality”. In computing, we ask “Can I do this algorithm slightly, slightly faster? This is a theoretical, a natural science discipline, one can always test the solution [...] in a very small, secure environment.”* The student adopted a disciplinary identity as someone that cares about artificial and controlled environments. He seemed to have withered in his ways of caring for the world in its complexity. This reminds us of the work by Stein et al. (2022), who argue that people are infantilized by the house of modernity.

Alternative spaces, in which students get to engage with more open societal questions do exist in the computing context, however, they are also under threat of the dominant disciplinary culture. The students from the computing programmes can choose to take an “open-ended project course” in which they get to work with and for the local hospital on a complex question such as “What could primary care look like in 2030 and what could be the role of IT within”? The students’ responses to this course vary from gratitude to resistance. Students are confused by the openness and seek to reduce the complexity by focusing on technical issues, which closes opportunities to make radically different futures. The relevance and learning in this course can be questioned by students and also other teachers and programme coordinators as the course does not focus on what is seen as technical competence. Consequently, the course is at risk of being erased and has struggled to attract students.

The research presented above on cultures in science and technology education suggests that we may need alternative educational spaces in which inter- and cross- disciplinary perspectives are welcomed, as they might provide more freedom and opportunities for radical futurity. However, attempts to transcend hierarchical and disciplinary academic cultures appear limited in practice. In the elective sustainability education where students are hired as course coordinators, this process can be perceived as elevating some students over others, suggesting a reproduction of the learning hierarchical dynamic, rather than a creation of more democratic learning environments (Ishihara et al., 2021). Furthermore, within the classrooms of this centre a disciplin(ing) seems to be evolving around sustainability, moralising behaviours and ways to engage with wicked challenges. The creation of moralising behaviours is perhaps most apparent in the well-known concept of the “carbon footprint”, a popularised tool which passes the onus for decreasing emissions and taking climate action onto the individual consumer and citizen (Supran & Oreskes, 2021; Turner, 2014). Virtuous consumers thus behave in ways that minimise their own carbon footprint.

A process of transferring a transformational response to climate change to rationing consumption to reduce emissions is replicated within the course on futures and global sustainability challenges, “The 30-Day Challenge”, which invites students to try out a sustainability lifestyle change for 30 days. An aim is to connect with larger sustainability issues and reflect on their own roles in relation to these issues as well as the structural aspects of lifestyles. We have noticed that the ways that students tend to interpret this exercise could be considered as a correction of unsustainability, rather than an opening up process. For example, of the 49 participating students, 29 elected to change consumption behaviours. Replacing meat with vegan alternatives yet following the same general lifestyle does not appear particularly explorative, rather it optimises an individual’s consumption to reduce environmental impact. Of course, such an interpretation is debatable; for students who had never questioned dietary habits this experience may have been particularly novel. With such approaches, the space for playing with open futures, students’ agency in making new futures, developing radically different lifestyles, or of playing with novel ways of living in neo-liberal societies is diminished by perceptions of virtuous behaviours that are normalised in relation to what it means to be “sustainable”. Furthermore, considering the challenge of scaling such individual changes to the global level, some students perceived their own role in shaping futures as restricted and left the course feeling pessimistic about the future. This activity was intended to be an opportunity to try something new in a playful manner, but instead convinced some students that realising sustainable futures might be futile.

Similar disciplinary and institutional challenges also emerge in the Change Project, where teachers focus on making change in their teaching and research contexts. One of the participants reflected that technical facts and skills are important in engineering while affective components and acting as a human concerned about the environment are discounted. Therefore, certain concerns, e.g. about the impact of technology on nature and the climate, might not be raised in engineering contexts. The teachers in the Change Project course further reflected that they are trapped by institutional cultures, for example, by the ways they are expected to grade certain

skills, such as the kind of competencies relevant for working with sustainability (see Wiek et al., 2011). One of the course participants reflected that her idea to change the assessment to only pass/fail complemented by a nuanced and personalised reflection of the student's learning process was rejected without an explanation. We suggest that these observations are connected to an orientation of closed futures, expressed through focusing on technical skills and facts, which has implications for which knowledge and skills are valued, who is recognised as competent and thus who gets power in meaning making (Latour, 2004).

We raise the question, how and if it is possible to work towards emergentist education in the contemporary disciplinary education system. We have shown how disciplines and institutions have homogenising and constraining effects on individuals and impede the opportunities of working with futures in open ways. Facer (2016) asserts that "conservative traditions of disciplinary and canonical knowledge are not antithetical" to modes of learning that we here describe in terms of emergentist education. Instead, she suggests disciplinary and canonical knowledge "can be harnessed [...] as historical, literary and scientific resources to help deepen our understanding of the multiple layers of contemporary reality" (2016, p.75). We ask *how* disciplinary cultures and institutions can play a more constructive role, one that does not limit but enriches students' and teachers' engagement - to be conscious of how historical, literary, and scientific resources are harnessed so that they do not stifle other forms of knowledge or engagement. One may even ask if disciplines are needed. Working towards emergentist education could mean to work towards "undisciplined" places, in which the learners are not objects to be disciplined, but subjects. What then characterises "qualified freedom" in an education that emphasises subjectification? In the light of our discussions, "qualified freedom" appears as a paradox, yet still possibly key to what is needed to allow for radical futurity in democratic, equitable spaces.

3.2. Convening around anticipatory emotions

Reflecting on our contexts, we have found that there are limited opportunities for students and teachers to work through the emotional responses to affective classroom content. A key conclusion from a review of the growing literature on emotions in relation to climate change is that as emotions emerge through social interactions, paying attention to them is critical for the facilitation of constructive encounters within learning environments (Davidson & Kecinski, 2022). The central aim of this section is to diffract ideas about social, emotional, and relational spaces in educational settings upon our own contexts and explore the potential for an opening-up of emotions in futures-facing education.

Emotions around sustainability are entwined with a sense of agency in shaping futures. Yet, when perceptions of agency are limited, students should be given the opportunity to work through these emotional implications. In the case of the 30-Day Challenge, projecting global sustainability challenges onto personal consumption patterns led to a general sense of pessimism connected to the limited observable impact these changes had on transforming the trajectory toward an unsustainable future. Students expressed fluctuating emotions from hope to grief about the overwhelming nature of sustainability challenges from scaling the individual's actions to global challenges. For example, one student planted a seed every day, an activity that could be interpreted as more generative and hopeful in its anticipation of growth. Yet the student explained how during this period of reflection they moved between feelings of hope that "we can do it" and meet the sustainability challenge, to being lost in a "deep anxiety hole". Such anxiety has been described as an anticipatory emotion towards a concerning future with a perceived incapacity to act on it (Neckel & Hasenfratz, 2021). The communication of such emotional responses to the future, and deliberate deconstruction of these emotions, have been found to help move individuals from feeling fear to finding ways to positively engage (Neckel & Hasenfratz, 2021; Ojala, 2017). In this case, despite being given the chance to experience something different, students were evidently not given enough opportunities to collectively reflect on the experiences and emotions generated, leaving students to work through them alone.

Teachers across the university are looking for ways to help their students gain stronger senses of agency. In the case of the Change Project, one participant expressed that she wanted her students to be activists, to understand that they could make change. She explained that she wanted her students to be hopeless because "*hope within this hopeless system is naive*". Contrary to Ojala (2017) conception of critical hope, noticing a lack of something within the present and deliberately disrupting the present status quo to demonstrate the possibility of alternatives, this expression connotes a sense of hopelessness. Yet it is precisely when coupled with action, particularly in the collective, that hope from hopelessness can emerge (Davidson & Kecinski, 2022; Ojala, 2017). As an anticipatory exercise, critical hope arguably reorients the student towards "the surplus of possibility in the present" (Facer, 2019, p.8). These moments rely upon collective engagement, however, and activism at the individual level as practised in the 30-Day Challenge might limit the student's capacity to collectively trial novel ways of understanding and being in this world. An approach based in critical hope could work towards enduring openness toward the future, by temporarily closing the future, in order to concretely work and think in new ways in the present towards desirable futures (Ojala, 2017; see also Bussey et al., 2012 on living with uncertainty).

Beyond the sense of anxiety towards the future, we also find that students and teachers can feel isolated. For example, teachers feel apart from their colleagues in their concern for sustainability then draw on narratives of an anxious future to try to engage people with sustainability (e.g. in the computing context, where sustainability challenges are seldom discussed). While there is a sense of isolation, staff are, in fact, not necessarily alone with feelings. In the Change Project, most teachers expressed concerns about the future. Norgaard (2011) finds that staff generally *are* concerned about the future, but discussions about worry and alarm are avoided as a part of the culture. Overcoming such cultural norms might enable educators to find allies and colleagues in their home departments. One of the participants in the Change Project explained that just being given the time and space to deal with frustrations about sustainability was valuable to her, that she otherwise had little opportunity for working through these ideas and emotions in her home departments.

An example of a student project from the 30-Day Challenge helps us imagine how more hopeful engagements might enable more open approaches to futures. This student volunteered every day for 30 days with different community organisations and demonstrates a multi-layered experience. First, his experience was social, discussing the future and sustainability with members of these

organisations. It was also material, as he worked in different spaces with materials such as soil when volunteering with a gardening group. Finally, his experience concerned the ideological, exemplified by his engagement with political activists and non-governmental organisations. This student's experience suggests that we move beyond *including* emotions in education to recognising that education is an inherently emotional process. In this case, the social construction of hope through experiencing those constructively engaging in hopeful ways. His experience can be situated within ideas discussed by Latour (2004) and Masschelein (2019), of social, local, and material interactions and the careful convening of the learning experience around these interactions. It likewise exemplifies some of the observations and ideas that Bryan (2020), Fielding (2011), and Ojala (2016) consider, of fellowship and relationship in their approaches to climate change and sustainability education in particular. The volunteering student enriched his learning experience beyond the classroom into a more-than-cognitive socio-material education, one inherently based on relations and interactions.

To convene around anticipatory emotions is to offer new ways of understanding and experiencing futures. The idea of anticipatory emotions, as we understand them, is that they are affected reactions from ideas of the future that are felt and experienced in the present (Baumgartner et al., 2008). Convening around matters that generate anticipatory emotions in education, then, is to convene around and within an emotional setting; further it is to deconstruct one's experiences and understandings of educational content through the multiple, amplified interactions in the collective. This process is emotionally emergent in that experiences come into being through these interactions. To extend upon this, however, we propose that convening around anticipatory emotions offers an opportunity for extending more creative ways of relating to futures. This occurs through first paying attention to the emotions inspired by anticipating anxious or closed futures and through recognising how this draws people together in what Bryan (2020), Ojala and Bengtsson (2019) call "emotional hotspots", such as we may find in futures-facing courses at university. Through explicitly framing these spaces as emotional, the cultural norm of avoiding the negative emotions generated by the future might be overcome and, as Hicks (2014) suggests, might allow for discussions to move over denialism into more creative and playful spaces for working with the not-yet.

The benefit of such an approach, convening around anticipatory emotions, could also relieve the frustration felt by some students, e.g. the student in computing coming from political science, and the seed-planting student, who both discussed their frustration at being "stuck" or that discussion does not "get anywhere". Instead, the burden of solving the concern for the future is removed because the objective is process-oriented, in developing new opportunities of engaging and relating in more than cognitive ways, as opposed to output-oriented. Such a relief from these burdens can aid in more creative and playful conversations that do not fixate on measuring the outcome of education as it might solve the future. Rather it encourages students (and teachers) to reorient themselves to the present, to pay attention to how they relate to the world as it unfolds, and to recognise the possibilities in rethinking their relationships to worldly matter.

3.3. Deepening the paradox of sustainability as emergent through radical futurity

We see that education and its instrumental approach is maintaining the current system, including sustainability education. Sustainability is mandated by international bodies, national education policies, and university missions and goals, as a *concern*; we should be concerned about sustainability as is given by others. Sustainability appears in university contexts as though it exists as an achievable goal - something that is already *there* with unquestioned preconceptions of what it may include - as something predefined. Such an approach that echoes mainstream approaches to sustainable development has been argued to maintain the current unsustainable system (Stein et al., 2022). It actively stifles imagination and radical futurity, and thus prevents alternative ways of living in and understanding the world.

The governance by goals framing of sustainable development (Biermann et al., 2017) appears to be replicated in the university, arguably in constructs of an "education by goals". Sara Ahmed (2012), reflecting on equality work in universities, criticises such a checkbox approach with other challenging issues such as diversity and representation which are seen as goals to be fulfilled rather than issues of power and equality to be reckoned with on a cultural level. The sustainability issue is already mapped out, as are the capabilities that might support us in working to resolve the respective challenges. In this way, plural and novel approaches to working with sustainability are stunted. Radically open futures are difficult to come by in such an educational context where diverse epistemological and ontological possibilities are crowded out (Stein, 2019). We have observed that teachers and students are denied opportunities to voice concerns from their particularly situated perspectives, but also may struggle to even relate to sustainability, as seen in the case of computing and engineering education. Or, in response to such closed conceptualisations of sustainability and futures, students similarly close their own creativity, as seen in the elective sustainability education context.

In this paper, we have described theoretical alternatives, framing education as emergentist. Here, sustainability and the ways of working towards it could be continuously re-imagined, renegotiated by the people that come together in shared matters of concern. From our engagement as teachers and researchers, we see that this could be a relief for teachers and students. For example, the participants of the Change Project express that they struggle to answer the question "*what is this damn thing called 'sustainability'?*". One participant talked about the negotiations they have had at their institution about the aims education for sustainability.

"I thought a lot about how we should teach about sustainability and also what we shouldn't try to teach because when the [sustainability] track was introduced I was worried about not being able to train students to think up some fine solutions to specific problems because that's not what ethnologists do. Then I think it was [the Change Project course facilitator], who said we are part of the problem so maybe we shouldn't be telling them what they should do. And that was sort of a relief that I didn't have to be this person that told them what to do."

Teachers feel this relief, but then what? Vanessa De Oliveira Andreotti and colleagues (2018) draw attention to the desire of modern Western culture to seek solutions and have answers - the single story of progress - and this is indeed the experience of teachers

we spoke to working with sustainability education. Approaching sustainability as emergent involves negotiating indeterminacy, requiring pedagogy with a different kind of attentiveness (see for example [Bozalek et al., 2018](#); [Stein et al., 2020](#)). We do live in urgent, terrifying times and inviting pedagogical moments for radical futurity may be completely paralysing to students and teachers alike ([Ojala, 2017](#)), which we saw in the computing education context where students sought to reduce the complexity introduced with thinking of the future of healthcare. Framing education as emergentist seems like a paradox, like an impossibility.

Radical futurity encourages us to hold on to the possibility of the impossible ([Osberg, 2010](#)) and this logic supports emergentist framings of education. It suggests we can hold on to the ideal of inviting everyone into democratic spaces in which futures are imagined and negotiated, to the idea of education as something curious, playful, and hopeful in which people are allowed to care and feel, and stay with the trouble ([Haraway, 2016](#)). If we realise that education is inherently emotional, as we have argued in the previous section, we can more constructively engage with sustainability as concern-oriented. We see in our contexts what [Biesta and Winter \(2011\)](#) argues about subjective and emotional engagement, that it cannot be taught or produced, but by contrast can be easily prevented. Arguably, there are several prohibitive processes that may be addressed by acknowledging and embracing education as emotional, problematising normativity within education, and addressing institutionalised hierarchies.

We need to find the stamina to deal with indeterminacy and the mess we are in ([Andreotti, 2021](#)). The Change Project course exemplifies the potential spaces and structures that support a concern-oriented approach to sustainability, by allowing time for teachers to deliberate what a deeper engagement with sustainability may entail. As one participant noted on her participation in the course: “*What we experience is the idea that we are not alone, and we start to talk across institutional borders*”. The participant expressed that they do not meet around shared matters of concern in other spaces, despite being colleagues on campus. Change Project participants experienced moments of democratic fellowship that provided opportunities to acknowledge how their perceptions of either “*very dark*” futures or their more hopeful future outlooks characterised by people acting to prevent “*apocalyptic futures*” shape action in the present. Stamina can be found within the democratic fellowship of these collective encounters.

One characteristic of emergentist education, then, may be drawing attention to the specificities that emerge in these democratic encounters, where futures are contextualised in specific bodies and moments rather than the universal (e.g. curricula), which is disembodied. Teachers thus share the responsibility of re-embodiment of futures together with the students. Futures are embedded in particular spaces where heterogeneous ways of understanding futures exist (even if in tension) and where we do not attempt to tame unknown futures ([Groves, 2017](#)) because it is soothing. Emergentist education might be conceptualised as a curriculum in abundance ([Jardine et al., 2006](#)), making space for the emergence of thick presents full of diverse concerns where “seeds of the future are present not only in our expectations but also in the variety of natural and social rhythms that *are* reality itself – and perhaps especially in those that are less easily accessible” ([Poli, 2011](#), p. 72). When one inhabits the thick present, attentive to the multiple social and natural rhythms that exist, this is too an opportunity to express novelty as an unknowable outcome of these rhythms.

Rejecting the output-oriented idea of education as leading to sustainability ([Jickling & Wals, 2008](#)) is crucial to achieve radical futurity. Engaging with the limitations of the current instrumental framings of education and the infantilising character of contemporary education, its oppressive character ([Freire, 1997](#)), could be a step forward in the work towards emergentist framings of education. This alternate approach may redistribute anticipatory capabilities in ways that might pluralise the types of futures able to be articulated ([Facer & Sriprakash, 2021](#)).

4. Conclusion

The conception of education as “emergentist education” is enriched by the concept of radical futurity. Emergentist framings of education are important and generative for moving towards an education that enables people to anticipate and contest visions of the future. We have identified three key areas to understand and value the concept as well as the challenges in developing emergentist education. The key areas point towards opportunities for rethinking norms in higher education, including disciplines, emotions, and conceptions of sustainability. In reading our different contexts through a diffractive methodology, a process of creation, we have used these three areas to identify and develop seeds for emergentist education.

This work contributes towards an understanding of how we can consider an education that does justice to the complexity of the philosophies and politics of education ([Osberg, 2010](#)). We have made the case to challenge the existing reduction of higher education to an instrument of control. We have argued for how we can have confidence to experiment, developing learning as a playful experience. It is a call to trust in that which emerges - the beautiful risk of education ([Biesta & Winter, 2011](#)).

This work contributes with perspectives on education and the roles of educators, which are complemented by questions to explore in the future. For example, exploring how emergentist education and radical futurity may be facilitated is an important continuation to explore further. We have also identified some paradoxes that could be a starting point for future work. One such paradox is making sustainable futures through non-instrumentalist education. We have argued for this through the concept of radical futurity. If we are to hold open the possibility of something radical (something playful and wonderful and hopeful) then we must be closed to the output-orientation of sustainability and futures-facing education.

We know we are not alone with our concerns and hope to invite others to join this conversation towards emergentist education and opening up for radical futurity. In writing this article, we realise the difficulty and seeming impossibility of staying away from the normative, the prescriptive, and have appreciated the learning experience. We hope we are not painting a beautiful picture of idealised education but are constructing a concept to help think through ways of doing things differently. Our hope is that in continuing to stay with these ideas and challenge the disembodied universal futures of higher sustainability education that we continue to learn and develop learning practices that are open towards radically different educational futures.

Declarations of interest

None.

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Author contributions

The ideas for this paper were developed equally and collaboratively among all three authors.

References

- Ahmed, S. (2012). *On being included—Racism and diversity in institutional life*. Duke University Press.
- Amsler, S., & Facer, K. (2017aaa). Contesting anticipatory regimes in education: Exploring alternative educational orientations to the future. *Futures*, *94*, 6–14. <https://doi.org/10.1016/j.futures.2017.01.001>
- Amsler, S., & Facer, K. (2017bbb). Introduction to 'learning the future otherwise: Emerging approaches to critical anticipation in education. *Futures*, *94*, 1–5. <https://doi.org/10.1016/j.futures.2017.09.004>
- Andreotti, V. de O. (2021). Depth education and the possibility of GCE otherwise. *Globalisation, Societies and Education*, *19*(4), 496–509. <https://doi.org/10.1080/14767724.2021.1904214>
- Angeloni, S. (2020). Education first: What really matters in working for sustainability. *Futures*, *120*, Article 102552. <https://doi.org/10.1016/j.futures.2020.102552>
- Avraamidou, L., & Schwartz, R. (2021). Who aspires to be a scientist/who is allowed in science? Science identity as a lens to exploring the political dimension of the nature of science. *Cultural Studies of Science Education*, *16*(2), 337–344. <https://doi.org/10.1007/s11422-021-10059-3>
- Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Duke University Press.
- Barnett, R. (2018). *The ecological university: A feasible Utopia*. Routledge. <https://www.routledge.com/The-Ecological-University-A-Feasible-Utopia/Barnett/p/book/9781138720763>.
- Barrineau, S., Engström, A., & Schnaas, U. (2019). *An active student participation companion*. Avdelningen för kvalitetsutveckling - Enheten för universitetspedagogik. (<http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-376580>).
- Baumgartner, H., Pieters, R., & Bagozzi, R. P. (2008). Future-oriented emotions: Conceptualization and behavioral effects. *European Journal of Social Psychology*, *38*(4), 685–696. <https://doi.org/10.1002/ejsp.467>
- Biermann, F., Kanie, N., & Kim, R. E. (2017). Global governance by goal-setting: The novel approach of the UN Sustainable Development Goals. *Current Opinion in Environmental Sustainability*, *26–27*, 26–31. <https://doi.org/10.1016/j.cosust.2017.01.010>
- Biesta, G. (2019). What is the educational task? Arousing the desire for wanting to exist in the world in a grown-up way. *Pedagogía York Saberes*, *50*, 51–61.
- Biesta, G. (2020). Risking ourselves in education: Qualification, socialization, and subjectification revisited. *Educational Theory*, *70*(1), 89–104. <https://doi.org/10.1111/edth.12411>
- Biesta, G., & Winter, P. (2011). Coming Into the world, uniqueness, and the beautiful risk of education: An interview with Gert Biesta by Philip Winter. *Studies in Philosophy and Education*, *30*(5), 537–542. <https://doi.org/10.1007/s11217-011-9254-7>
- Biesta, G. J. J. (2015). *Good education in an age of measurement: Ethics, politics, democracy*. Routledge. (<https://doi.org/10.4324/9781315634319>).
- Bozalek, V., & Zembylas, M. (2018). Practicing reflection or diffraction? implications for research methodologies in education. In R. Braidotti, V. Bozalek, T. Shefer, & M. Zembylas (Eds.), *Socially just pedagogies: Posthumanist, feminist and materialist perspectives in higher education* (pp. 47–62). Bloomsbury Publishing.
- Bozalek, V., Bayat, A., Gachago, D., Motala, S., & Mitchell, V. (2018). A pedagogy of response-ability. In R. Braidotti, V. Bozalek, T. Shefer, & M. Zembylas (Eds.), *Socially just pedagogies: Posthumanist, feminist and materialist perspectives in higher education* (pp. 97–112). Bloomsbury Publishing.
- Bryan, A. (2020). Affective pedagogies: Foregrounding emotion in climate change education. *Educational Research for Policy and Practice*, *30*.
- Bussey, M. (2012). When no crisis is the real crisis! The endless vertigo of capitalist education. In D. R. Cole (Ed.), *Surviving economic crises through education* (pp. 247–255). Peter Lang Publishing.
- Bussey, M., Bjurström, A., Sannum, M., Avadhuta, S., Nadhomi-Mukisa, B., Ceruto, L., Muwanguzi, D., Giri, A., Mukherjee, A., Pervyi, G., & Pineda, M. (2012). *Weaving pedagogies of possibility* (pp. 77–90). (https://doi.org/10.3920/978-90-8686-757-8_04).
- Corcoran, P. B., Weakland, J. P., & Wals, A. E. J. (2017). Envisioning futures for environmental and sustainability education. *Wageningen Academic Publishers*. (<http://ebookcentral.proquest.com/lib/uu/detail.action?docID=4819418>).
- Davidson, D., & Kecinski, M. (2022). Emotional pathways to climate change responses. *WIREs Climate Change*, *13*. <https://doi.org/10.1002/wcc.751>
- Davies, B. (2014). Reading anger in early childhood intra-action: A diffractive analysis. *Qualitative Inquiry*, *20*(6), 734–741.
- De Oliveira Andreotti, V., Stein, S., Sutherland, A., Pashby, K., Susa, R., & Amsler, S. (2018). Mobilising different conversations about global justice in education: Toward alternative futures in uncertain. *Times Policy & Practice: A Development Education Review*, *26*.
- Dolphijn, R., & van der Tuin, I. (2012). *New materialism: Interviews & cartographies*. University of Michigan Library: Open Humanities Press.
- Easterbrook, S. (2014). *From computational thinking to systems thinking: A conceptual toolkit for sustainability computing*. pp. 235–244. (<https://doi.org/10.2991/ict4s-14.2014.28>).
- Facer, K. (2016). Using the future in education: Creating space for openness, hope and novelty. In H. E. Lees, & N. Noddings (Eds.), *The Palgrave International Handbook of Alternative Education* (pp. 63–78). UK: Palgrave Macmillan. https://doi.org/10.1057/978-1-137-41291-1_5.
- Facer, K. (2019). Storytelling in troubled times: What is the role for educators in the deep crises of the 21st century? *Literacy*, *53*(1), 3–13. <https://doi.org/10.1111/lit.12176>
- Facer, K., & Sriprakash, A. (2021). Provincialising Futures Literacy: A caution against codification. *Futures*, *133*, Article 102807. <https://doi.org/10.1016/j.futures.2021.102807>
- Faulkner, W. (2001). The technology question in feminism: A view from feminist Technology Studies. *Women's Studies International Forum*, *24*(1), 79–95. [https://doi.org/10.1016/S0277-5395\(00\)00166-7](https://doi.org/10.1016/S0277-5395(00)00166-7)
- Fielding, M. (2011). Patterns of partnership: Student voice, intergenerational learning and democratic fellowship. In N. Mockler, & J. Sachs (Eds.), *Rethinking educational practice through reflexive inquiry*, 7 pp. 61–75). Springer. https://doi.org/10.1007/978-94-007-0805-1_5.
- Freire, P. (1997). *Pedagogy of the oppressed*. Continuum.
- Gonsalves, A.J., & Danielsson, A.T. (Eds.) (2020). *Physics education and gender: Identity as an analytic lens for research*. Springer Cham. (<https://link.springer.com/book/10.1007/978-3-030-41933-2>).
- Gough, N. (1990). Futures in Australian education—Tacit, token and taken for granted. *Futures*, *22*, 298–310. [https://doi.org/10.1016/0016-3287\(90\)90149-C](https://doi.org/10.1016/0016-3287(90)90149-C)
- Groves, C. (2017). Emptying the future: On the environmental politics of anticipation. *Futures*, *92*, 29–38. <https://doi.org/10.1016/j.futures.2016.06.003>
- Günter, K. (2022). *Figuring worlds; imagining paths: A feminist exploration of identities in higher education biology* [PhD thesis, Uppsala: Acta Universitatis Upsaliensis].
- Haraway, D. (1997). *Modest Witness@Second_Millennium: FemaleMan_Meets_OncoMouse: Feminism and Technoscience*. Routledge.

- Haraway, D. (2000). *How like a leaf: An interview with Thyrza Nichols Goodeve*. Routledge.
- Haraway, D. (2016). *Staying with the trouble—Making Kin in the Chthulucene*. Duke University Press.
- Harding, S.G. (1986). *The science question in feminism*. Cornell University Press.
- Hicks, D. (2012). The future only arrives when things look dangerous: Reflections on futures education in the UK. *Futures*, 44(1), 4–13. <https://doi.org/10.1016/j.futures.2011.08.002>
- Hicks, D. (2014). *Educating for hope in troubled times: Climate change and the transition to a post-carbon future*. Institute of Education Press.
- Holfelder, A.-K. (2019). Towards a sustainable future with education. *Sustainability Science*, 14(4), 943–952. <https://doi.org/10.1007/s11625-019-00682-z>
- Huckle, J., & Wals, A. E. J. (2015). The UN decade of education for sustainable development: Business as usual in the end. *Environmental Education Research*, 21(3), 491–505. <https://doi.org/10.1080/13504622.2015.1011084>
- IPCC. (2022). In H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, ... B. Rama (Eds.), *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New York, NY, USA: Cambridge University Press.
- Ishihara, S., Tommasini, A., Ponzelar, C., & Livmar, E. (2021). “Student-led education for a better world?” Reflections in conversation. *Högre Utbildning*, 11(3), 3. <https://doi.org/10.23865/hu.v11.3006>
- Jardine, D.W., Friesen, S., & Clifford, P. (2006). *Curriculum in abundance*. Lawrence Erlbaum Associates.
- Jickling, B. (1994). Why i don't want my children to be educated for sustainable development. *Trumpeter*, 23.
- Jickling, B., & Wals, A. E. J. (2008). Globalization and environmental education: Looking beyond sustainable development. *Journal of Curriculum Studies*, 40(1), 1–21. <https://doi.org/10.1080/00220270701684667>
- Király, G., & Gering, Z. (2019). Editorial: Introduction to ‘futures of higher education’ special issue. *Futures*, 111, 123–129. <https://doi.org/10.1016/j.futures.2019.03.004>
- Knappe, H., Holfelder, A.-K., Beer, D. L., & Nanz, P. (2019). The politics of making and unmaking (sustainable) futures: Introduction to the special feature. *Sustainability Science*, 14(4), 891–898. <https://doi.org/10.1007/s11625-019-00704-w>
- Kopnina, H. (2020). Education for the future? Critical evaluation of education for sustainable development goals. *The Journal of Environmental Education*, 51(4), 280–291. <https://doi.org/10.1080/00958964.2019.1710444>
- Latour, B. (2004). Why has critique run out of steam? From matters of fact to matters of concern. *Critical Inquiry*, 30(2), 225–248. <https://doi.org/10.1086/421123>
- Lenz Taguchi, H. (2012). A diffractive and deleuzian approach to analysing interview data. *Feminist Theory*, 13(3), 265–281.
- Lotz-Sisitka, H., Wals, A. E., Kronlid, D., & McGarry, D. (2015). Transformative, transgressive social learning: Rethinking higher education pedagogy in times of systemic global dysfunction. *Current Opinion in Environmental Sustainability*, 16, 73–80. <https://doi.org/10.1016/j.cosust.2015.07.018>
- Mandikonza, C., & Lotz-Sisitka, H. (2016). Emergence of environment and sustainability education (ESE) in teacher education contexts in Southern Africa: A common good concern. *Educational Research for Social Change*, 5, 107–130. <https://doi.org/10.17159/2221-4070/2016/v5i1a7>
- Masschelein, J. (2019). Turning a city into a milieu of study: University Pedagogy as “Frontline”. *Educational Theory*, 69(2), 185–203. <https://doi.org/10.1111/edth.12365>
- Mendick, H., & Peters, A.-K. (2022). How post-Bologna policies construct the purposes of higher education and students’ transitions into Masters programmes. *European Educational Research Journal*. <https://doi.org/10.1177/14749041221076633>
- Miller, R. (2018). *Transforming the future—Anticipation in the 21st century*. Routledge.
- Milojevic, I. (2005). *Educational futures: Dominant and contesting visions*. Taylor & Francis Group. (<http://ebookcentral.proquest.com/lib/uu/detail.action?docID=181960>).
- Neckel, S., & Hasenfratz, M. (2021). Climate emotions and emotional climates: The emotional map of ecological crises and the blind spots on our sociological landscapes. *Social Science Information*, 60(2), 253–271. <https://doi.org/10.1177/0539018421996264>
- Norgaard, K.M. (2011). *Living in denial: Climate change, emotions, and everyday life*. MIT Press.
- Ojala, M. (2016). Facing anxiety in climate change education: From therapeutic practice to hopeful transgressive learning. *Canadian Journal of Environmental Education (CJEE)*, 21(0), 41–56.
- Ojala, M. (2017). Hope and anticipation in education for a sustainable future. *Futures*, 94, 76–84. <https://doi.org/10.1016/j.futures.2016.10.004>
- Ojala, M., & Bengtsson, H. (2019). Young people’s coping strategies concerning climate change: Relations to perceived communication with parents and friends and proenvironmental behavior. *Environment and Behavior*, 51(8), 907–935. <https://doi.org/10.1177/0013916518763894>
- Osberg, D. (2010). Taking care of the future?: The complex responsibility of education & politics. *Complexity Theory and the Politics of Education*, 153–166. https://doi.org/10.1163/9789460912405_014
- Osberg, D. (2017). Education and the future. In R. Poli (Ed.), *Handbook of Anticipation: Theoretical and applied aspects of the use of future in decision making* (pp. 1–20). Springer International Publishing. (https://doi.org/10.1007/978-3-319-31737-3_88-1).
- Osberg, D., & Biesta, G. (2021). Beyond curriculum: Groundwork for a non-instrumental theory of education. *Educational Philosophy and Theory*, 53(1), 57–70. <https://doi.org/10.1080/00131857.2020.1750362>
- Ottemo, A., Berge, M., & Silfver, E. (2020). Contextualizing technology: Between gender pluralization and class reproduction. *Science Education*, 104(4), 693–713.
- Pacis, M., & VanWynsberghe, R. (2020). Key sustainability competencies for education for sustainability: Creating a living, learning and adaptive tool for widespread use. *International Journal of Sustainability in Higher Education*, 21(3), 575–592. <https://doi.org/10.1108/IJSHE-12-2018-0234>
- Peters, A.-K. (2017). *Learning Computing at University: Participation and Identity: A Longitudinal Study*. Acta Universitatis Upsaliensis.
- Peters, A.-K. (2018). Students’ Experience of Participation in a Discipline—A Longitudinal Study of Computer Science and IT Engineering Students. *ACM Transactions on Computing Education*, 19(1), 5:1–5:28. <https://doi.org/10.1145/3230011>
- Poli, R. (2011). Steps toward an explicit ontology of the future. *Journal of Futures Studies*, 16(1), 67–78.
- Salminen-Karlsson, M. (2011). The problem in the eye of the beholder: Working with gender reforms in computer engineering. *International Journal of Gender, Science and Technology*, 3(2), 445–459.
- Skilling, K., & Stylianides, G. (2020). Using vignettes in educational research: A framework for vignette construction. *International Journal of Research & Method in Education*, 43(5), 541–556.
- Slaughter, R. (2003). *Futures beyond dystopia—Creating social foresight*. Taylor and Francis Group.
- Stein, S. (2019). Beyond higher education as we know it: Gesturing towards decolonial horizons of possibility. *Studies in Philosophy and Education*, 38(2), 143–161. <https://doi.org/10.1007/s11217-018-9622-7>
- Stein, S., Andreotti, V., Suša, R., Ahenakew, C., & Čajková, T. (2022). From “education for sustainable development” to “education for the end of the world as we know it”. *Educational Philosophy and Theory*, 54(3), 274–287. <https://doi.org/10.1080/00131857.2020.1835646>
- Stein, S., Andreotti, V., Suša, R., Amsler, S., Hunt, D., Ahenakew, C., Jimmy, E., Čajkova, T., Valley, W., Cardoso, C., Siwek, D., Pitaguary, B., D’Emilia, D., Pataxó, U., Calhoun, B., & Okano, H. (2020). Gesturing towards decolonial futures: Reflections on our learnings thus far. *Nordic Journal of Comparative and International Education (NJCIE)*, 4(1), 43–65. <https://doi.org/10.7577/njcie.3518>
- Supran, G., & Oreskes, N. (2021). Rhetoric and frame analysis of ExxonMobil’s climate change communications. *One Earth*, 4(5), 696–719. <https://doi.org/10.1016/j.oneear.2021.04.014>
- Traweek, S. (1988). *Beamtimes and lifetimes: The world of high energy physicists*. Harvard University Press.
- Turner, J. M. (2014). Counting carbon: The politics of carbon footprints and climate governance from the individual to the global. *Global Environmental Politics*, 14(1), 59–78.
- UNESCO. (2017). *Education for sustainable development goals*. (<https://www.sdg4education2030.org/education-sustainable-development-goals-learning-objectives-unesco-2017>).
- Wiek, A., Withycombe, L., & Redman, C. L. (2011). Key competencies in sustainability: A reference framework for academic program development. *Sustainability Science*, 6(2), 203–218. <https://doi.org/10.1007/s11625-011-0132-6>