
ARTICLE

Education for Sustainable Food and Nutrition – Towards Criteria for German Secondary Schools

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Food is an integral part of everyone's life, but the food sector also hugely contributes to harming the environment. Education is the best tool to bring the topic closer to the youngest generations by integrating sustainable food and nutrition into their educational institutions. The UN Sustainable Development Goals (SDGs) address this challenge through multiple SDGs, for example, through SDG 12 on sustainable consumption and production. This research was conducted for the KMGNE, a Berlin-based research educational institute. This research explores criteria that can be used to incorporate the topic of sustainable food and nutrition in German secondary schools. Through a mix of qualitative methods, the concept of shaping competences, outcome-based learning was explored, and based on the research results, a set of criteria were determined. The research shows that transformative learning changes behaviour, as it allows internal change about assumptions and beliefs in students. This is why transformative learning works best to bring a change in behaviour. It is essential that schools not only teach about sustainable food and nutrition but also teach by example through the food they offer. Practitioners need to receive training to integrate sustainable food and nutrition-related topics into their lessons. External partners and learning environments should be included in education for sustainable food and nutrition to add authenticity as they can tell personal stories or show food production. The research was conducted in Germany; however, it is possible to use the determined criteria in different educational settings and countries.

Keywords: Food and Nutrition; Transformative Education; Sustainability; Sustainable Development Goals; Sustainable Consumption and Production; Secondary Education

Introduction

Food is a necessity for every human being, which makes the topic of food and nutrition relevant in everyone's life. Food is also one of the topics addressed in the Agenda 2030, more commonly called the United Nations Sustainable Development Goals (SDGs). The SDGs are a framework for governments, organisations, and businesses to work towards a more sustainable world. SDG 2 works towards eliminating hunger, providing access to food for everyone and creating sustainable food production systems. According to Ritchie and Roser (2020), food production currently harms the environment through the use of phosphorus, excessive nitrogen inputs, industrialised monocultures with lack of crop rotation, extensive use of pesticides, and excessive water use. As food production is such a big contributor to the climate crisis, it is essential to include this important topic in lessons of secondary school education (United Nations Sustainable Development, n.d.). SDG 4 on quality education considers the importance of developing global citizens who can find innovative solutions for the future. SDG 4.7, in particular, addresses the need to promote education for sustainable development. This is why,

to achieve a change in the food system, transformative education must be integrated into educational settings to encourage students to critically reflect on their assumptions and beliefs (Galt et al., 2013; Leal Filho et al., 2018). SDG 4, target 4.A of the Agenda 2030, highlights the importance of creating a safe, inclusive, and non-discriminatory learning environment for all students. The creation of a safe learning space is central in transformative learning because only with this safe space transformation is possible. Next to transformative education, climate change education is key to support students in understanding their individual and societal responsibility for the future (Graham, 2018).

While there is extensive research on education for sustainable development, limited research has been conducted on the specific topic of education for sustainable food and nutrition. At the moment, not enough practical information to start sustainable food and nutrition habits at schools are available. A guideline for schools that want to transform towards incorporating more sustainable food and nutrition is needed to encourage and support change (KMGNE, personal communication, February 5, 2020). This research aimed to develop criteria for transformative climate education for sustainable food and nutrition in German secondary school education, exploring the 12 shaping competences developed by De Haan (2010). Criteria in this context refer to specific guidelines

and principles that schools can use to incorporate sustainable food and nutrition in their formal contexts.

From Agenda 21 to Agenda 2030

Since the Rio Earth Summit in 1992, the concept of Education for Sustainable Development (ESD) has grown and shaped. International political and economic forums in many countries helped to develop ESD concepts and content. After the development of the concepts by ministries, educators tested them in educational settings. Agenda 21, a document that outlined issues related to sustainability was taken as a starting point for planning and implementing ESD. The three big priorities are improving basic education, reorienting existing education, and raising public awareness, understanding, and training around ESD (Hopkins & McKeown, 2002).

After Agenda 21, the Millennium Development Goals (MDGs) were developed, where education was also highlighted. In the agenda, it became evident that education is one of the most powerful tools to enhance transformative changes towards sustainable development. It was recognised that education needs to be flexible, culturally sensitive, and most importantly suited to change people's values to take advantage of the potential of education in the future. However, both Agenda 21 and the MDGs focused on the quantity of education, for example, the number of people in schools and literacy rates (Leicht, Combes, Byun & Agbedahin, 2018).

Following the MDGs, Agenda 2030, known as the Sustainable Development Goals (SDGs), was launched in 2015. It is an international commitment, comprised of 17 global goals to plan action for people, planet, and prosperity (Mochizuki, 2019). Regarding education, the SDGs focus more extensively on quality than quantity. While it wants to ensure equal access to education for everyone, it also wants to increase the availability of qualified practitioners (United Nations Sustainable Development, n.d.). Furthermore, Agenda 2030 can be used as the basis for ESD in different educational settings. In Agenda 2030, it is recognised that education plays a critical role to achieve sustainable development (Leicht, Heiss & Byun, 2018). One of the goals is SDG 4 on Quality Education. One of its several targets, SDG 4, target 4.7, talks specifically about ESD and global citizenship (Mochizuki, 2019). Target 4.7 says it should be ensured that

by 2030 [...] all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development. (Sustainable Development Solutions Network, n.d., paragraph 1)

SDG 4.7 should be taken into account and used to integrate sustainability in the school's core subjects to reorient learning towards education for the planet (Mochizuki, 2019). This target shows the importance of ESD, and it is

seen as the cross-cutting measure for sustainable development and all areas of the SDGs (Leicht, Heiss & Byun, 2018). Further, SDGs with importance in the topic of sustainable food and nutrition are SDG 12 on sustainable production and consumption and SDG 13 on climate action (United Nations Sustainable Development, n.d.). All three SDGs (4, 12, and 13) are supported by changing towards sustainable food and nutrition habits. To end hunger and fight climate change, as well as to change production and consumption patterns, working towards sustainable food and nutrition is vital. After reviewing how the topic of education for sustainable food and nutrition is situated within the UN agenda over time, the way to create a sustainable diet was examined.

Towards a climate-friendly diet

If schools want to encourage a more climate-friendly diet, one of the most important aspects is knowing how to create sustainable eating habits. Food is the source of energy for every person, we all depend on it, and it is essential to take into account when creating a more sustainable planet. Research on industrial production of food has shown that this sector is severely affecting the environment through greenhouse gas (GHG) emissions (Wirsam & Leitzmann, 2011). Around 13% of the CO₂ emissions of consumption per person are generated through the cultivation, processing, and transport of foodstuffs and food waste. Besides, there is a loss of biodiversity and pollution of water, air, and soil through agriculture (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit, 2017). Evers and Hämel (2010) state that a climate-friendly diet in schools, combined with lessons about the topic, have the potential to make students understand the importance of sustainable food and nutrition and apply them in their own lives. In a study conducted by the Hans-Böckler Foundation, it becomes apparent that 79% of the schools researched do offer projects or learning opportunities about food and nutrition. Still, only 8% connect all of them to the food offered at their school (Evers & Hämel, 2010).

There are multiple factors that can help to create a climate-friendly diet. First of all, one can buy food that was produced through organic farming. Through more preservative cultivation methods, less GHG are released (Oxfam Deutschland, 2015). However, organically produced food is expensive because it has to comply with high EU standards (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit, 2017).

Secondly, the food should be regionally produced and seasonal as this ensures shorter transportation routes and less time in storage, lowering GHG emissions (Regionaler Planungsverband Westmecklenburg & Oekom e.V., 2019). Thirdly, livestock farming plays a considerable role in GHG emissions within the food sector. It is said to double by 2050 as consumption of animal products have already tripled over the past 50 years in developing countries (Nakicenovic & Schulz, 2011). Livestock feed crops cover 34% of global croplands, and these significant stretches of land needed for livestock farming harm the carbon cycle and the climate (Stehfest et al., 2009). The production of animal products needs a lot of energy, cropland and fertiliser. Furthermore, cattle produce methane, which pollutes

the climate (Klimawerkstatt Essen, n.d.). Therefore, diet changes towards fewer animal products can have a positive effect on the climate (Oxfam Deutschland, 2015).

One other significant factor in the topic of nutrition is food waste. Almost two thirds of spoilage and waste of foodstuffs could be avoided and would reduce emissions and costs (Nakicenovic & Schulz, 2011). In Germany, yearly 80kg of food per person is thrown away (Regionaler Planungsverband Westmecklenburg & Oekom e.V., 2019). The best before date is often interpreted wrongly by consumers as it does not mean that the food is inedible after that date but that the food producers only guarantee the quality of the product up to that date. This means one way to avoid food waste it to make sure to check the smell and taste of a product that is expired before throwing it away (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit, 2017).

Food waste is not only produced at the consumer side but also through high-quality standards imposed by the industry, e.g., due to this standard deformed products cannot enter the market but go to waste directly (Gustavsson, Cederberg, Sonesson, Van Otterdijk, & Meybeck, 2011).

Lastly, more factors can be taken into account to create a climate-friendly diet. One can consider going to the grocery store on foot, by bike, or by bus to choose climate-friendly alternatives to taking the car (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit, 2017). Avoiding frozen food helps to conserve energy that would be needed to keep the food frozen (Regionaler Planungsverband Westmecklenburg & Oekom e.V., 2019). Besides, drinking water from the tap is safe in Germany (and other European countries) and is thoroughly controlled, even more than bottled water. Through drinking tap water, one can also save on the plastic bottle. The packaging is also a factor that can be taken into account, here, for example, avoiding plastics helps to reduce waste that will otherwise stay in the environment for a long time (Oxfam Deutschland, 2015). Now that most aspects of a climate-friendly and sustainable diet were addressed, the system of German secondary schools is explained to make the connection between education for sustainable food and nutrition and where it fits into the system.

German secondary school system

To understand how sustainable food and nutrition can be included in education in German secondary schools, it is important to be familiar with the German secondary school system. Each German federal state can set standards for all aspects of their education (e.g., curricula and which school forms are available), which may vary per federal state. There are some general guidelines posed by the German government, but the federal governments have the freedom to make final decisions regarding education (Biewen & Tapalaga, 2016). The Standing Conference of the Ministers of Education and Cultural Affairs (Kultusministerskonferenz) ensures that differences between federal states are kept to a minimum. Each state sets up its educational plans with subject-centred framework curricula. While subject focused (different disciplines) education is mostly used, interdisciplinary approaches can be used as long as the practitioner has the

knowledge and capability to use them. Framework curricula tend to be formulated as very general guidelines to leave room for practitioners to shape the content, methods, and assessment tools they see fit (called pedagogical freedom). During practitioner conferences, practitioners of a particular subject in one school agree on the way a subject is taught in their school (Schreiner, 2019).

After finishing primary school (Grundschule), the students (around age 9 or 10) decide with their parents which kind of secondary school the student will transition to (Puschner, 2010). There are four kinds of secondary schools. The lowest secondary level (Hauptschule) is a five-year education, grade 5 to 9. The middle secondary track (Realschule) is a six-year education, grade 5 to 10, which typically prepares for vocational training. The highest secondary track is a grammar school (Gymnasium), taking 8 or 9 years depending on the federal state, grade 5 to 12 or 13. The comprehensive schools (Gesamtschule) combine the possibility to stop at grade 10 with graduating from the Realschule or allows students to continue after grade 10 to finish with the same secondary degree as in the Gymnasium. This degree is the A-Level (Abitur), which is the only degree that allows students to continue education in a university or university of applied science (Fachhochschule).

Practitioners go through a two-phased practitioner education which encompasses a theoretical phase at university and an internship phase (Referendariat) at a school where they show what they have learned (Schreiner, 2019). According to Schreiner (2019), many practitioners become civil servants (Beamte) which ensures their job and their pension. This job security that many practitioners have makes them less inclined to do further training. The current educational system does not encourage practitioners to develop professionally; it depends on a practitioner's internal incentive to do further training (Schreiner, 2019).

To ensure incorporation of new topics in the school curricula or to encourage new forms of learning, pilot projects (of the working group quality and competences of programme Transfer-21) are started which are often done at a certain number of schools. One example is the pilot project of shaping competences in German schools. If these are having the desired outcomes, there is a slight chance that a federal state decides to include a method or topic in their school curricula (De Haan, 2007). For sustainable food and nutrition to be incorporated into every secondary school in Germany, every federal state would need to make the decision to take up the topic in their educational concepts (Biewen & Tapalaga, 2016). As described before, education for sustainable food and nutrition fits into the concept of ESD; ESD is then contrasted against other forms of learning. A way to combine the different approaches is explored, and transformative learning as a basis for education for sustainable food and nutrition is described.

Education for sustainable development, transformative learning, and climate education

There is a close connection between the need for more sustainable development and current issues like climate change, biodiversity loss, or pollution. To ensure long-

term sustainable development, a widespread and fundamental shift in perspective is needed (Van Opstal & Hugé, 2013). This mental shift is only possible through learning processes. This is the reason why it is fundamental to use systematic learning approaches to achieve sustainable development. People will also need to change the way they live, current production and consumption patterns must be broken, and decision processes need to be reoriented towards protecting our environment (Michelsen & Fischer, 2016).

The key goal of ESD is to transform the student's worldviews. It enables them to understand their responsibilities towards the planet and to develop a consciousness about global problems (Garcia Alvarez, 2020). ESD, therefore, also deals with the topic of sustainable food and nutrition. It is inherently different from other educational concepts of additive, cumulative, and archival knowledge acquisition (Michelsen & Fischer, 2016). Therefore, successful ESD uses participatory methods and media within the frame of situational learning. It asks for interdisciplinarity, future, and value orientation (Brock et al., 2017; De Haan, 2008). By implementing ESD methods, schools have the chance to transform education and to be the entry point for students into sustainability (Garcia Alvarez, 2020). When ESD is incorporated in schools, practitioners need to be trained to have the knowledge and the methods to incorporate sustainable development in their lessons (Albiez, König & Potthast, 2018).

Dirkx, Mezirow, and Cranton (2006) state that learning is a process that is complex and multifaceted, in which it is not apparent yet what the outcome might be. Transformative learning is the process of transforming perspectives, revising belief systems and behaviour, and changing the self-image (Dirkx et al., 2006). It looks at assumptions, which Mezirow (2003) calls problematic "frames of reference" and transforms them to be more inclusive, open, and reflective. It is not only about gathering knowledge or its application, but also it helps students to gain a better understanding of the world (Garcia Alvarez, 2020). A learning process is transformative if a person significantly changed their cognitive, emotional, or spiritual way of being. There is no principle structure for transformative learning, but practitioners need to provide opportunities for students to become aware of their frames of reference and to assess them. Meaningful learning opportunities challenge the learner's way of thinking, feeling, or believing (Dirkx et al., 2006). Learners need to be willing to work on their beliefs and assumptions. Only if the students take an active role in discovering, discussing, and changing their assumptions can transformative learning become fruitful. The environment for transformative learning needs to be built on trust, creating a safe space (Mezirow, 1997). The creation of a safe space gives everyone the chance to express views, opinions, and beliefs freely. A safe space nurtures out of the box ideas and transformative innovations (Pereira, Karpouzoglou, Doshi & Frantzeskaki, 2015).

Contrary to transformative learning, transmission-oriented education relies on knowledge transfer and instructional forms of teaching. This form of education gives a set of rules and codes of conduct to the learners and only

transfers a predetermined body of knowledge (Mogren & Gericke, 2019). According to Wals (2012), as education for sustainable development progresses, it needs to move away from being mainly transmissive towards a transformative model. In transformative learning, schools need to focus on educational processes rather than outcomes, address the uncertainties within sustainability and provoke transformative commitments that still consider precautions (Mogren & Gericke, 2019; Wals & Kieft, 2010). Educators need to encourage a student's personal development and promote responsible citizenship (Bell, 2016). Students need to develop the ability to collaborate, speak up, and act towards positive change (Rieckmann, 2018).

Once a transformation happens, there is no possibility that an individual regresses into a lower level of understanding. After a transformation, a person is likely to alter their behaviour. Additionally, many scholars see it as essential for ESD that worldviews and behaviours are changed (Kronlid & Lotz-Sisitka, 2014; Papenfuss, Merritt, Manuel-Navarrete, Cloutier & Eckard, 2019). Wals (2012) mentions in the UN Decade of ESD Report that ESD should provide the capacity for people to transform themselves and others. Integration of transformative learning in education for sustainability is vital to create a sustainable world (Berner, Lobo & Silva, 2013; Papenfuss et al., 2019). Through transformative education, young people can become actors in society that help to create a sustainable future (Mogren & Gericke, 2019). A combination of transformative learning, ESD, and climate education could be beneficial for education for sustainable food and nutrition. To investigate the criteria for education for sustainable food and nutrition, a conceptual framework from the field of ESD was chosen.

Conceptual framework

This research explored the conceptual framework of shaping competences, known as 'Gestaltungskompetenzen', introduced by De Haan in 2010. For this paper, when referring to the competences described by De Haan, they will be addressed as *shaping competences*. De Haan developed 12 shaping competences within the framework of ESD. Shaping competences describe the abilities of a person to shape the future and the specific capacity to act and solve problems (De Haan, 2010). De Haan's (2010) model concentrates on shaping competences that are needed to transform social relations, the economy, and management of natural resources in conditions of uncertainty (Dannenberg & Grapentin, 2016). The shaping competences capture the essence of acquiring and producing knowledge by embracing different ways of knowing and avoiding the narrow focus on specific skills (Giangrande et al., 2019).

De Haan's (2010, p. 320) 12 shaping competences are the ability to

1. gather knowledge in a spirit of openness to the world, integrating new perspectives;
2. think and act in a forward-looking manner;
3. acquire knowledge and acting in an interdisciplinary manner;
4. deal with incomplete and overly complex information;
5. cooperate in decision-making processes;

6. cope with individual dilemmatic situation of decision-making;
7. participate in collective decision-making processes;
8. motivate oneself as well as others to become active;
9. reflect upon one's own principles and those of others;
10. refer to the idea of equity in decision-making and planning actions;
11. plan and act autonomously; and
12. show empathy for and solidarity with the disadvantaged.

Currently, shaping competences are not integrated into the curricula of German secondary schools; however, around 200 model schools were used for a try-out project called transfer-21 by the Institut Futur, led by De Haan. A general ESD curriculum was set up for these schools to implement and evaluate afterwards. In the curricula, shaping competences were matched with competences from the Organisation for Economic Co-operation and Development (OECD), and these matched competences were used as a basis for the curriculum (De Haan, 2007).

The limitation of the shaping competences model is that everyday situations cannot be divided into subjects, and it is challenging to decontextualise them to be specific to different situations and problems (De Haan, 2008). Shaping competences are criticised for being formal, which might be one of the reasons why it was never applied in the subject of climate change (Becker, 2018). According to Sleurs (2008), reorienting teaching principles towards the desired outcomes does not say anything about the actual practices of learners and practitioners in educational settings. As long as the institutional culture stays the same, the idea of shaping competences cannot be implemented successfully. Shaping competences might also propose social constructs that are based on values and ideological assumptions as setting competences is also an ethical and political task. Intended or unintended paradigms may be embedded in set competences (Sleurs, 2008). Certain transversal meta competences, which describe competences that are transfereable to all areas of knowledge, are difficult to operationalise and assess (Garcia Alvarez, 2020).

In order to explore the shaping competences and to see if they could serve as a base for criteria for education for sustainable food and nutrition, the conceptual model of De Haan is explored. It is contrasted against the existing literature (see information above) and opinions of experts expressed in the interviews of this research. The possibility of using the model as a tool for transformative learning is also evaluated.

Design and Methods

This research had the objective to determine criteria for transformative education for sustainable food and nutrition in German secondary school education while exploring the 12 shaping competences developed by De Haan. An explorative research approach was undertaken, including different qualitative research methods. In a qualitative approach, interviews and observation help to gain a thorough insight into the field of education for

sustainable food and nutrition. The usage of qualitative research helps to gather more in-depth information from experts and practitioners. It provides the opportunity to the researcher to ask follow-up questions which help to clarify certain answers given in the interviews. Furthermore, a literature review gives a firm foundation for the researched topic. The research investigated different aspects of secondary education (such as curricula, teachers, and school set-ups) as an example to determine the implementation of sustainable food and nutrition in a formal educational setting.

The observation was conducted for seven hours (including breaks), observing 15 students in grade 12 of the Fritz-Greve-Gymnasium, a partner of the Collegium for the Management and Design of Sustainable Development (KMGNE). The KMGNE is a Berlin-based research educational institute, which carries out research and consultancy projects, as well as educational projects focused on sustainability. They have a project farm in rural Germany where the observation took place. The observation helped to explore the concept of the shaping competences by De Haan (2010) as a possible basis for education for sustainable food and nutrition. The observation results were based on a checklist looking at the possibility to witness if the students displayed the competences in their lesson by the KMGNE (e.g., they were not acting autonomously as they needed close guidance from the practitioners present). It determined if and how the shaping competences were displayed by the students during a science experimenting lesson of the KMGNE.

The first set of interviews were conducted with six experts in the fields of climate-friendly diets, transformative education, and sustainable food and nutrition. These experts work for different organisations where some teach sustainable nutrition and some support schools or other formal educational institutions to implement education for sustainable food and nutrition. Based on the results of the expert interviews, the practitioner interview protocols were set up. The practitioner interviews were conducted with five practitioners from German secondary schools. These practitioners did not necessarily have knowledge about the topic of sustainable food and nutrition. The sample included practitioners from two federal states that are or were teaching at grammar schools.

Both the experts and practitioners were selected through a combination of purposive and convenience sampling. The experts were chosen based on their expertise, and the practitioners were chosen due to their availability during the Covid-19 situation. No particular selection criteria were determined to ensure that the practitioner sample took the current situation and willingness of the practitioners to implement sustainable food and nutrition in their own classes into account. The sample was not based on subjects, specific schools, or other factors. All collected data were transcribed manually in German and summarised in English by the researcher. Open coding was used to analyse the content of the interviews. The practitioner and expert interviews were combined by looking at different codes from both perspectives. Inductive coding was used to take the codes directly from the interviews to ensure the usage of relevant and useful codes. Ethical considerations

were taken into account. During the interviews, each interviewee gave informed consent to be a part of the research. The practitioner interviews were anonymised to ensure that everyone felt safe to share their opinions on the topic. In the research, these interviews are referred to numerically (Practitioner 1, 2, 3, 4, and 5). The experts explicitly agreed to be named in citations. Validity was secured by using data triangulation from three sources (practitioners, experts, and students). Reliability was ensured by using the same protocol in the interviews, one protocol for the expert interviews and another for the practitioner interviews.

Results and Findings

The results and findings of this research are presented around the three main topics of the current situation, exploration of the shaping competences by De Haan (2010), and potential criteria for education for sustainable food and nutrition.

Current approach

According to experts, in German secondary schools, there is minimal to no engagement in the topic of sustainable food and nutrition at the moment. When the topic is introduced or discussed in a school, this is mostly done in a theoretical way (E. Carceller, personal communication, April 03, 2020). Environmental schools that engage in environmental protection, environmental education, and ESD seem to cover it most extensively. For example, some aspects of ESD can be seen in school gardens (K. Braun-Wanke, personal communication, March 27, 2020), veggies days (Practitioner 3, personal communication, April 15, 2020), beehives (Practitioner 5, personal communication, April 16, 2020), or project days where the topic was addressed. C. Schulze, programme manager at BildungsCent, sees that in case a school engages in the topic, it differs per school how sustainable food and nutrition is implemented (personal communication, April 06, 2020).

The results of the interviews show that information about sustainable food and nutrition can change by the day. S. Ramelow, the founder and board member of BildungsCent, stated that contrary to subjects like math or science, sustainable food and nutrition cannot be taught without giving the students room for discussion because there is no one correct answer (personal communication, April 06, 2020). This position makes practitioners vulnerable and raises the importance for them to step out of the traditional student-practitioner role. This traditional role sees practitioners as the ones transferring the knowledge to students without students contributing their own knowledge and ideas. This role division hinders the knowledge and ideas of students to be heard and discussed in class. It can be beneficial for practitioners to learn from their students in certain situations where they do not hold the ultimate truth (S. Ramelow, personal communication, April 06, 2020).

As mentioned before, Brock et al. (2017) noted that in education for sustainable development, an interdisciplinary approach is needed. First of all, there is a strong connection between sustainable food and nutrition and our daily life. According to K. Braun-Wanke, a project manager,

and coordinator at the research centre for environmental politics in Berlin, “We all need to eat, no matter what social class we come from” (personal communication, March 27, 2020). This reality makes the topic a powerful tool for students to feel that changed eating habits can have a positive impact on the world (S. Ramelow, personal communication, April 06, 2020).

According to M. Singer-Brodowski, coordinator of monitoring education for sustainable development at Institut Futur, practitioners can break down the complex topic of sustainable food and nutrition by working transdisciplinary across subjects. One example would be history class where the students could discuss the connection of former colonies in the global south to its current food production for the global north (personal communication, March 25, 2020). Working transdisciplinary could also mean linking different subjects to a school garden, like calculating the use of space in mathematics (K. Braun-Wanke, personal communication, March 27, 2020). From the practitioner side, working transdisciplinary also comes with certain challenges; practitioners need more time planning their lessons and other topics need to be eliminated from the lesson plans (Practitioner 5, personal communication, April 16, 2020). Interdisciplinary work might limit the pedagogical freedom of the practitioners as they cannot decide on their own but have to discuss their lesson plans with their colleagues (S. Ramelow, personal communication April 06, 2020).

School meals can be used as a starting point to teach different aspects of sustainable food and nutrition. Carceller, coordinator of the Slowfood Youth Academy, stresses that “if you talk about sustainable food, but you do not implement it in the school’s meals, a counterproductive education has taken place” (personal communication, April 03, 2020). To ensure successful education, schools can offer sustainable meals to be a role model for a sustainable lifestyle. S. Rehmer, community manager and education consultant at Naturfreundejugend, suggests that schools can set certain standards by changing their meals towards organic or fairtrade food (personal communication, April 01, 2020). Another option is to change the food towards regional and seasonal food with local food providers. Some of the practitioners addressed challenges when changing school meals. One practitioner (Practitioner 2, personal communication, April 14, 2020) mentioned the challenge of the availability of sustainable food providers in a school’s area. The research demonstrates that initiatives like a school garden, a beehive, or student enterprises can be linked back to the school meals. Food produced in a school garden can be processed in the school’s canteen. Seeing that schools live sustainable food in everyday school life elevates the chances of the students changing their eating habits (Practitioner 4, personal communication, April 15, 2020).

Exploration of shaping competences and transformative learning

According to B. Schautz, project manager food and nutrition at the consumer advice centre in Berlin, the 12 shaping competences (De Haan, 2010) are theoretical, and it

is difficult to translate them into practice (personal communication, April 02, 2020). One reason why it is difficult to put them into practice is that they are abstract (K. Braun-Wanke, personal communication, March 27, 2020). The 12 shaping competences are focused on the learning outcome and should, at some point, be operationalised and measured (M. Singer-Brodowski, personal communication, March 25, 2020).

The research observation showed evidence of two shaping competences (open-minded and integrating new perspectives) and no evidence for three shaping competences (thinking and acting in a forward-looking manner, dealing with overly complex information, and planning and acting autonomously) in the behaviour of the students. The other shaping competences were observed slightly. Most of the students in the observation showed engagement in the class activities, while only some of them displayed excellent motivation. Looking at the difficulties mentioned above with the shaping competences it is not clear if this observed behaviour directly links with the shaping competences or that another observer might have seen different competences in the student's behaviour. Furthermore, the evidence for the shaping competences was very subjective to how the researcher interpreted what she saw in the observation.

In contrast to the 12 shaping competences, transformative education focuses on the process of learning (M. Singer-Brodowski, personal communication, March 25, 2020). As mentioned before, Dirkx et al. (2006, p. 130) state that “the process of learning represents the process of the world becoming an integral part of our being. Moreover, when this happens, it has the potential to transform our sense of self and our being in the world.” Transformative learning looks at the presuppositions we have that shape our actions. This process does not work towards specific results. It does not necessarily lead to climate-friendly behaviour or to having the 12 shaping competences but has the potential to do so through a transformation (M. Singer-Brodowski, personal communication, March 25, 2020).

Suggested criteria for education for sustainable food and nutrition

In the interviews, experts and practitioners suggested multiple criteria for education for sustainable food and nutrition that have the potential to be implemented in German secondary schools.

Giving students space to build their own opinions

When teaching sustainable food and nutrition in schools, the topic should be presented to the students in a way that makes them interested, where they can see the difference of a behavioural change. Students need to be aware of all the theory, for example, about the effects of food production on the Amazonian forest in Brazil (M. Singer-Brodowski, personal communication, March 25, 2020). According to Schautz (personal communication, April 02, 2020), when the students get the opportunity to explore the topic and solutions by themselves, it raises the chance of engaging students emotionally. The key is

to approach it [the topic of sustainable food and nutrition] with optimism and motivation. I think the most important thing is to be able to explain why this is such an important topic, why people do this to engage more in the heart of a person. (S. Rehmer, personal communication, April 01, 2020)

According to Braun-Wanke (personal communication, March 27, 2020), authenticity when teaching sustainable food and nutrition is crucial. A change in behaviour has to come from inside of the student. The students need to have the space to build their own opinions; practitioners should not pressure the students or try to persuade them (M. Singer-Brodowski, personal communication, March 25, 2020).

Embed in practitioner training

As stated before, according to Albiez et al. (2018), additional practitioner training is needed for practitioners to be able to incorporate sustainable food and nutrition in their subjects. “One cannot assume that practitioners naturally know how to deal with it [the topic of sustainable food and nutrition]; they need to have some guidance and input” (E. Carceller, personal communication, April 03, 2020). Among the experts and practitioners, there were different opinions on content and number of practitioners that should have the opportunity to participate in the practitioner training.

Content ideas included educating on ways to incorporate external partners (B. Schautz, personal communication, April 02, 2020), operationalisation of complex sustainability concepts (K. Braun-Wanke, personal communication, March 27, 2020), re-evaluation of the practitioner self-image (S. Ramelow, personal communication, April 06, 2020), or ways to cope with the student's emotions. It is critical for practitioners to understand the student's emotions towards the climate crisis and that they learn how to handle them in their classes.

Some of the practitioners said that every one of them should get the chance to participate in a practitioner training (Practitioner 2, personal communication, April 14, 2020), but others disagree and think that it is enough if some practitioners get the chance to participate. The offers of practitioner training should have a high quality, giving the practitioners time to change one of their lesson plans with the information acquired during the training. It raises the probability of practitioners changing other lesson plans to include sustainable food and nutrition (Practitioner 5, personal communication, April 16, 2020).

Use of external opportunities

Practitioners need to be aware of their limits and their possibilities to invite external partners or use external learning places to elevate their teaching (B. Schautz, personal communication, April 02, 2020). “These [external partners] are real highlights that are coming from outside, and normally...the practitioners are grateful to get an external impetus. The routines and monotony of the lessons are also broken by these initiatives” (Practitioner 3, personal communication, April 15, 2020). Practitioner 3 (personal

communication, April 15, 2020) further claims that the majority of practitioners welcome impulses from outside sources to their classes. One practitioner (Practitioner 5, personal communication, April 16, 2020) said that, for them, education primarily takes place in the classroom and external opportunities only play a minor role.

Cooperating with external partners (e.g., Slowfood, an organisation that works towards socially and ecologically fair food systems) that can convey information about sustainable food and nutrition with authenticity gives the students an introduction to the topic that can be taken up by the practitioners in future lessons (M. Singer-Brodowski, personal communication, March 25, 2020). According to Braun-Wanke (personal communication, March 27, 2020), learning in a new context raises the receptiveness for students, generates more interest, and makes students more curious. A practitioner stated that external learning opportunities on the topic of sustainability outside of the regular school lessons allow students to learn for a life outside of the school (Practitioner 1, personal communication, April 14, 2020). Project days and weeks are a way to incorporate external partners with ease. There is the possibility to extend the collaboration beyond projects towards long-time commitments (Practitioner 4, personal communication, April 15, 2020).

Situational adaptation

Education for sustainable food and nutrition can be adapted according to the students' situations and the location of the school. In some contexts, the topic needs to be addressed with great care. Students might live on a farm that does not have an organic certification but where they feel like the animals are treated well. It is important to ensure that these students do not feel denounced (S. Rehmer, personal communication, April 01, 2020). Carceller (personal communication, April 03, 2020) states that another contextual adaptation can be made for the reality of food in a specific area. For example, if a school is located close to the ocean, fish is a critical topic to cover in education for sustainable food and nutrition. It is essential to adapt the education to the student's realities to make them more inclined to learn (Practitioner 4, personal communication, April 15, 2020). Schulze (personal communication, April 06, 2020) states that all students, however, need to be prepared for the same future in the same educational system.

Institutionalisation

Some of the interviewed experts think the current school system does not offer the capacity to include topics like sustainable food and nutrition without changing the system (S. Ramelow, personal communication, April 06, 2020). Others think that sustainable food and nutrition should be integrated into the framework curricula to raise its relevance (B. Schautz, personal communication, April 02, 2020). Most experts agree that sustainable food and nutrition should be institutionalised in the way that it is integrated into everyday school life. Sustainable food should be served in schools, necessarily changing the system of canteens and cafeterias.

According to Practitioner 3 (personal communication, April 15, 2020), there is some scepticism about institutionalising sustainability topics because not all practitioners are passionate about it. It might be difficult for a practitioner that does not eat sustainably to inspire the students to change their eating patterns. Here, external partners gain high importance again and can be utilised to give these practitioners the chance to outsource the topic of sustainable food and nutrition (S. Rehmer, personal communication, April 01, 2020).

Discussion

While previous research was focused more on education for sustainable development in general, this research focused specifically on education for sustainable food and nutrition. Existing literature on this topic is limited.

The findings suggest that there are no existing criteria in schools for sustainable food and nutrition. Missing practical information is a difficulty for schools to engage in the topic. This implies that there is still much room for sustainable food and nutrition in schools and that they need more support to implement the topic successfully. If a school does incorporate it, this does not mean that they are using criteria to implement it. For example, a school with a school garden does not necessarily make a connection to sustainable food and nutrition or incorporate the produce in their canteens.

Furthermore, it was unexpected that some experts questioned the usability of the 12 shaping competences as a basis of education for sustainable food and nutrition. Through the observation, it became evident that it is difficult to observe these shaping competences in action. Students might have shaping competences even though the observer did not see them during the observation. As learning processes never have an apparent outcome, the process itself gains higher importance than the outcome. Some experts suggested using the transformative learning theory within education for sustainable food and nutrition. Transformative learning is essential for students to question their assumptions and beliefs. People first need to look at their patterns of perception and status of perspectives to transform through education. Planting the seed for transformation during secondary education is important to ensure a starting point for students to change their behaviour. It encourages students to challenge old perspectives and transforms the way they look at food. The transformation itself can then also take place months or years after secondary school graduation. It is important to highlight that learning transformatively and developing the 12 shaping competences are not mutually exclusive. Through the process of transformative learning, students might develop the 12 shaping competences, but this is not definite.

Besides, all experts proposed similar criteria they see as crucial for education for sustainable food and nutrition in German secondary schools; these criteria were, however, not focused on information that should be conveyed. Criteria for education for sustainable food and nutrition should not focus on possible ways to make one's diet more climate-friendly but instead on the surrounding situation.

In general, the experts suggested that a holistic approach is needed. The proposed criteria focus on a support system and the environment that can be created to teach about sustainable food and nutrition. The importance of creating a welcoming environment for students to learn about sustainable food and nutrition and the connection of theoretical and practical ways of teaching was highlighted by the experts and some practitioners.

Additionally, the data suggests that if sustainable food and nutrition are incorporated in education, the rapid changes and transdisciplinarity of the topic need to be taken into account. Teaching one thing and showing the exact opposite in the school canteen can make students feel more resistant to change. The practitioners saw more problems and barriers to implementing sustainable food in canteens and cafeterias. In contrast, the experts were focused on the possibilities a school has to change their school meals. The practitioners were concerned that there were no sustainable food suppliers available in the area of the school or not at an acceptable price. The effectivity of education is enhanced by connecting sustainable food and nutrition to different aspects of school life and different subjects. Possible challenges need to be addressed when implementing these criteria. Another important aspect is that practitioners need to be aware that sustainable food and nutrition is no stagnant topic but changes over time and that the students need to have the space to come to their own conclusions. This is why the effort of trying to achieve this free space for students to develop their own opinion elevates the effectiveness of education for sustainable development. Students are more inclined to change their behaviour if they themselves conclude that it is crucial to do so. It implicates for practitioners to be aware of their position and the way they portray the topic. The traditional student-practitioner roles need to be re-evaluated, and more in-depth exchanges between the practitioners and the students need to be initiated. The practitioners need to work on eye-level with the students to allow a knowledge exchange rather than knowledge transmission.

Moreover, the data provides new insight into the practitioner's ability to include additional topics in the subjects they teach. It cannot be assumed that practitioners are able to incorporate sustainable food and nutrition in their lessons. They are trained in a specific subject, which might limit their ability to incorporate different topics in their subjects. From this standpoint, practitioner education can be considered as very important to support practitioners in incorporating new themes in their lessons. Practitioner training can convey the knowledge and skills that are needed in order to ensure that a practitioner is confident to talk about sustainable food and nutrition, knows how to engage the students, and has the opportunity to ask for help when needed. A need for practitioner training on the topic of sustainable food and nutrition is seen on the expert and practitioner side.

Another important aspect is using external partners and external learning places, which has a very positive effect on classes about sustainable food and nutrition. In general, external learning opportunities (e.g., visiting

a community garden) have positive effects on a lesson's atmosphere and the desire for students to learn. They take pressure from practitioners to be experts in every topic. This research shows that external partners and external learning opportunities have high importance, not only to make sure that students see where their food is produced but also to introduce the subject through people who consume sustainable food. Seeing how much work it is to produce our food might help students to appreciate it more and consume food more consciously, which contributes to more sustainability.

Even though everyone needs to be prepared for the same future in the same system, slight content adaptations can help to display the different regional and situational realities. Adapting what is taught to the situation and region helps students to relate more to the topic and makes it more authentic. A universal education on sustainable food and nutrition would likely not work for every student and every school.

In secondary schools, the institutional framework sets boundaries to the aspects that are taught in a specific subject. These boundaries are stretched by some schools, and there is a debate about institutionalising sustainable food and nutrition in schools. Instead of trying to bring it into the existing system, changing the system towards embracing topics like sustainable food and nutrition could be beneficial. The question of institutionalisation is challenging and cannot be answered easily, especially because the German secondary school system is complex and decentralised. Here, more research would be needed on ways to institutionalise the topic. However, a part of institutionalising, to incorporate sustainable food and nutrition in schools, can be done through a change towards sustainable meals.

Finally, the criteria mentioned above need to be tested in German secondary schools to evaluate their effectiveness and possible gaps. It also needs to be assessed if there is any difference in the implementation of the criteria in other forms of German secondary schools than grammar schools and other federal states. It would be essential to include as many states with differing framework curricula and types of secondary schools as possible. There is also more research needed to evaluate if the model of transformative learning is sufficient. This research can be used as a basis for further research in secondary schools in other countries or different forms of formal and informal education. The criteria can also be used as principles to bring sustainable food and nutrition into different educational institutions.

Further, the limitation of the conceptual framework for the research became apparent while the active phase of the research had already started. A better conceptual framework for further research would be transformative learning. For the observation, observing one school once is also a limitation and also the reason why the observation could only contribute a small portion to explore the conceptual framework of the research. Additionally, the observation was also right before the school closures due to Covid-19, which might have influenced the students' behaviour. In general, another

method might have been more beneficial, one that includes more detailed interviews with teachers that are using the shaping competences as a framework or tried to use them. Besides, further study of the German secondary school curricula would be needed to understand the whole picture and to look into possibilities to include education for sustainable food and nutrition more in curricula. Other limitations to the research are the limited sample group for the practitioners and translation issues as the research was conducted in German (e.g., the translation of the German concept Gestaltungskompetenzen).

Conclusion

To conclude, the goal of the research was to set up criteria for transformative climate education for sustainable food and nutrition in German secondary school education, while exploring De Haan's 12 shaping competences. The criteria were determined based on the information acquired through expert and practitioner interviews. The results suggest that the transformative learning theory should be the basis for education for sustainable food and nutrition. The focus is on guiding students through a transformative learning process, as it is likely to lead to a change in behaviour. The 12 shaping competences might be acquired in the process but should not be the basis for education for sustainable food and nutrition.

The final criteria for education for sustainable food and nutrition in German secondary schools that were determined in this research are:

1. Continuously update the topic
2. Use a transdisciplinary approach when teaching about sustainable food and nutrition
3. Give students the space to build their own opinions
4. Embed sustainable food and nutrition in practitioner training
5. Collaborate with external partners and use external learning places
6. Adapt education for sustainable food and nutrition according to the student's situation and the location of the school
7. Institutionalise sustainable food and nutrition by making school meals more sustainable.

The research explicitly focused on education in German secondary schools; however, the criteria should also be applicable in other educational settings. The criteria can be implemented and evaluated in different countries and different educational institutions.

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Competing Interests

The author has no competing interests to declare.

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