

ESD for managers in the Danish lower secondary educational curriculum

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Abstract

Purpose – The purpose of this paper is to challenge the current educational methods taking place in Danish lower secondary school by introducing the concept of education for sustainable development (ESD) to help managers and teachers facilitate an action-oriented approach aimed at potentiating the level of sustainability and environmental awareness.

Design/methodology/approach – This conceptual paper is based on the relevant literature and examines the necessity to move beyond traditional education curricula by offering a new practical sustainable framework for facilitating ESD at Danish lower secondary schools. A particular focus relates to evaluating and adopting sustainable approaches in the educational literature that is sufficiently sensitive to practical changes in Danish lower secondary teaching methods.

Findings – With the purpose of generating awareness about climate change and students' ecological footprint to lower secondary school students in Denmark, it was found that embedding ESD in the Danish curriculum would be an important tool for this purpose. The authors outline practical recommendations for managers at the lower secondary school level.

Originality/value – This conceptual paper addresses the core issue of traditional education in Danish lower secondary schools by suggesting to adopt the educational framework of ESD. To this end, the authors have offered a variety of specific practical suggestions accordingly to how traditional education can be redesigned by focusing on action-oriented learning and future-oriented ESD. Furthermore, the authors propose that certain educational components of smart cities might promote an underlying commitment to meet the core issues of climate change, as this has yet to be examined. The research on ESD for managers at the Danish lower secondary school level is fairly limited to date.

Keywords ESD, Danish lower secondary school, Smart cities, Action-oriented learning, Sustainability, Sustainability curriculum

Paper type Conceptual paper

Introduction

The declaration proposed by the United Nations Educational, Scientific and Cultural Organization (UNESCO) argues that education should be reorientated to address “the causes



and consequences of climate change" (UNESCO, 2009), and this has generated a lot of focus over the past years as education is critical for addressing climate change (Tilbury 2011). Læssøe and Mochizuki (2015) address this problem in the Danish educational system, where schools ought to become an active learning environment for new ways of living and acting together in more sustainable ways. According to them, Denmark has much to learn from international initiatives on educational policies as we have seen a disconnectedness, "where the CC [climate change] policy includes an initiative on raising public awareness about CC without any relation to the Ministry of Education and ESD" (Læssøe and Mochizuki, 2015, p. 34). Rather than increasing the focus on standardized curricula "linked to a quest for tests and performance indicators" (Breiting *et al.*, 2009, p. 24) – as put into practice in Danish schools – education for sustainable development (ESD) should serve as an incentive to address core issues of climate change, namely how we strengthen sustainable values to the students. We argue that, unlike traditional teaching methods, ESD can play an important part to reconfigure this "disconnectedness" in a way of moving toward sustainable lifestyles.

We shall argue that the most plausible way for managers and teachers in Danish lower secondary schools to address the core issue of climate change is to put an even greater focus on social, cultural and environmental sustainability in their curricula. We have chosen to put our focus on lower secondary schools in Denmark as they have received little attention in the literature. Rather, the focus has been put on higher education (Benneworth *et al.*, 2020; Fokdal *et al.*, 2020; Adams, 2013). We believe that adopting ESD in Danish lower secondary schools can act as a catalyst for how knowledge about the issue of climate change can influence and benefit the local environment in a more sustainable manner. A recent analysis by Carbon Brief claims that if temperature rises are to be kept to 1.5° C, then younger generations will only be able to emit around 43 tonnes of lifetime CO₂, around eight times less than someone born before 1950 (Hausfather, 2019). In 2018, the representatives of the Intergovernmental Panel on Climate Change (IPCC) stated in their report on climate change that: If we have to achieve the goal of remaining within the limit of global warming of 1.5° C by 2100, it appeals to "rapid, far-reaching and unprecedented changes in all aspects of society" (IPCC, 2018). One such way to address this pressing issue is through teaching curriculum, as recommended by the United Nations Sustainable Development Goal 13.3. On June 17, 2020, the Danish Parliament passed the Climate Act targeting a 70% reduction of greenhouse gases (GHGs) by 2030.

Such an exploration has led us to ask if education, more particularly ESD, can prove as an important tool to address climate change in Danish lower secondary schools. But, unlike ESD, the current sociopolitical climate of education in Denmark favors an approach to teaching and learning where test preparation and scripted curricula are the order of the day (Breiting *et al.*, 2009; Læssøe, 2010; Madsen, 2013). It is our core aim to demonstrate why and how ESD at the Danish lower secondary school level should be a more central and visible part of the international response to climate change. Although the focus is limited to Danish lower secondary schools, this paper serves as an illustration of the more general point of including sustainability centrally within the curriculum to increase awareness of sustainable development.

This paper is structured as follows. In the first section, we will explain why it is necessary to move beyond a traditional structure of education and afterward provide a theoretical overview of ESD. The second section will concretize the practical implications in Danish schools and put forward recommendations of ESD. Furthermore, this section will flesh out the objectives for managers at Danish lower secondary schools of ESD and how an integration of ESD is one of the crucial approaches to move away from a traditional curriculum. This section argues that managers will have to play a critical role in this process of increasing awareness to get their students to participate and collaborate in the process of improving the conditions of the environment. Lastly, we will shortly examine how the structure of a smart city can be interlaced with ESD.

Rethinking education: integrating action-oriented learning and ESD

The philosophical and pedagogical field of environmental education has been prominent throughout the last decade and has produced a variety of theoretical and practical methods. Rather than focusing on test preparation and scripted curriculum, the common view of ESD is to address the problem of climate change aimed at action-oriented learning, which can then encourage students to change their consumption patterns (Anderson, 2012) and influence the local environment in a more sustainable way. This section explains the necessity for a new educational structure and then provides an overview of ESD.

Traditional education and ESD as the new educational structure

In recent years, many climate change scientists have argued that the issues of climate change cannot be properly addressed solely through techno-scientific solutions (UNESCO, 2009; IPCC, 2018). We, as individuals, should work to ensure that our actions and expectations for the good life come into a better balance with the ecological boundaries. On these grounds, an educational scholar Jickling (2018, p. 63) argued that it is of the utmost importance to turn away from this modernist way relating to the world and seeing nature as the “other”: “A renegotiated and renewed vision of education must include structures, curricula and pedagogies that are fundamentally disruptive to these ways of being.” In other words, it is time “to revisit arguments for reconceptualizing schools as learning organisations” (Stoll and Kools, 2017, p. 3). One such argument is also found in the climate change literature, as continuing on the present track will push us closer to dangerous tipping points, leading to further deterioration of ecosystems and important natural resources (Steffen *et al.*, 2015). The pedagogical work should be aimed at teaching the students how to take care of the Earth system they have to take care of later in life.

One approach to challenge the traditional educational approach is by *transformative learning*, which aims at a shift of perspective compatible with sustainability. Transformative learning has gained increased recognition in the sustainability literature and is considered pivotal to enhance social transformations, importantly encouraging sustainability (Boström *et al.*, 2018). One compelling argument appeals to the idea that students should not only learn about sustainability but also ought to experience what it is like to live sustainably. Sterling (2004, p. 50) makes an argument of this sort, where he maintains that sustainability is a “gateway to a different view of pedagogy, of organizational change, of policy and particularly of ethos.

Accordingly, this suggests a rethinking of pedagogical practices and didactical ideals so an action-oriented learning approach can help mediate climate mitigations, addressing the need for long-term policies. Rather than adopting short-term policies that curtail the standard of living of current generations, it is important to consider other educational frameworks that reduce the consequences of climate change. On such approach is ESD, which embodies approaches to support learning that, unlike traditional education, supports adopting sustainable lifestyles. On Fokdal *et al.* (2020, p. 2) account, the importance of incorporating such an approach has an effective way to educate future generations to become ‘change agents’ for the great societal transformation toward a more sustainable future.” This type of ESD approach, supplemented by multidimensional issues of sustainability incorporated in Gough and Scott (2003), appeals to us rather than an approach based on ESD governance (cf. Feinstein *et al.*, 2013). These two approaches are crucially different, where the latter aims to encourage core competences such as normative and interpersonal competences. Often, the first type of ESD refers to “change agents”, which for example have in mind how students can learn how to cultivate, and thereby understand how photosynthesis and ecological cycles work. In a response to the importance of ESD, Gough and Scott (2003, p. xiv) argued that learning as an instrument for climate mitigation and increasing awareness offers

considerable possibilities since “there will be no sustainable development where learning is not happening.”

Nonetheless, the real issue of ESD, one might argue, is the nature of integrating ESD, so teachers feel motivated to teach the subject of climate change. In one study (Swim and Fraser, 2013), many teachers felt that the task of educating the topic of climate change was both difficult (theoretically and emotionally) and multi-faceted because of the politicization and polarization of opinions on the topic. However, we believe, considering several studies (IPCC, 2018; UNESCO, 2009), that rethinking education in a more sustainable framework is paramount for reaching the Danish target of a 70 % GHG reduction by 2030, complying with the responsibility of the Paris Agreement. The same aspects that make climate change, at first glance, difficult to teach — its multi-temporal and ideological complexity — are precisely what make it relevant and meaningful to a wide range of students and managers/teachers. Unlike ESD, the reasons that are standardly offered in defense of traditional education do not keep in mind the aspects of sustainability within the curriculum. As such, education should be motivated as a crucial tool aimed at mitigating climate change, and there is an urgent need for management to better understand climate responses through education. We propose to integrate philosophical perspectives into the ESD approach of how we relate, think and act toward future generations and current generations. Let us explicate precisely how ESD is defined.

A thumbnail sketch of education for sustainable development (ESD)

In this entry, ESD is defined as an educational concept that covers the basic transformative paradigm that values, sustains and realizes the human potential of sustainability toward the need to encourage social, economic and ecological well-being. Transformative in the sense of contributing to transformational competences through fostering knowledge within society (Fokdal *et al.*, 2020). As mentioned earlier, Danish lower secondary schools should become an active learning environment to promote new sustainable ways of living. One promising way of integrating ESD to learners of all ages has been proposed by Kagawa and Selby (2010). According to them, learning processes “need to have personal and societal transformative potential, flowing directly and naturally into direct community engagement” (2010, p. 5). On this view, all students, regardless of age, can be seen as facilitators and environmental stewardship of sustainable development.

Sustainable development has been explained as a vision to help develop attitudes, skills and knowledge for everyone’s interests. In 2002, UNESCO was assigned the task to integrate the principles, values and practices of sustainable development into all aspects of education and learning to confront the environmental problems. One decade later, the UN outlined the 17 SDGs comprising a wide range of goals, including Goal 13 (climate action) with target 13.3 advocating for an improvement of education, awareness and institutional capacity on climate change. One such aim can be seen as a broader view that incorporates individual, organizational and social transformation and provides a pragmatic basis for change in existing formal education systems. Several countries and higher education institutions have acknowledged the crucial role that universities must play in developing future leaders of sustainability by “successfully negotiating the intertwined challenges of social, cultural, economic and environmental sustainability” (Mader *et al.*, 2013). It has, however, ignored the importance of establishing a sustainable mindset for lower secondary school children and managers. Unlike the considerable focus of integrating ESD on the higher education sector (Benneworth *et al.*, 2020; Fokdal *et al.*, 2020; Adams, 2013), our focus is consequently explicitly on developing a framework of ESD on the lowersecondary school level in Denmark by seeking to construct an ecological identity and motivating an environmental awareness.

The didactic objective of ESD is to enable students to understand the issues of sustainability and contribute to sustainable solutions. ESD incorporates key issues of sustainability by promoting an action-oriented learning and sustainable pedagogic approach to facilitate an improvement of sustainable perspective upon the traditional education curriculum. ESD is, furthermore, a cooperative process centered upon fact-based knowledge, concatenating the impact of the student and the environment as they learn about the consequences of human actions. One such approach that serves as a good example of a model has been implemented in the Swedish education system, which consists of developing a sustainable mindset within their students toward nature and dealing with climate change as an unprecedented change in numerous aspects of society.

With its focus action-oriented learning, ESD can play an important part in collective action toward identifying practices that, to some degree, can increase climate change awareness *and* mitigation at the educational level, as action-oriented learning “flourishes when the culture demands action alongside learning” (Lawson *et al.*, 1997, p. 226). More recently, Leonard (2015) argues that the purpose of action-oriented learning should be to achieve effective and creative solutions to complex, critical and urgent problems. One study (Williams *et al.*, 2016) has indicated that the approach of action-oriented learning is seen as instrumental to generating environmental behavior, where children are capable of learning and acting sustainably by focusing on energy use and food and transport choices. A further component that applies to this type of learning is that it proves to be influential in creating an intergenerational bond between parents and the student.

This rationale is also embodied in Bourdieu’s concept of *habitus*, which extends how our experiences of the world are passed on to other people through our bodily actions. In this way, children will learn about the world by imitating teachers’ ways of being in the world, as the teacher’s way of teaching shapes the students’ ways of interpretation. Action-oriented learning can, in this way, be seen as a necessary tool to be implemented by managers and teachers in Danish lower secondary schools to build a learning environment around collaborative work on real-life problems, like climate change. This is one of the many strategies that are necessary according to atmospheric chemist Crutzen and professor in biology Stoermer that contend “to develop a world-wide accepted strategy leading to sustainability of ecosystems against human induced stresses will be one of the great future tasks of mankind” (Crutzen and Stoermer, 2000, p. 18).

Our main aim in this paper is recognize the value of the green transition and the imperative of inserting sustainability centrally into the educational goals at all levels and regions, though we concentrate at Danish lower secondary schools. At the same time, this should make us think more substantially about nature in our teaching methods by encouraging a new generation to work toward a sustainable environment in an imaginative and future-oriented way. We must, fundamentally, rethink what *learning* means in the context of ESD. As noted above, action-oriented learning in education has emerged recently as a powerful alternative to change pedagogical *praxis*.

This leads us to the next section that elaborates which elements of ESD are necessary to implement at the Danish lower secondary school curriculum.

Practical implications in Danish schools and recommendations of ESD

ESD is seldom viewed as an independent concept in Danish schools. Rather, the concept is considered a feature of existing courses, such as science education (Blum *et al.*, 2013; Breiting *et al.*, 2009). In this way, a new framework of ESD should not only add ideas that link sustainability to existing courses but also hold sustainability as the central learning topic throughout the whole curriculum. The specific concern of traditional education is that this

form of praxis has not explicitly addressed the issue of sustainability neither for students nor managers in education.

The next subsections identify which objectives should managers focus upon and which elements of ESD should be at the center of learning. Moreover, we suggest that an implementation of smart cities in Denmark is shortly discussed as an opportunity for climate change mitigation as smart cities are emerging in lots of countries to solve issues of sustainability.

ESD objectives for managers at Danish lower secondary schools

While we will explain why the educational institutions of Denmark have struggled to deal with the implications of climate change, our ultimate goal is to specify how managers at lower secondary schools in Denmark ought to respond to the challenges posed by climate change. At this point, one might start to wonder which specific values and perspectives should managers at Danish lower-secondary schools focus on. The framework of ESD ought to presage enhanced roles of the educational sector for thinking about the place of human action and social systems in response to climate change.

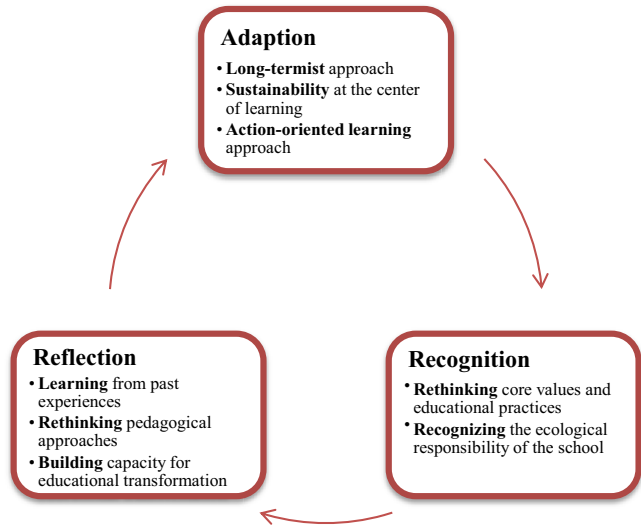
The approach of ESD strengthens the attention of long-termist learning rather than short-term thinking by focusing on issues of climate change, biodiversity loss and environmental degradation. Managers in the education sector should apply ESD to alter policies and teaching curricula more long-termist, as this is where managers can play a critical role. One specific perspective that managers in Danish lower secondary schools should focus on is the growing awareness of the impact of the student's ecological footprint (Neta and Seisax, 2018). Indeed, it is also clear that the theoretical framework of ESD have an implication, which makes it difficult to teach.

One such implication in the process of implementing ESD is that research has shown that teachers' competencies and commitment toward sustainability are crucial components in the successful implementation of ESD in the school system (Barth, 2015). Suppose, for instance, that one teacher or manager believes that climate change is a rather irrelevant problem. It might then be difficult to motivate students to learn about sustainability and indulge their students in action-oriented learning. However, we find these implications possible to overcome in the face of climate change as a growing recognition of climate change manifests itself even though commitment toward sustainability in Danish public schools has been an issue (Læssøe, 2007).

How should we start rethinking educational practices in Danish lower secondary schools? We argue that the process of designing a curriculum should draw attention to sustainability and take into account the following framework of ESD that is illustrated below.

Figure 1 puts forward an illustration that combines elements from three components: (1) recognition, (2) reflection and (3) adaption. *Recognition* aims to recognize the environmental conditions and transformation. *Reflection* combines learning from positive outcomes and failures, which aim to reflect over pedagogical approaches and building capacity for educational transformation. Lastly, the objective of *adaption* is to alter institutional policies toward sustainable practices. These ways of addressing the current educational methods at Danish lower secondary schools seek to rethink the educational practices by encouraging managers to build capacity for sustainability within the educational framework. Rather than organizing temporary project weeks involving the subject of sustainability, an imperative for building capacity for educational transformation and a reorientation of curricula striving toward a sustainable pedagogy should be recognized. These components are encapsulated in the idea of *adaptive management* and *adaptive governance* that serves to advocate impetuses of societal transformations in light of environmental crises. Let us explicate precisely why these guiding components are necessary in the Danish lower secondary school curricula.

Figure 1.
Components of a
framework of ESD



One of the main obstacles to incorporate sustainability at the Danish lower secondary school level is that sustainability is seldom embedded systematically, and the components of ESD are not reflected in the curriculum (Breiting *et al.*, 2009; Læssøe, 2007, 2010). As the Danish educational literature points out, this learning model is insufficient when learning about sustainability and climate change (Madsen, 2013). Managers should implement sustainability by treating it as an independent subject or throughout the whole curriculum rather than solely introducing it on temporary projects weeks (Blum *et al.*, 2013). A *transformative learning model* aimed at shifting the perspective of its students to enhance a sustainable lifestyle (e.g. focusing on individual ecological footprints for an early learning center) should be recognized to help mitigate the consequences of climate change. In their contribution to this issue, Álvarez-Suárez *et al.* (2014) found that when students increased their knowledge of the social and environmental impacts of consumerism, they became more aware of the need to take action by developing behaviors oriented toward a sustainable lifestyle. As political institutions often prioritize short-term policies that significantly attenuate attention to long-term issues, it is important to consider ways that do not impede solutions to climate change.

Accordingly, one objective of ESD that has greater efficiency of addressing such long-term issues is by generating a renewed pedagogy that accentuates a behavior that challenges the issues of climate change. This pedagogy is encapsulated in the idea of individual responsibility in light of environmental issues that have threatened the condition of the Earth system. In this way, an action-oriented approach is at the center of the students' attention. One central consideration underlying this renewed vision of an action-oriented pedagogy is the ideal of reflection and adaption (as the figure illustrates above), which seeks to recognize the condition of the environment.

This type of action-oriented learning embodies a wide spectrum of ways that managers can move toward ESD, typically through repeated cycles of planning, action adaption and reflection. What is of utmost significance by this kind of learning is the way students are positioned in the learning environment by prompting students to reflect on their learning. This leads to underlying changes in values, attitudes and behaviors. In the service of example, Jiménez *et al.* (2015) collected data in Costa Rica which showed that a management-oriented approach recognized protection of nature by integrating conservation and economic

development, successfully implementing a vision of sustainability within the curriculum for schoolchildren. This highlights the opportunities for Danish lower secondary school students to actively influence and benefit the local environment in a more sustainable manner. For example, an action-oriented ESD approach can engage lower secondary schoolchildren in the following ways:

- (1) Seeking collaborative practices (building sustainable materials from the forest and planting trees) by increasing environmental awareness and acting for positive environmental change,
- (2) A sustainable lifestyle by focusing on each individual's ecological footprint by recycling and lowering one's water use, energy use and use of heavy CO² products,
- (3) Fun educational events or using digital tools by providing students with environmental information about what living unsustainably means for the students and the planet and
- (4) Supporting a problem-based solution approach, where students learn about environmental problems in their local environment by mapping species, taking samples of pollution.

All these ways of engaging students focus on how to deal with climate change both collaboratively and individually. Next, we will suggest that implementing ESD at Danish lower secondary schools is a plausible idea that will shape Danish generations in years to come. Lastly, we will see how this concatenates with the idea of smart cities.

Integrating ESD in the Danish lower-secondary educational system

How should we start rethinking the educational approach in a more sustainable manner? We take it as our point of departure that the task of rethinking the educational methods involves more than encouraging institutions to alter their policies; it also involves restructuring the pedagogic approaches in a way that promotes sustainability.

In Denmark, environmental education has been seen as a decline in priority, as it has become difficult for teachers to allocate time to interdisciplinary teaching and outside teaching (Breiting and Wickenberg, 2010; Madsen, 2013). Although initiatives have been proposed by the Danish Ministry of Education, the focus has been primarily on integrating sustainability at the higher educational level, particularly science education (Blum *et al.*, 2013; Breiting *et al.*, 2009; Madsen, 2013). For instance, the problematic of environmental education in Denmark is that the substantial focus on science education “will distract attention from the potential of environmental education and ESD for empowering and developing students’ action competence” (Breiting and Wickenberg, 2010, p. 27). To date, the attempts to address sustainability in Danish lower secondary schools have been insufficient in overcoming the complicity of educational institutions in further destabilizing the Earth system.

This suggests that Denmark has seen a change from being a grassroots movement in environmental education to seeing a disconnectedness of climate change policies and ESD. In 2001, Mogensen and Nielsen (2001) found that environmental education was paid little attention as it does not have the status of a subject. In 2009, it was expected that few schools in Denmark intended to integrate environmental education in practice, and from the perspective of integrating ESD, it seems to be even weaker (Breiting *et al.*, 2009). This is the case when schools around Denmark organize project weeks involving the 17 SDGs. The unfortunate fact is that the SDGs are not firmly integrated into the teaching curricula as suggested by SDG 13.3, which means that a student focuses on the SDGs for a week, but in the remaining 51 weeks he/she should focus on how to deal with mathematics or language courses, without the aspect of sustainability. This suggests that embodying an educational approach that

cultivates sustainability is required, when it comes to building capacity for educational transformation. We believe that a sounder approach is ESD, as this approach places heavy emphasis on the social aspects of sustainability. By seeking a balance of human well-being with respect for the Earth's natural resources, and aspects of learning that strengthen the transition toward sustainability, ESD holds facets that can motivate sustainability at Danish lower-secondary schools.

ESD should be given a higher priority and should be directed toward a long-termist approach that encourages educational institutions which accordingly bear future generations in mind. One of the challenges for the future of environmental education in Denmark is to avoid continuing to attenuate pluralistic approaches of ESD (Breiting and Wickenberg, 2010). The approach of ESD is the only way to ensure that students are given the best possible departing points by thinking about nature and sustainability into our teaching methods. Students should not only be provided with information about the condition of the environment but also learn in an action-oriented way that rethinking core values in a sustainable way is engaging. By way of example, we can imagine that teachers and managers will take their students on visits to Danish companies such as Ørsted, which have made active choices to operate around sustainability. Ørsted undertook a huge environmental restructuring as they went from producing oil to developing, constructing and operating offshore and onshore wind farms. The task of including practice-based perspectives aimed at action-oriented learning, as visiting sustainable companies as Ørsted, is a way of enlarging our understanding of learning (Anderson, 2012; Mulcahy, 2018). An example of restructuring an educational policy was enacted in the Swedish curriculum in the 1960s. The Swedish government serves as a good model of increasing environmental awareness, as they prepare their students with better knowledge of the conditions of the Earth by encouraging a sustainable lifestyle. While Sweden has become a pioneer in promoting ESD initiatives, Denmark has overlooked the development of ESD (Breiting and Wickenberg, 2010).

Below, we put address which educational shifts in Danish lower secondary schools is needed in order to move beyond the traditional curriculum (see Table 1).

In this table, we deploy which educational shifts that managers at Danish lower secondary schools should exhibit when rethinking core educational approaches in the process of recognizing sustainability. The prospect of developing action-oriented learning for empowering sustainable lifestyles as a desired result is crucial by moving away from a traditional curriculum. It is an important task to develop students' relationship and understanding of nature as a foundation for learning processes, which can be used to challenge environmental issues. The concept of ESD is accordingly encouraging students to reflect on social norms and unsustainable practices by providing information about the condition of the Earth. In order to move away from the scripted curriculum that is taken place at the Danish lower secondary schools, it is a necessity to integrate ESD into the curriculum,

Table 1.
Educational shifts in
Danish lower
secondary schools
proposed by ESD

From	To
Management promoting a traditional curriculum and pedagogic approaches	Management promoting sustainable curriculum and teaching sustainable values
Seeing students from higher education as the only contributors	Seeing all students, regardless of age, as facilitators of change
Traditional learning process	Learner-centered and action-oriented approach, encouraging sustainable lifestyles
Considering education as detached from solving climate change	Addressing local and global perspectives in order to highlight the impact of localized actions by seeing education as an essential element of global response to climate change

since ESD seeks to develop the ability to solve concrete sustainability issues through transformative learning (Fokdal *et al.*, 2020). To accomplish the Danish target of a 70% reduction of GHGs by 2030, restructuring the pedagogic approaches in Danish lower secondary schools that attempt to rethink core values in a more sustainable fashion.

We now address a very different facet of ESD, which extends to encapsulate digital tools and the concept of smart cities.

Promoting smart cities and digital tools to frame ESD

According to Liu *et al.* (2017, p. 3), creating a smart learning environment in smart cities is one of the key elements for promoting innovation, creativity and, importantly, sustainable development as these deal with urban sustainability issues by aiming to solve “crucial problems in traffic, pollution, city crowding and poverty by using high technologies.” One of the underlying logics in smart cities are that these key elements are rooted in education and learning that rethink core educational practices. The primary discussion on smart cities refers to the issue of education by emphasizing the need to educate a new generation (e.g. students at Danish lower secondary school level) who will incorporate the value of sustainable development within the curriculum in smart cities.

The concept of smart cities can be seen as a useful tool when applied to generating environmental awareness and mitigating the consequences of climate change, in the use of natural resources due to the intelligent use of digital information. Instead of withdrawing from using digital tools, managers at Danish lower secondary can apply them to promote environmental awareness and tackle urban sustainability issues by using data analysis to understand the consumption of natural resources. As smart learning environment “is a high level of digital environment and can support “easy, engaged and effective learning”, [...] which can also actively provide the necessary learning guidance, hints, supportive tools or learning suggestions for learners” (Zhuang *et al.*, 2018, pp. 4–5). Experts have asserted that the way to achieve sustainability in all its dimensions is to develop and strengthen the concept of smart cities. This concept contributes to restructuring pedagogic approaches that put the core value of sustainability at the heart of education in Denmark, which should include a more appropriate adaption to the new professional profiles that a globalized labor market in constant transformation requires.

Education has become an essential part of any long-term plan devised by government authorities and planners toward smart and sustainable cities. In most societies, the term smart cities, in the beginning, used to prioritize primarily the technological elements. However, as the term evolved to focus more and more on the well-being of the citizens, the equation changed and gave way to a more integrated approach, in which education began to play a very fundamental role. For example, in Denmark, the concept of smart city was only used in a narrow and governmental context especially concerning environmental, energy and infrastructure issues in terms of how information and communication technologies can improve urban functionality. Subsequently, virtually all other areas of welfare started working with smart city, for example in business development, innovation, citizen involvement, culture, healthcare and social services, where the use of data and digital platforms helps smart new solutions (Lima *et al.*, 2020). This line of thought can be extended to the concept of ESD, as, by way of example, we can imagine that teachers can implement using digital games to promote students to reflect on their choices in relation to issues of sustainability. All of this proves the constant and vibrant evolution of the concept of smart cities. Smart cities entail a new philosophy for learning, and this includes the use of the concept of innovation as a way to boost and accentuate education. It is very urgent for many societies to craft ambitious plans allowing them to move from a traditional learning model to one that builds sustainable capacities for educational transformation. Smart cities will see

positive environmental gains as a result of an effective implementation of a new model of education by integrating core elements of ESD.

Conclusion

The modern *praxis* in public schools influences how students relate to the rest of the biological world and should encourage sustainable values. The educational institution should recognize the ecological responsibility of the school in the Anthropocene, since it is within the school that children can discover how the world operates. It is a necessary imperative to implement an action-oriented learning approach to develop the students' view on the solidarity between nature and the external environment. In this way, managers at Danish lower secondary schools should put sustainability at the center of learning as this seeks to rethink core values and educational practices, which motivate sustainable capacities.

This paper has examined the concept of ESD, and it might overlook some of the positive impacts on education put forward by other educational frameworks, such as positive features from traditional education. But from the perspective of climate change, implementing the ideas of ESD put forward in this paper will restructure the pedagogic approaches that attenuate attention to short-term issues. The approach of ESD strengthens the attention to action-oriented learning by focusing on issues of environmental degradation and biodiversity loss. Managers will have to play a critical role in this process of cultivating sustainability in the curriculum, which is illustrated in Figure 1, to get their students to participate and collaborate in the process of improving the conditions of the environment. This entails (1) *recognizing* the environmental conditions and transformation, (2) *reflecting* over pedagogical methods that frame sustainability and, lastly, (3) *adaption* that seeks to alter educational policies in a sustainable fashion. Such approaches resonate with the kind of long-termist approach that seeks to improve upon the traditional learning process by building capacity for sustainability within the educational framework.

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