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(Un)expected Learning Outcomes of Virtual School Garden Exchanges in the Field of Education for Sustainable Development

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Abstract: Global solidarity is paramount in times of global crises and essential in Education for Sustainable Development (ESD). Virtual School Garden Exchanges (VSGEs) link local gardening with global thinking. In VSGEs, elementary and secondary school students in different parts of the world exchange information about their school gardens and related topics via digital media. Educators' perspectives and the learning outcomes they observed in the participants of the VSGEs were the focus of this study, as there has been controversy about whether VSGEs are suitable for implementing ESD and whether VSGEs result in the learning outcomes that the educators expect them to. We conducted 20 semi-structured interviews with VSGE educators and analyzed them in an abductive and qualitative manner. The results showed substantial overlap with both the expected learning outcomes and the aims of ESD. Nevertheless, the data revealed different ways in which learners who engaged with their international peers were influenced by stereotypes and norms. On the one hand, VSGEs can lead to Othering, which is not congruent with either ESD or the expected learning outcomes. On the other hand, it can inspire Transformative Learning processes, which contribute to the aims of ESD. Therefore, depending on a complex interplay of various factors, there is potential for ESD in VSGEs, but VSGEs are not guaranteed to be a good ESD practice.

Keywords: school garden; virtual exchange; education for sustainable development; learning outcomes; othering; transformative learning

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1. Introduction

In times of global challenges such as the climate crisis or the coronavirus pandemic, worldwide interconnectedness becomes more tangible, and the relevance of global solidarity stands out particularly clearly. The international "Fridays for Future" youth movement has shown that bottom-up mobilization of people for the common goal of climate justice (e.g., by using social media) is possible. Another example for addressing these challenges, which operates mostly in a top-down fashion, is the Agenda 2030 [1]. It was adopted in 2015 by the United Nations (UN), and 17 Sustainable Development Goals (SDGs) were defined. Education is both a goal in and of itself (SDG 4) and a means for contributing to achieving all 17 SDGs [1,2]. The concept of Education for Sustainable Development (ESD), which is recognized worldwide, is at the core of SDG 4 (see target 4.7). In this study, ESD is defined as a holistic, problem-solving, future- and action-oriented educational concept that addresses social, cultural, ecological, and economic aspects of different issues that are related to sustainability and local and global perspectives on these issues [3–6]. It aims to empower learners by fostering knowledge, competencies, and values, all of which enable learners to contribute actively to sustainable development [1,2]. Even though ESD is now well-established, and plenty of experience has been gathered, it is still difficult to measure its effectiveness [3,7,8].

The focus of this study is on Virtual School Garden Exchanges (VSGEs). VSGEs are educational practices that combine local gardening and global thinking, thus providing many opportunities to embed ESD. In VSGEs, primary and secondary school students from different parts of the world who work in school gardens engage in Virtual Exchanges (VEs) about their gardens and related topics. They use media such as photos, films, and videoconferences.

There is barely any research on VSGEs yet. A systematic literature review by Lochner et al. [9] identified only one research paper [10] that was directly related to a concrete example of a VSGE. Bowker and Tearle [10] performed a pre-test before the VSGE was implemented, coming up with a list of hypotheses about possible learning outcomes. In previous studies, Lochner also covered a variety of aspects of VSGEs such as experiences, challenges, and solutions in the implementation [11], the broader context of VEs [12], and learning outcomes targeted by educators [13]. Against the background of these studies, the question that emerged was: What do the students who are engaged in VSGEs really learn?

To address this question, educators who have implemented VSGEs were interviewed (see Section 3.2). The experiences of 24 educators who worked in 10 different countries and five different continents and who were engaged in 16 VSGEs were captured with semi-structured interviews. We analyzed the interviews in an abductive manner by following Mayring's [14] qualitative content analysis model, with the objective of identifying patterns in the observed learning outcomes.

The context, theoretical foundations and research questions in this paper are described in Section 2. Section 3 outlines the research design. Subsequently, the empirical results of the interviews are described in Section 4 and discussed in Section 5. The article concludes by highlighting the main learning points, merits, limitations, and remaining questions.

2. Context and Theoretical Foundation

School gardens exist all around the world and provide ample opportunities to integrate ESD. They are usually located on school grounds or nearby. They have different shapes and sizes and serve various purposes such as learning, recreation, and food production [15,16]. School gardens have a long tradition as places of learning. Depending on the regions, they differ in their objectives. In the Global North, school gardens predominantly serve as outdoor laboratories for science, environmental studies, and other subjects. More recently, the reconnection of youth to nature and the origin of their food emerged as a new aim of school gardening. In the Global South, the focus has been more on "vocational agricultural training and food production for consumption or cash" (p. 5, [15]). The 'Global North' and 'Global South' are not geographical terms but are rather an attempt to describe different positions within the globalized world in a less biased manner. "The phrase 'Global South' refers broadly to the regions of Latin America, Asia, Africa, and Oceania. (. . .) The term 'Global South' (. . .) references an entire history of colonialism, neo-imperialism, and differential economic and social change through which large inequalities in living standards, life expectancy, and access to resources are maintained" (p. 12, [17]).

A VSGE is one of many different approaches that can be used to embed the global perspective of ESD in school gardens [9,11,18]. ESD needs settings—such as in VSGEs—"in which learners can deal with global sustainability topics and can communicate and collaborate with people from other countries" (p. 27, [19]). Even though there is a significant overlap between ESD and VSGEs [13], ESD is not the main driver behind VSGEs [11].

Some potential learning outcomes of participants in VSGEs are mentioned in the literature, but no empirical data are available yet. Therefore, this study was guided by the following research questions:

What learning outcomes do VSGE educators observe in the participants of VSGEs and what do these say about VSGEs as an ESD practice?

(a) Which factors influence learning experiences in VSGEs?
(b) How do learners react emotionally to VSGEs?

(c) Do the observed learning outcomes match the learning outcomes intended by VSGE educators [13]?
(d) Does Othering occur in VSGEs?
(e) Does Transformative Learning happen in VSGEs?

The following section provides an overview of factors that influence VSGEs and the role of emotions as indicators for learning (Section 2.1). Furthermore, the intended learning outcomes addressed by VSGE educators as well as the learning outcomes of ESD (Section 2.2), and the concepts of Othering (Section 2.3) and Transformative Learning (Section 2.4) are introduced. The importance of these topics was highlighted in previous studies as well as in empirical analyses that have emerged from a continuous dialogue between empirical findings and theoretical conceptualizations. Such a dialogue is typical of the iterative process of qualitative research. In order to provide readers with an "advance organizer", however, relevant concepts are explained up front.

2.1. Factors That Influence Learning in VSGEs and Learners' Emotional Reactions

VSGEs—as well as the learning of participating students—are influenced by many factors. On the basis of experiences from seven VSGEs, Lochner [11] developed a four-level matrix containing 28 factors that influence the implementation of VSGEs (see Figure 1). These factors influence the success of VSGEs and therefore also the learning outcomes of participants. For example, if VSGEs are not successful—due to defective planning or a defective structure (organization level)—it will be impossible for educators to achieve their intended learning outcomes. Potential internet connectivity problems might lead to interruptions of videoconferences, which also stops the learning experience (implementation level). Furthermore, matching different academic calendars (school level) can be challenging: finding dates for interactions and achieving a continuous exchange can become very difficult. Additionally, if learners are very young (learner level), their age might influence the level of complexity they are capable of understanding.

Closely linked to the latter are learners' emotional reactions, which are a first and immediate output of VSGEs. Emotions play important roles in learning processes [20–22], e.g., "enjoyment of learning, hope, pride, anger, anxiety, shame, hopelessness, or boredom" (p. 36, [21]). Positive emotions enhance learners' performance and learning, while negative emotions reduce it [21]. For VSGEs, this can mean that if learners are motivated, the VSGEs will work well, which means learners will be likely to connect with their peers, they will probably enjoy the exchange, and they will learn easily. However, if, for example, their language competencies are too limited or they are too young and unprepared for such an intercultural encounter, they might be ashamed, and their learning might be inhibited.

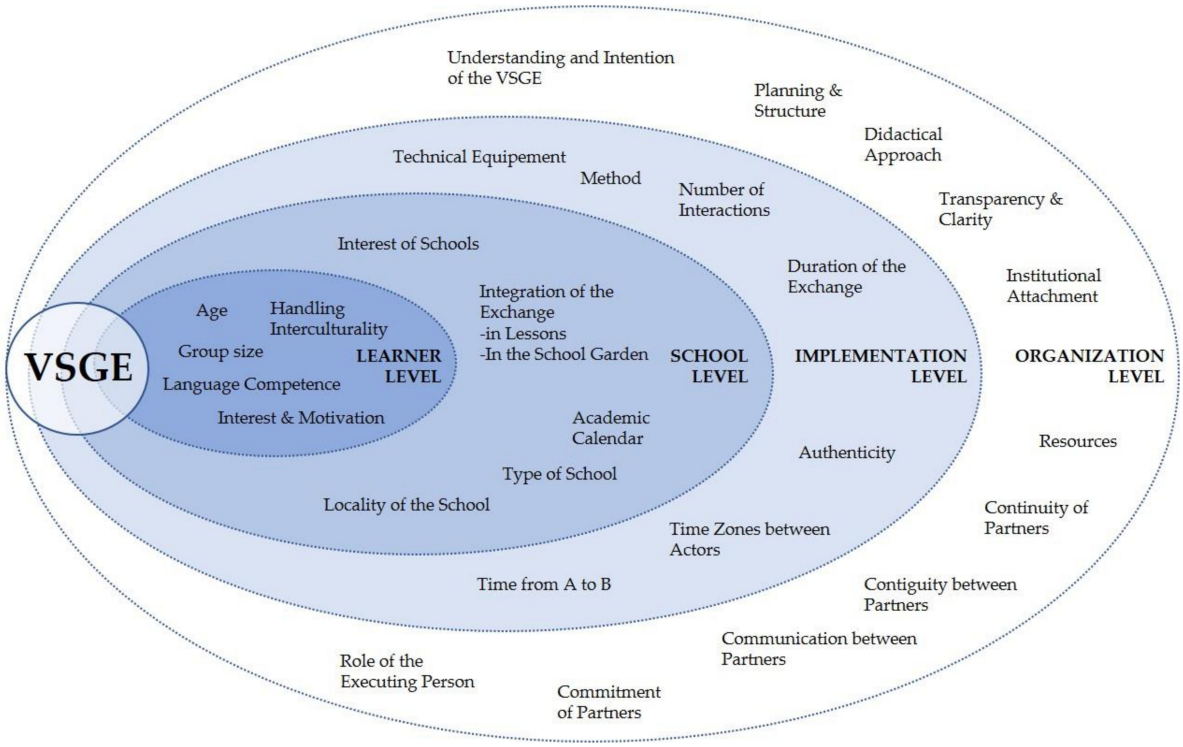

Figure 1. Factors that influence VSGEs (adapted [11]).

2.2. Intended Learning Outcomes and Settings in VSGEs and ESD

Learning in VSGEs is a recent and mostly unexplored field of research that faces many unanswered questions [9,13]. In a previous study, Lochner [13] contributed to filling this research gap by analyzing the intended learning outcomes and learning settings of VSGE educators in the field of ESD. Twenty-three semi-structured interviews with 27 educators involved in 18 different VSGEs were conducted. A qualitative content analysis revealed clusters of common intentions (see Figure 2). For example, it was expected that, by participating in VSGEs, learners would gain knowledge about gardening and food, acquire competencies such as horticultural and/or collaboration competencies, and develop values such as solidarity. Furthermore, educators advocated learning settings, reflecting global complexity and enabling learners to explore differences and similarities with their peers. The results revealed parallels with the aims of ESD.

ESD is about empowering learners to contribute to sustainable development by fostering their knowledge, competencies, and values [1,2]. Regarding the acquisition of knowledge, some of the key themes of ESD programs are cultural diversity, sustainable production and consumption, climate change, and globalization. Thus, ESD programs exhibit many parallels with the SDGs [2,6,23]. Furthermore, key sustainability competencies such as critical thinking, self-awareness, systems thinking, and collaboration competency are targeted in ESD [2,4,24–28]. Additionally, basic competencies such as linguistic competency are essential for ESD [3]. To address global and local challenges today and in the future, values (e.g., solidarity, tolerance, empathy, and sufficiency) are central [5,29,30]. However, measuring the learning outcomes of ESD programs is challenging and evidence that the expected learning actually takes place is often missing [3,7,8]. Some VSGE educators have expressed that they fear that it might not be very easy to achieve the intended learning outcomes, as the paths to such outcomes are likely not linear and instead involve a rather complex process [13]: instead of creating a feeling of global citizenship, VSGEs might strengthen stereotypes. In literature, school linking (mostly virtual), school partnerships (including visits), and sponsorships between schools (e.g., encounters and interactions be-

tween learners in the Global North and Global South) have been described as controversial, also exhibiting a variety of possible negative outcomes [31–37] (see Section 2.3).

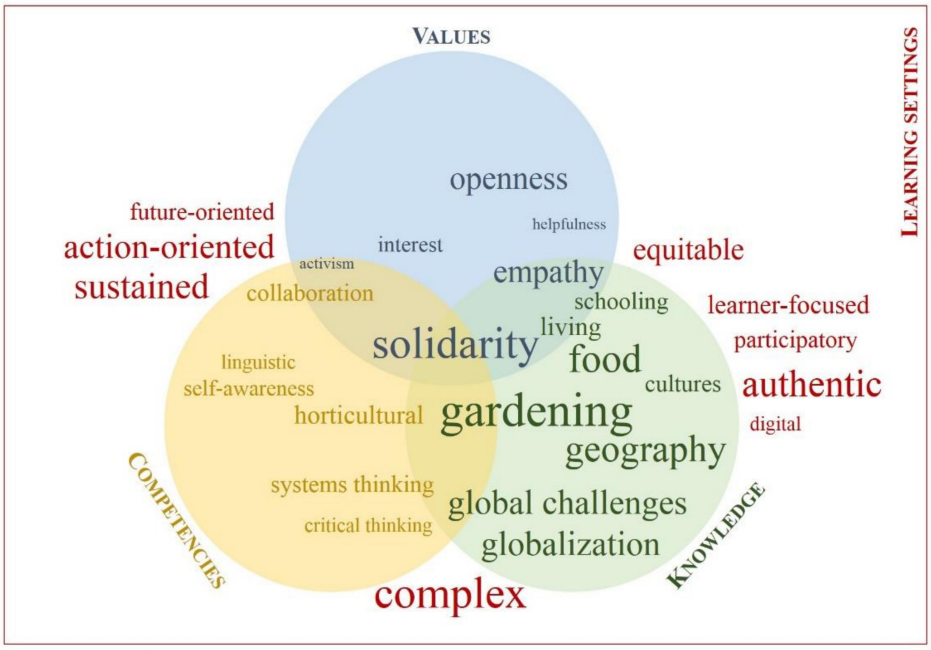

Figure 2. Intended learning outcomes and learning settings. The font size reflects the number of interviews in which the interviewee referred to the codes (e.g., gardening in 19 of 23 interviews and helpfulness in 3 of 23 interviews) [13].

2.3. The Global Dimension of ESD: The Danger of Othering

ESD needs "experience in global and intercultural contexts" (p. 26, [19]). To orient themselves in today's complex realities, learners need "to know different perspectives and interpretations" (p. 27, [19]), a "global view" (p. 23, [26]), or a so-called "worldmindedness" (p. 3, [38]). Andreotti and de Souza [39] viewed this as a challenge and expressed their belief that encouraging educators to "bring the world into their classrooms" (p. 23, [39]) is an invitation to walk in minefields. They point out the danger of "uncritical reinforcement of notions of supremacy and universality of 'our' (Western) ways of seeing and knowing, which can undervalue other knowledge systems and reinforce unequal relations of dialog and power" (p. 23, [39]).

In VSGEs, learners with different backgrounds, stereotypes, and assumptions interact. They grew up on different continents, probably in different environments, were brought up in different manners, received different forms of education, etc. All these elements have a decisive influence on their identity, their norms, and their way of interacting with peers from abroad [40–42]. Even though learners from a single school have diverse backgrounds, in a VSGE, they tend to identify themselves as the in-group and their peers from abroad as the out-group [43]. Ethnocentrism consists of attitudes and behaviors by which ones sees one's own group as superior, one's own standards of values as universal, and the outgroups as contemptible and inferior [44]. It is an essential part of Othering. Othering leads one to differentiate between one's in-group and the out-group, creating the other, and separating oneself from others in such a way as to reinforce and protect oneself [45]. It is based on stereotypes, which are defined as a set of beliefs about the characteristics of a social category of people (cf. [46]). Whereas these points are primarily made from the perspective of those who see themselves as superior, Derman-Sparks [41] brings in the perspective of those who live with "internalized racial oppression" (p. 103, [41]). "This is a complex socialization process that teaches People of Color from early childhood to believe, accept, and live out negative, societal definitions of self and to carry out the inequitable relationships and roles designated by racism" (p. 103, [41]). This is a part and a result of

Othering. To prevent such processes of Othering, there is a need for Anti-Bias approaches, which are about challenging prejudices, stereotypes, biases, and the "isms" [40]. A project with similar objectives is "Through Other Eyes", which offers a conceptual framework that is based on Spivak [47] and is about "learning to unlearn, learning to listen, learning to learn and learning to reach out" (p. 29, [39]) (see Section 2.4).

2.4. Transformative Learning

Kay [48] supported Andreotti and de Souza [39] and discussed the need to unlearn: "in some sense, our ability to open the future will depend not on how well we learn anymore but how well we are able to unlearn" (p. 21, [48]). Transformative Learning is closely linked with unlearning, as it is about transforming frames of reference [49,50]. Frames of reference help people understand the world, are developed through experiences, and are usually uncritically assimilated [51]. The Transformative Learning Theory arose from adult education, as adults tend to have developed more or less well-established frames of reference [49]. However, learners from primary and secondary schools also already have their frames of reference, as these "are deeply embedded in our childhood, community, and culture" (p. 67, [50]). Othering, ethnocentrism, as well as internalized racial oppression (see Section 2.3) create and establish individual frames of reference.

To transform these, there needs to be some sort of disorienting event so that individuals become aware that they hold a limited or disoriented view. As a consequence, they may examine it, open themselves to alternatives, become engaged in discourses with others, revise their assumptions, and ideally act accordingly [50].

Transformative Learning is a key pedagogical approach in ESD [2]. Thinking about and acting to promote sustainability are strongly anchored in the identities of learners and their frames of reference [52]. This deep structural change in the basic assumptions of thinking, feeling, and acting can lead to sustainable development [53]. Educators can facilitate this process by which learners become "aware and critical of their own and others' assumptions" (p. 10, [49]).

It remains unknown whether VSGEs foster the knowledge, competencies, and values that are relevant for ESD and provide chances to unlearn and transform frames of reference or whether they cause Othering and thereby act as reinforcements of power structures, stereotypes, and assumptions.

3. Research Design

3.1. The Sample

The data were collected in 20 semi-structured interviews with 24 educators who were currently or previously engaged in a total of 16 VSGEs (see Figure 3). These projects were part of a larger sample of 18 VSGE projects that had been identified by applying a snowball sampling system following Schnell, Hill, and Esser [54] in the context of Lochner's study [13] on intended learning outcomes and settings of VSGEs. The sampling ended in early 2019 when no additional VSGEs or new educators could be found. Two of these projects had not yet been implemented at the time of the interview, and therefore, three interviews were not included in this study.

The earliest VSGE in the sample began in 2001. Most exchanges had already been completed by the time of this study. Alongside many commonalities, they differed with respect to various aspects such as the age of the target group, the medium of the exchange, the duration of the exchange, or language (see Table 1). All the schools that were involved were primary or secondary schools. Most of the VSGEs were bilateral exchanges that always included one school from the Global North and one from the Global South. Only a few multilateral exchanges included additional North–North or South–South exchanges (see Figure 3). Among the 16 VSGEs, three different forms of organizations could be distinguished: programs to which schools from different countries could apply (4 of 16), projects with a fixed number of schools from particular countries (5 of 16), or individual bilateral school exchanges (7 of 16).

Table 1. Overview of VSGEs and interviewees.

	Virtual School Garden Exchanges (VSGEs)						Interviewee
	Years of Implementation	**Participating Countries**	**Type of VSGE**	**Language**	**Medium of Exchange**	**School Level**	**Pseudonym—Country of Origin**
1	Since 2001	Uganda, United Kingdom	Project: Bilateral Exchange	English	Drawings, Emails, Letters, Photos	Primary and Secondary	Nellie (f)—England
2	2001–2003	Ecuador, Germany	Project: Bilateral Exchange	German/Spanish	Drawings, Letters, Photos	Secondary	Nora (f)—Germany
3	2004–2005	Brazil, Czech Republic, Germany, Russia, South Africa, Taiwan	Program: Bilateral Exchange	English/German	Emails, Photos	Primary and Secondary	Norbert (m)—Germany
5	2013–2017	Bolivia, Costa Rica, Czech Republic, Germany, Kenya, Lesotho, Madagascar, Philippines, Poland, South Africa, Tajikistan	Project: Bilateral Exchange	English/German	Emails, Photos	Primary and Secondary	
4	2004–2008	India, Kenya, United Kingdom	Project: Multilateral Exchange	English	Emails, Photos, Poems, Recipes	Primary and Secondary	Supriya (f)—India Nick (m)—England
6	2015	Germany, South Africa	Individual: Bilateral Exchange	English/German	Drawings, Letters, Photos	Primary	Natascha (f)—Germany
7	2015	Italy, Uganda	Individual: Bilateral Exchange	English/Italian/ Luganda	Drawings, Letters, Photos, Social Media, Video conferences	Primary	Samweli (m)—Uganda
8	2015	Germany, Tanzania	Individual: Bilateral Exchange	English	Letters, Photos	Primary	Nadine (f)—Germany
9	2015–2016	Germany, India, Mexico, South Africa	Program: Multilateral Exchange	English/Marahti /Spanish	Photos, Videos, Vidoe conferences	Primary and Secondary	Saransh and Shivam (m/m)—India Saray (f)—Mexico
10	Since 2016	Germany, Kenya	Individual: Bilateral Exchange	English/German	Drawings, Letters, Packages with Seeds, Photos	Primary	Sabina (f)—Kenya Natalie and Nana (f/f)—Germany
11	2016–2017	Uganda, USA	Program: Bilateral Exchange	English	Emails, Photos, Videos	Primary	Samson (m)—Uganda
		Burkina Faso, Democratic Republic of Kongo, Italy, Tanzania, Uganda, USA				Primary and Secondary	Nancy and Naomie (f/f)—USA

Table 1. *Cont.*

	Virtual School Garden Exchanges (VSGEs)						Interviewee
	Years of Implementation	**Participating Countries**	**Type of VSGE**	**Language**	**Medium of Exchange**	**School Level**	**Pseudonym—Country of Origin**
12	2016–2017	Argentina, Armenia, Azerbaijan, Brazil, Bulgaria, China, Croatia, Cyprus, France, Georgia, Greece, India, Ireland, Italy, Latvia, North Macedonia, Norway, Pakistan, Poland, Romania, Serbia, Slovenia, Tunisia, United Kingdom, Ukraine, Vietnam	Project: Multilateral Exchange	English	List of Vocabulary, Packages with Seeds, Photos, Recipes	Primary	Naira (f)—Greece
13	2017	Germany, Kenya	Project: Bilateral Exchange	English	Blog, Photos, Videos, Video conferences	Primary	Simon (m)—Kenya Noreen (f)—Germany
14	2017	Germany, Mexico	Individual: Bilateral Exchange	International Sign Language	Videos, Video-story	Primary	Nanett (f)—Germany
15	2018	Argentina, Mexico, Puerto Rico, Ukraine, Uruguay	Individual: Bilateral Exchange	English/Spanish	List of Vocabulary, Photos, Video conferences	Primary	Sofía (f)—Argentina
16	2018	Germany, Peru	Individual: Bilateral Exchange	Spanish	Blog, Drawings, Letters, Photos, Videos	Primary	Nils and Nele (m/f)—Germany

To study the learning outcomes in the VSGEs, we tested several approaches: We interviewed a group of learners via videoconferencing but found that the learners lacked confidence in this interview setting. Furthermore, the idea of implementing on-site interviews with learners was foiled by insurmountable research regulations. Therefore, we decided to address the research question by interviewing only the educators by focusing on the participants' learning outcomes as perceived by the educators.

Educators possess specific professional knowledge, also called teachers' knowledge. They have particular knowledge about their learners and learning processes [55,56]. Teaching and observing learners in everyday school life are part of pedagogical work and part of educators' expertise [57]. This knowledge and the observations the educators made during the VSGEs formed the basis of this study.

The majority of interviewed educators were based (13 of 24) in Europe (England, Germany, and Greece), whereas another four were in Africa (Kenya and Uganda), four were in the Americas (Argentina, Mexico, and the US), and three were in Asia (India) (see Figure 3). Most of them worked with a particular group of learners to implement VSGEs as teachers or external educators in one school. Other interviewees worked as national or international coordinators of VSGEs, so they were responsible for promoting and sustaining VSGEs nationally or internationally, thus visiting and working with several schools, sometimes even in different countries. On the basis of the observations of educators who

have worked with various schools with different conditions in one country or in different countries, different aspects of VSGEs that only became apparent through comparisons could be integrated.

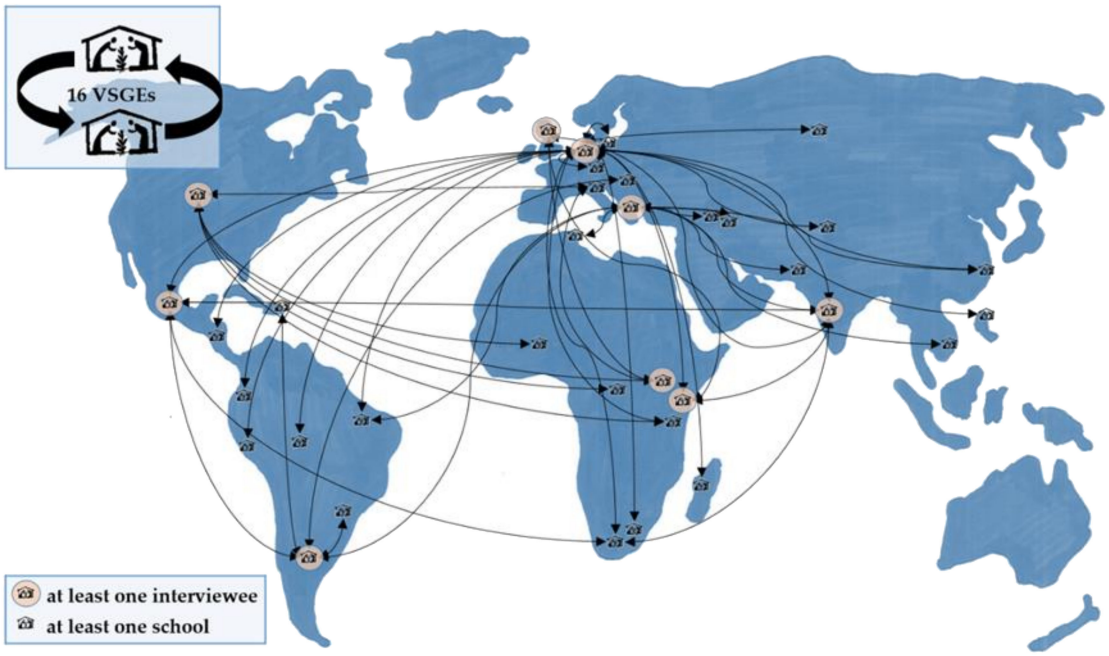

Figure 3. Participating countries and the origins of the interviewees; only the exchange with schools from 27 countries is not fully represented (just one of the 18 European countries is shown) (adapted [13]).

3.2. Study Procedure

We used semi-structured interviews, which allowed us to explore personal perspectives, backgrounds, and structures relevant to the interviewees [54,58]. In four cases, two educators were interviewed together because they had cooperated closely in the same VSGE. In five VSGEs, educators from two different countries were interviewed (separately). All interviewees were anonymized, and pseudonyms were used. The pseudonyms reflected the interviewees' gender and origin. The pseudonyms of interviewees from the Global North begin with N and those from the Global South with S.

The interviews averaged 60 min in length and were audiotaped with the respondents' permission. Interviews were conducted via Skype in English, German, or Spanish. The interview guidelines consisted of pre-formulated open questions [54] and were revised, proofread, and tested in all three languages.

The interviews were divided into several parts, of which one addressed the educators' intentions, which had been analyzed in the prior study [13]. In the study at hand, we analyzed educators' comments about learning outcomes and the factors they believed influenced the learning and the emotional reactions they perceived in their learners during and through the VSGE. To introduce the narrative process with respect to their observations of the learning outcomes, the educators were asked the following questions "What kind of feedback did the learner give about the VSGE?" and "How did participating in the VSGE affect the learner? Please give me some examples." When the participants' answers did not directly address the questions or digressed, supporting questions were asked to guide the interviewees, such as "Were there any effects that you were able to observe?" or "Do you remember a situation in which one of your learners had a change of perspective? Can you please describe it to me?"

3.3. Data Analysis

The raw data consisted of anonymized interview transcripts. Pauses, tone of voice, and other non-verbal elements were omitted from the transcriptions [58]. The transcriptions and analyses were conducted with the MAXQDA software. The analyses followed Mayring's [14] qualitative content analysis model.

The coding system (see Table 2) was based on Lochner [13] (see Figure 2). It was revised, expanded, and modified iteratively in an abductive manner, establishing a continuous dialogue between the data and literature [14]. The learning outcomes code was divided into knowledge, competencies, and values, each with five to seven subcodes. Additionally, three cross-sectional codes—differences and similarities, factors influencing learning outcomes, as well as the emotional reactions of learners—were analyzed.

Table 2. Coding system.

Code	Subcodes
Learning Outcomes	
Knowledge	globalization geography living schooling food gardening outer appearance *
Competencies	horticultural self-awareness collaboration linguistic systems thinking critical thinking digital *
Values	solidarity interest openness empathy helpfulness
Cross-Sectional	
	factors of influence * emotional reactions * differences and similarities

* New codes compared with the coding system used by Lochner [13].

To ensure the reliability and validity of the coding system, the codes and codings were regularly discussed and validated by other researchers. Subsequently, the coded segments were paraphrased to facilitate the detection of similarities and contradictions before they were analyzed and interpreted [14].

4. Results

First, we introduced the factors that influenced learning in VSGEs (Section 4.1). These were followed by the emotional reactions observed in the learners (Section 4.2) and the observed learning outcomes (knowledge, competencies, and values) (Section 4.3). Building on these, three forms of dealing with differences and similarities between groups of learners were analyzed (Section 4.4). In the last step, we analyzed the relations between the learning outcomes and the differences and similarities (Section 4.5).

4.1. Factors Influencing the Learning Outcomes

Educators often named factors that influenced or limited learning. The factors of influence can be grouped into different levels: the learner level, the school level, the implementation and organization level, and the general context (see Figure 4).

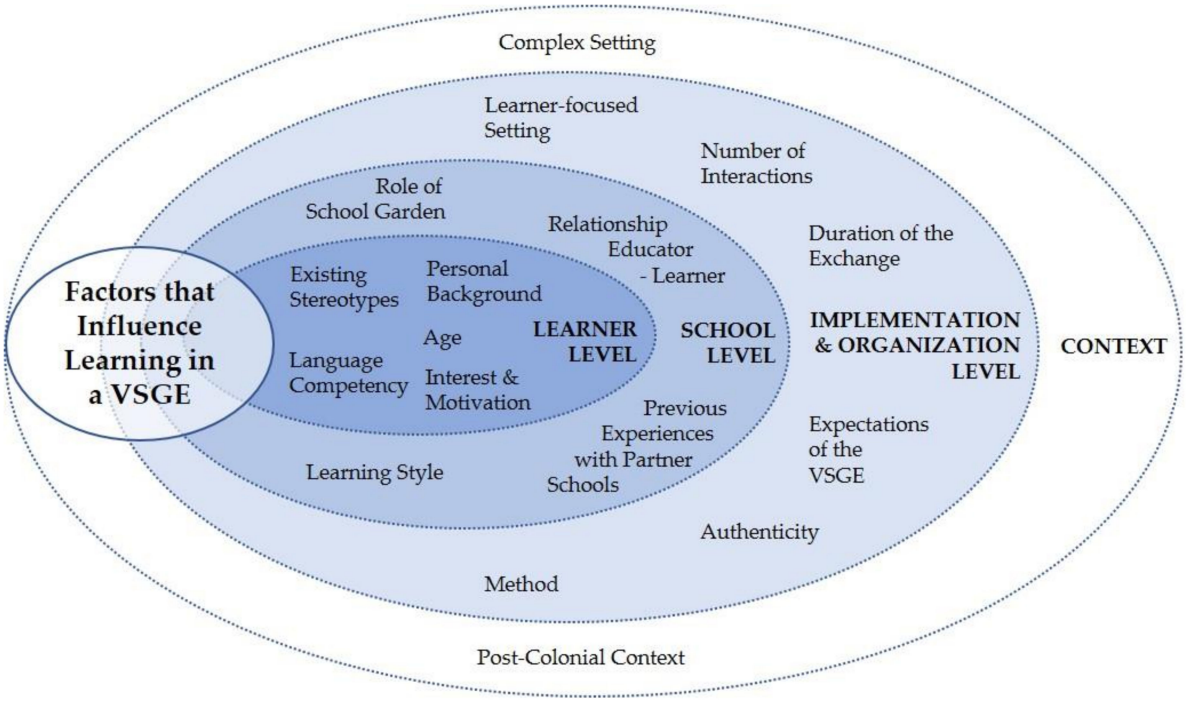

Figure 4. Factors influencing learning in VSGEs (adaptation of Figure [11]).

Some educators mentioned that due to their learners' young age or because of time constraints, they had to break down the complexity and simplify. In some situations, it seemed that learners made quick judgments about what they saw or heard, and it seemed that stereotypes were reinforced or established: "when we looked at the setup of the class rooms (i.e., of the international peers), (. . .) they (i.e., learners in the Global South) realized that, in their saying (. . .): Those people are rich" (Samweli). Furthermore, educators observed that learners' motivation and interest had a strong influence on the learning of their in-group but also on the learning of the out-group. For example, one educator from Germany shared his VSGE experiences in which learners reacted with apathy and intentionally shared misinformation in their blog posts.

On the school level, the influence of different school contexts became obvious. On the one hand, learning in VSGEs is influenced by the purpose of the school garden, but on the other hand, it is influenced by teaching and learning styles. One educator working as an international coordinator observed, "there are cultural dimensions to how learning is understood" (Nick), such that some schools practice open learning settings, whereas others primarily use lecture formats, which influence the implementation of and learning in VSGEs.

Regarding the implementation and organization of VSGEs, educators frequently mentioned that the interactions were too short and too few. Educators also highlighted the importance of authenticity. Authentic, direct, and first-hand contact and explanations aroused learners' interest. Furthermore, according to the interviewees, a learner-focused setting influenced the learning processes during VSGEs. Educators gave examples of learner-focused settings that were adapted to learners' abilities, such as by using visualization, providing space for participation, and providing opportunities to use their own "cultural capital" (Saransh/Shivam), including their local languages, knowledge, and competencies.

Furthermore, educators mentioned the influence of the historical context: "we (are) trapped in a post-colonial situation" (Nick). In some VSGEs, partner countries had previously been the colonized and the colonizer. This was described as, "out of the historical context (. . .) various expectations (arose)" (Nick).

Particularly for learners from the Global South, the global setting was special, interesting, and motivating. "The connection with the outside world (was, what) they (i.e., learners from the Global South) were interested in" (Nellie), as well as the opportunity "to expose themselves to the larger world and (. . .) to tell the larger world what they are" (Saransh/Shivam). Educators reported that it led to feelings of happiness, excitement, and pride in their learners, and it was seen as a "privilege to interact with the schools from other countries" (Saransh/Shivam).

4.2. Learners' Emotional Reactions

Happiness, excitement, and pride were mentioned as learners' emotional reactions. During the interviews, a range of different emotional expressions were used to describe learners' reactions to VSGEs. Often educators repetitively used the same adjectives. In the word cloud (Figure 5), each adjective was counted once per interview.

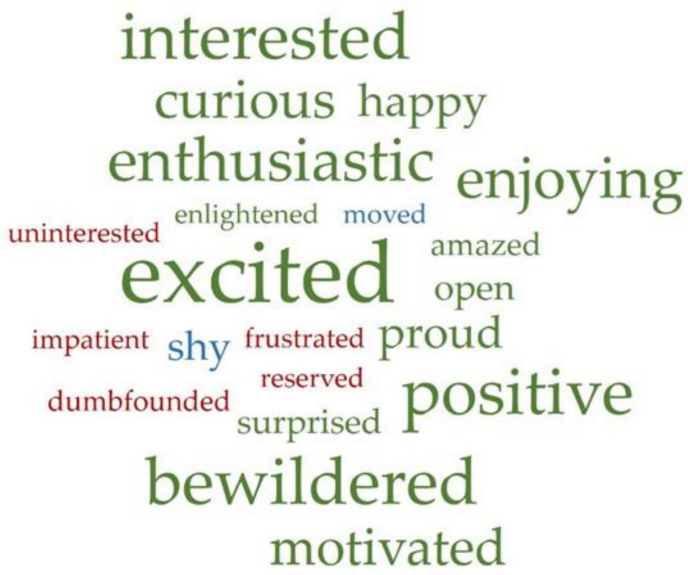

Figure 5. The educators used these adjectives to describe the emotional reactions of their learners during the VSGE. The font size reflects the number of interviews using the adjective, and the font color symbolizes reactions such that red indicates negative, blue means neutral, and green means positive.

In half of the interviews, educators emphasized their learners' excitement. Educators remembered their learners' positive, bewildered reactions along with joy and happiness, enthusiasm, motivation, interest, and curiosity, plus feelings of pride that the learners experienced during the VSGEs. Less dominant were their descriptions of their learners as shy, surprised, moved, open, or enlightened or descriptions of learners' negative reactions such as uninterested, impatient, or reserved.

4.3. Learning Outcomes

The emotional reactions indicated that most educators remembered their learners' positive experiences. Educators evaluated most of the learning outcomes as positive. Nevertheless, there were also some doubts about the positive impacts of VSGEs and some fear that VSGEs can cause damage.

The learning outcomes were structured into knowledge, competencies, and values with a total of 19 subcodes. Figure 6 shows that the interviewees primarily focused on knowledge and competencies and less on values.

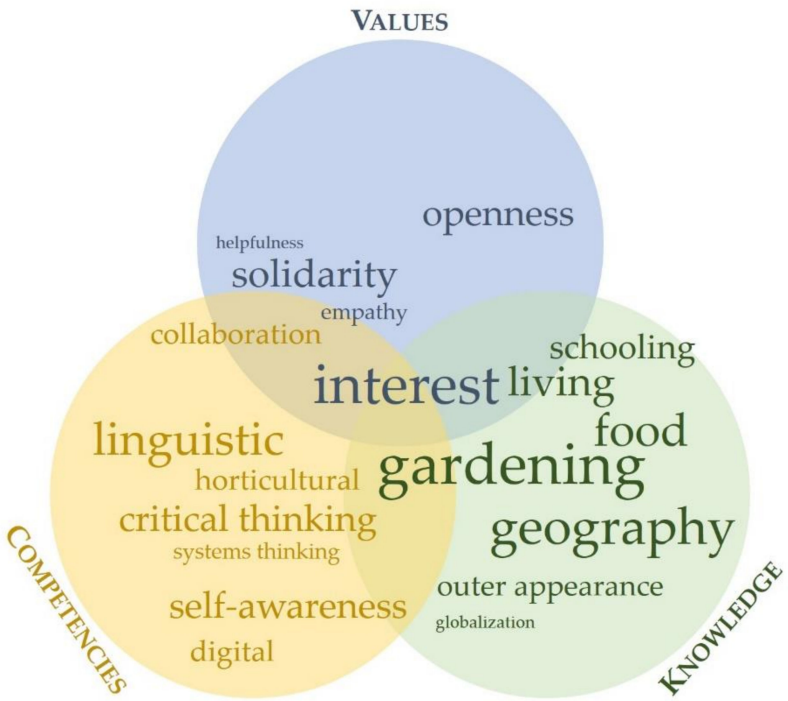

Figure 6. Observed learning outcomes. The font size reflects the number of interviews that referred to the codes (e.g., gardening in 19 of 20 interviews and helpfulness in 2 of 20 interviews) (adaptation of [13]).

4.3.1. Knowledge

The fact that school gardens also exist in distant countries surprised and motivated the learners. Some educators observed that a process of deeper identification with and increased knowledge about their gardens was induced by the task of presenting it to their peers overseas in the form of videos or photos.

The perceptions and norms of agriculture and gardening differed between groups of learners and changed through the VSGEs. In two interviews, educators explained that most of their learners from rural areas in the Global South see gardening as "a common place activity" (Saransh/Shivam) and realized during the exchange that they had "special" (Saransh/Shivam) knowledge that they were unaware of so far. Furthermore, they had expected that their peers in the Global North—whom they assumed were wealthy—would not engage in gardening because it was perceived as a poor person's activity (Simon). Conversely, learners from the Global North, who had not had much contact with gardening, were amazed to hear that gardening is a normal part of other pupils' lives.

The purposes and uses of school gardens differed from school to school and country to country, which led learners to reflect on their own concept of a garden (see Section 4.3.2—critical-thinking competency). While in some schools in the Global South, the harvest contributed to school meals, in other schools in the Global North and South, the gardens instead served the purposes of demonstrating food production, providing material for biology and botany lessons, or they were ornamental. These different garden concepts led learners to reflect on and question their own norms. For example, learners who related gardening to food production and earning money believed that gardens that contained mostly flowers and primarily served the purpose of beautification were therefore a "wast(e) (of) time" (Samson). Through the VSGE, Samson's students learned that flowers can serve a purpose, e.g., natural plant protection. Along the way, learners realized that school

gardening can be seen as fun, and the comment was made that "we don't have to convert it (the harvest) to money; we can also eat it" (Simon). Gardens look different, and learners noticed that due to their different uses, some gardens are more like fields, whereas others resemble parks.

Furthermore, learners had strong interest in asking each other "Which crops do you grow?" (Samson, Samweli, Natascha (translated from German)). Learners became aware of new crops and learned which crops they have and do not have in common with their international peers. In this regard, certain norms were disrupted, e.g., learners in rural Kenya learned that bananas and peanuts, the most normal thing in front of their homes, do not grow all around the world, which they had previously never questioned. Furthermore, educators observed learning about genetic diversity of useful plants such as "potatoes" (Nora (translated from German)) or "bean varieties" (Natalie/Nana (translated from German), Naira): "the colors, the sizes were different (which) (. . .) was surprising" (Naira). Additionally, the needs for genetic and species' diversity and the origin and history of crops were discussed in the exchanges.

During the VSGEs, learners exchanged and learned about specific garden activities (see Section 4.3.2—horticultural competency). In several exchanges, learners shared information about traditional garden festivals, e.g., the Indian harvest festival "Pongal" (Supriya) or the "Pachamama celebration, in which one pays tribute to mother earth" (Sofía (translated from Spanish)). Sometimes these were copied by the partner school. Furthermore, learners exchanged and learned about factors that influence garden activities, such as seasons or pests and diseases. Additionally, the size of their gardens, the type of soil, as well as the garden equipment were subjects that were discussed in some VSGEs.

Learners also developed their geographical knowledge, e.g., distances between countries in terms of flight length or time differences. Many educators used maps to locate themselves and their partner schools, and some explained that their learners' ability to orient themselves on the globe improved during the exchange. Additionally, learners got an impression of what the other country was like.

Furthermore, many educators reported that learners' awareness of different climates increased, particularly differences in seasons, but also the weather. Learners from India realized that their peers in the UK lack sunshine, and they realized "we are lucky to have the sunshine all year round" (Supriya). In another VSGE, learners from Argentina, coming from a water-rich region, "could not believe that their peers had problems with drought" (Sofía (translated from Spanish)). It might have challenged their belief that water is an endless resource and raised awareness of this global issue.

In VSGEs, the often strikingly different outer appearances of the peers attracted attention. For example, learners from Germany realized differences between themselves and their peers from Kenya "most of whom are all shaved bald or have braided hair" (Natalie/Nana (translated from German)). Learners from Argentina were surprised that their peers from the Ukraine "were so white, so blond, and had clear eyes" (Sofía (translated from Spanish)). Very often, learning takes place when something new is encountered, and learners recognize that something is different from what they know. For example, by comparing their school with the partner school, they realized that school equipment, teaching, school dresses, classrooms, group sizes, and age difference in classes varied. Sometimes this information led to assumptions and judgments about the financial situations of the peer group: e.g., "those people are rich" (Samweli) (see Section 4.4.1).

Learners showed considerable interest in their peers' living situations and expanded their knowledge about living abroad. They compared their own way of living with their international peers' way of living: in rural or urban settings, in houses or flats, with animals (e.g., pets or livestock), and with a garden at home or not. They also learned about their peers' possessions, such as clothes, shoes, and mobile phones. They exchanged information about their favorite sports and the forms of mobility used by their international peers. Furthermore, they learned that the value of money differed between countries. Again,

comparing different living conditions led to different reactions: Learners identified either differences or similarities (see Section 4.4).

Furthermore, learners got to know the eating habits of their peers in other countries by exchanging recipes and talking about favorite dishes. They compared their own food traditions with those of their peers or the price of food. In three interviews from the Global North and South, this comparison led learners to realize that the others were disadvantaged compared with themselves because the others did not have enough food. Furthermore, educators reported that norms related to food were challenged through the exchange. Learners asked their peers questions about common dishes or what, for instance, "coriander"—a common ingredient in Mexico—was used for (Saray). These questions were confusing to the children, as these things were so normal to them, and they had never had to explain such things before.

4.3.2. Competencies

Closely linked to the acquisition of knowledge is the development of competencies. Besides learning new information about gardening, learners' horticultural competency increased as they developed new practices in their school gardens. It is important to mention that basic horticultural competencies had already been developed beforehand and were therefore not the focus of the interviews. Through interacting with their international peers, students learned and tested new ways of "constructing fences" (Sofía (translated from Spanish)), "planting" (Naira), gardening in greenhouses, keeping chickens, diversification and intercropping, dealing with pests, irrigation, gardening in pots vs. beds, decorating their gardens, and "composting" (Sabina). These are examples of how students learned from each other, which is an essential part of the collaboration competency. Apart from learning from each other, educators remembered situations in which the learners understood and respected their international peers' needs and perspectives and were able to relate and be sensitive to these peers, all of which are important elements of the collaboration competency [2].

Some educators observed that in their VSGEs, learners' self-awareness competency was fostered. By making comparisons and engaging in a process of "self-reflection and self-assessment" (Nils/Nele (translated from German)), "students became aware of the good circumstances under which they live" (Nadine (translated from German)). Furthermore, educators recalled that their students' self-confidence was strengthened. The VSGE was experienced as an international stage on which to present themselves and their "cultural capital" (Saransh/Shivam) (see Section 4.3.1—gardening), which is normally not appreciated in school. In and through the VSGE, learners "felt important" (Sofía (translated from Spanish)) and empowered. Some educators from the Global North and South emphasized that the learners expressed surprise such as "oh we have others who are caring about us" (Sabina). Two educators from African countries explained that their learners had grown up with the feeling that they were not worth any attention and had the idea that people from the Global North do "not even really want to hear anything from Africans" (Samson).

The VSGEs were spaces for practicing second languages, as the communication took place in English, Spanish, and international sign language, among others (see Table 1). In some exchanges, words related to gardening in participants' mother tongues were listed, and learners identified differences and similarities between the languages. Additionally, educators reported that learners practiced their writing and communication skills by writing letters or recipes and created little videos. One educator reported that her learners said: "I didn't know that English (for these learners, English was their second language) could be so much fun" (Natascha (translated from German)). Furthermore, learners were able to train their digital competencies, such as learning "to use cell phones and to make videos" (Nanett (translated from German)). Some learners had their first contact with laptops or tablets, which also led to new experiences and competencies.

In VSGEs, learners were confronted with many different issues that are often linked and depend on each other. Still, only a few interviewees described situations in which

the systems-thinking competency was fostered. The ability to recognize and understand relationships and to analyze complex systems, for example, was exercised by one VSGE that implemented a creative method by which the children from the four participating countries introduced themselves. Learners presented their countries in films without revealing where they were from. Then all participants had to find out where the films were from by making "guesses based upon the climate, soil, and different agricultural products" (Saransh/Shivam).

Interviewees described nearly thirty different situations of learners questioning and reflecting on their norms, practices, and opinions. Through the close contact with their peers and the opportunity to see videos of real-life situations and to ask their peers questions, their critical-thinking competency was fostered.

4.3.3. Values

Educators were also able to observe the fostering of values, even though it was less dominant than the acquisition of knowledge or the development of competencies. A strengthening of solidarity was observed. As the VSGEs connected their learners with peers from abroad, it led to a feeling of connectedness, which some described as an awareness of global citizenship. This is closely linked with the fostering of empathy, which the educators also mentioned.

Furthermore, increased interest and curiosity were frequently observed, and this could be seen in the large number of questions that arose. Nevertheless, in one interview, the educator remembered learners clearly expressing that they had no interest whatsoever and even distanced themselves from "his (the educators') global learning" (Norbert (translated from German)).

Other educators described their learners as very open to interacting with their international peers. They reported situations in which their learners underwent a change of perspective or moved away from their fixed ideas.

Two educators from the Global North whose schools partnered with schools with very limited resources observed the fostering of helpfulness among their learners. The VSGE began as a charity project with donations being sent to the partners in the Global South, and the learners in the Global North experienced themselves as donors. Two educators described that they had to explain to their learners that "money cannot solve all types of problems" (Natalie/Nana (translated from German)).

4.4. Differences and Similarities

In VSGEs, learning is often inspired by differences and similarities between groups of learners, as already addressed in the findings presented so far. Three forms of learning could be distinguished and are presented in the following.

4.4.1. Othering and Hierarchical Comparing

The learners participated in the VSGEs with a set of assumptions and stereotypes. Therefore, it was easy for them to react to international and therefore often different peers with Othering (cf. Section 2.3). Educators remembered situations in which learners compared their possessions with those of the others such as school or garden equipment, access to water, clothes and shoes, food, or money. On the basis of these, they concluded that the others were rich or poor, and they perceived themselves as superior or subaltern. Almost exclusively, educators from the Global North concluded that their learners saw the others as poor, for example, learners "noticed that they (their peers) don't have as much as they do" (Natalie/Nana (translated from German)). By contrast, only educators from the Global South expressed that their learners experienced their peers as e.g., "rich and really well off" (Samweli). One exception was an educator from Argentina, who, sharing the experience of exchanging with schools from five countries, particularly in the exchange with a school from the north of Argentina, used the expression "poor ones" (Sofía (translated from Spanish)), because there they had to carry their water in buckets.

In another VSGE, learners from India compared themselves with two groups of international peers, one from the UK and one from Kenya. Prior to the exchange, they perceived themselves as being economically in the middle of the two partner countries. However, their experience in the VSGE did not match their expectations or stereotypes: They realized that their Kenyan peers had a much larger school garden than they had themselves, while the British kids lacked sunshine and, due to the cold weather, much of their food had to be imported. The educator involved in this exchange shared a situation that showed the immense complexity of the power of stereotypes embedded in a historical colonial context, as the UK was their colonizer, and how learners struggled to orient themselves. While the Indian learners were studying on benches and desks, their peers in the UK were sitting on the floor, which is normal in India in "poor" government schools. The Indian educator recalled that her learners "were saying: they are sitting on the floor, why don't we sit on the floor. Why (. . .) we are sitting on the benches?" (Supriya). This example is a clash of narratives or stereotypes.

Probably out of a similar context arose the surprise of two groups of learners from the Global South about their advantage of gardening knowledge compared with their international peers. One group of learners saw in videos from their peers "very basic kinds of horticultural activities", which made them "feel, that yes, (. . .) (we) are doing something quite interesting and special, which they didn't realize before they saw the videos from those schools" (Saransh/Shivam).

4.4.2. Expecting Differences but Identifying Similarities

Educators reported that their learners were sometimes surprised by similarities with their peers abroad, because they expected them to be different: "It is certainly different from here, they (the learners) said" (Natalie/Nana (translated from German)). Examples of surprising similarities were the crops the others were growing, the fruit they were eating, or the fact that they also have "indigenous chickens in the US" (Samson). The term "indigenous" was something that they previously associated with the Global South. Similar to this point was the expectation of learners from Kenya that in Germany, farming and gardening were something unusual. "They had this perception that they (i.e., in Germany) are not supposed to be dirty (i.e., from working with soil) and that is why they (i.e., themselves) are trying very hard to go to school and get that white-collar job in the future. So they had a perception that in a place like Germany people are already in that kind of a life" (Simon).

Very often, the expected differences were closely linked to learners' stereotypes, and the VSGEs confronted them with new information about the others. Instead of confirming the expected differences, they identified similarities. Learners realized that the garden activities, the animals they kept in the garden, the soil, or the climatic conditions were the same. However, similarities that were related to their way of life, food, or schooling were also found. It was remarkable that only the interviewees from the Global South mentioned that their learners were astonished that their peers in the other countries were "kids like them" (Sabina, Sofía (translated from Spanish)), that "foreign students, (. . .) are also students" (Samson), and that "we are all human beings" (Samson). In different interviews, the potential of similarities were mentioned, such as: "similarities were very good" (Supriya).

4.4.3. Expecting Similarities but Identifying Differences

Prior to participating in a VSGE, learners saw many things as a norm that they had never questioned. There were different examples with respect to food, gardening, living, or schooling (see Section 4.3.1), such as that certain ingredients are used in the cuisine they grew up with, the commonness of typical dishes, the ordinariness of certain crops growing in front of their houses, knowledge about the cultivation and manufacturing of their favorite food, etc. Through the contact with their peers from overseas, they realized that some things normal to them might be unknown to the others. After realizing this, they

identified many more differences, which led to new learning. Learners noticed differences due to their gardens, e.g., different irrigation, crops, climates, uses of school gardens, and processing of the harvest (see Section 4.3.1—gardening). Furthermore, learners identified differences in living conditions, food, schooling, language, and outer appearances (see Section 4.3.1).

4.5. Relations between Learning Outcomes and Learning about Differences and Similarities

These three forms of learning about differences and similarities can be seen as three different but related ways of dealing with otherness. Othering or hierarchical comparing is based on stereotypes. Learners might question their stereotypes during the VSGEs but might also find examples that bolster their stereotypes. Expecting differences but identifying similarities is also based on stereotypes. Learners often expected their peers to be different and to fit their stereotypes, but during the VSGE, they identified similarities. This can foster values such as solidarity, interest, and openness. In some VSGEs, learners gained new knowledge, e.g., about globalization, as shown in the analysis of relations between subcodes (see Figure 7). The third form—expecting similarities but identifying differences—is based on norms. It is about challenging the belief "that is the way to do it" or about things that seem to be "self-evident" (e.g., coriander in Mexican food). In VSGEs, learners experience situations in which they get the chance to question their norms and can start identifying differences and diversity. On these occasions—compared with situations in which they expected differences—educators observed a fostering of empathy and helpfulness (see Figure 7). An example is a situation in which learners from Germany—for whom wearing shoes was the norm—realized that their Kenyan peers walked barefoot: "They don't know a world without shoes" (Natalie/Nana (translated from German)). In their eyes, it might be a symbol of poverty, and they reacted with empathy and the wish to help their peers, e.g., by collecting donations.

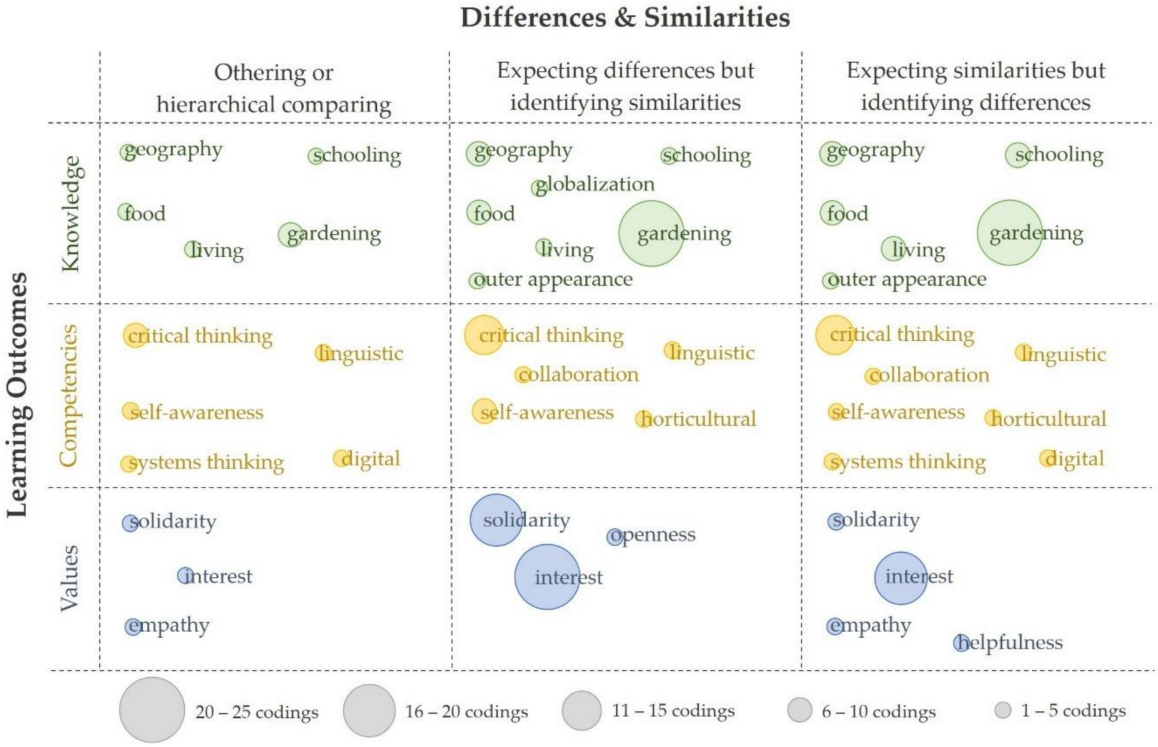

Figure 7. Coding relations between the subcodes differences and similarities and the subcodes from the code learning outcomes: knowledge, competencies, and values.

These three forms of learning and dealing with differences and similarities were not separated or mutually exclusive. Often they merged, and the learning situations of all

three types occurred in the same exchange. Taking the example of gardening, the number of codings increased from seven (Othering) to 25 (expecting similarities) and overlapped in some cases. This shows that the school gardens provided a common ground for the exchange, and learners could identify similarities as well as differences. For example, if they compared what they usually did in their gardens, such as planting, watering, weeding, and harvesting, they identified similarities, but if they looked closer, the others might water or plant differently.

5. Discussion and Conclusions

The data presented here indicate that the learning outcomes of the students participating in the VSGEs matched the educators' expectations only in parts. Obviously, the educators intended to produce positive learning outcomes, but they also expressed their fear that the VSGEs might "cause some damage" (Noreen (translated from German)) (cf. [13]). The literature on VEs, school linking, school partnerships, and sponsorships [31–37] is in accordance with the concerns stated by Andreotti and de Souza [39]: such encounters are minefields and exhibit a variety of possible negative outcomes, such as actually strengthening stereotypes instead of dispelling them. Positive as well as negative learning outcomes—which to some extent fit but also diverge from the aims of ESD—need to be discussed.

Learning experiences in VSGEs are influenced by various factors that are grouped into four levels (see Figure 3). These show parallels with Lochner's matrix [11] (Figure 1), which categorizes factors that influence the implementation of VSGEs. Nevertheless, certain factors have particularly strong influences on learning outcomes, such as the relationship between learners and educators or the learning styles used in participating schools. While Lochner [11] identified learners' handling with interculturality as a factor that influences the success of VSGEs, in this study, it was displaced by learners' existing stereotypes. These form the backbone of learners' participation and learning. Moreover, these stereotypes influenced how learners dealt with interculturality. Furthermore, the post-colonial context, which is often linked with learners' stereotypes, was added [42].

A first indicator regarding learning outcomes during VSGEs were learners' emotional reactions (see Figure 5). While most reactions were positive, neutral and negative reactions, such as frustration or impatience, were also observed. Nevertheless, positive reactions were predominant, and this can be interpreted as a good basis for learning [21,22].

Most subcodes regarding the fostering of knowledge, competencies, and values observed by educators matched their intended learning outcomes and the aims of ESD [13] (just three were not found, and two new ones were added—see Table 2). Nevertheless, the educators' emphasis on specific subcodes changed between talking about intentions and observations. Due to the gain of knowledge, the expectations and observations were quite congruent. Gardening was intended [13] and was the main area of learning. However, instead of the learning about global challenges and globalization that was expected [13], learners expanded their knowledge in areas that went beyond gardening with respect to geography, food, schooling, living, and their international peers' outer appearances. This might be linked to the shift from the systems-thinking competency to the critical-thinking competency (compare Figures 2 and 6): The fostering of the systems-thinking competency was expected by seven educators [13], but just four observed it, similar to learning about globalization and global challenges. The opposite happened with respect to the critical-thinking competency. Themes such as food, schooling, or living conditions are more closely connected to learners' own lives and norms than, e.g., global challenges and provide occasions to train the critical-thinking competency: for example, to "question norms, practices and opinions (and) to reflect on own one's values [sic], perceptions and actions" (p. 10, [2]). The systems-thinking and critical-thinking competencies belong to a list of eight key sustainability competencies [2] as well as the collaboration and self-awareness competencies. Educators observed the development of these four competencies in the VSGEs. Nevertheless, the other four competencies were neither intended nor observed. In

addition to the four sustainability competencies, an acquisition of basic competencies such as linguistic or digital competencies were observed by educators, but these were hardly intended [13].

Furthermore, a difference between intentions and observations with regard to the development of values appeared. While nearly all educators expected the VSGEs to foster solidarity [13], which is central to ESD [5,29,30], only just half observed growing solidarity in their learners. Instead, they mentioned a strong and unexpected (in its intensity) [13] increase in learners' interest in the others. It could be that in longer VSGEs, after an initial rousing of interest and becoming more familiar with each other, solidarity might be fostered.

Moreover, the data provided insights into learners' ways of dealing with differences and similarities. This led us to the research questions about Othering and Transformative Learning. While Lochner [13] found that educators generally saw differences and similarities as a field of learning, in this study, three different ways of dealing with differences and similarities were identified. In VSGEs, learners participate with a previously formed set of expectations in the forms of stereotypes and norms regarding the world and others [40,41,45]. Educators mentioned numerous learning situations in which expectations were not fulfilled, and instead of similarities, learners identified differences or vice versa. This led to the assumption that these situations are particularly rich for learning. Depending on how these stereotypes and norms were challenged, they ended up in Othering (1) or led to a Transformative Learning process (2) (see Figure 8).

1. **Othering:** Our findings supported previous work by Spivak [47], Dervin [45], Derman-Sparks [40,41], Allport [46], etc., describing the identification of learners as a group and the concept of Othering in which the out-group is described as inferior. Furthermore, learners from the Global South believed that they and their in-group were inferior to their peers from the Global North, which is an outcome of Internalized Racial Oppression (see Section 2.3) and a form of Othering. It might be interpreted as a product of colonialization because these images have been engrained in societies for centuries [42]. In both of these cases of Othering, learners are influenced by stereotypes, so they put aside and ignore the complexity and subjectivity of the others. Moreover, in most cases, learners interact with only one partner school. If learners absorb what they see as the only reality of the partner country, and in the worst case of the whole continent, instead of reflecting on the diversity of schools (urban vs. rural settings, governmental vs. private schools, etc.), it is another case of Othering. Several interviewees mentioned this danger and reported different ways to counteract it, such as giving learners a broader view of the partner country or working with "cluster partnerships" (Nick) of three schools per country so that they always get to know various realities.
2. **Transformative Learning:** Our findings also showed parallels with the Transformative Learning Theory [49–51]. A Transformative Learning process begins with "an activating event", followed by "critical reflection" and engagement in discourse with others and revisions and transformations of frames of reference (p. 66, [50]). In one example from the interviews, participants from India interacted with peers from the UK. Due to the frame of reference of the Indian students, they believed their UK peers were wealthier than themselves. During the exchange, they saw photos of the British school garden in the winter, where nothing was growing. This did not match the Indian students' frame of reference. In a process of reflection and discourse with their peers from the UK, the Indian students "really understood, oh my god, UK does not produce (. . .) their own food, (. . .) (much) less is grown there", and the UK has to "import food from other countries" (Supriya).

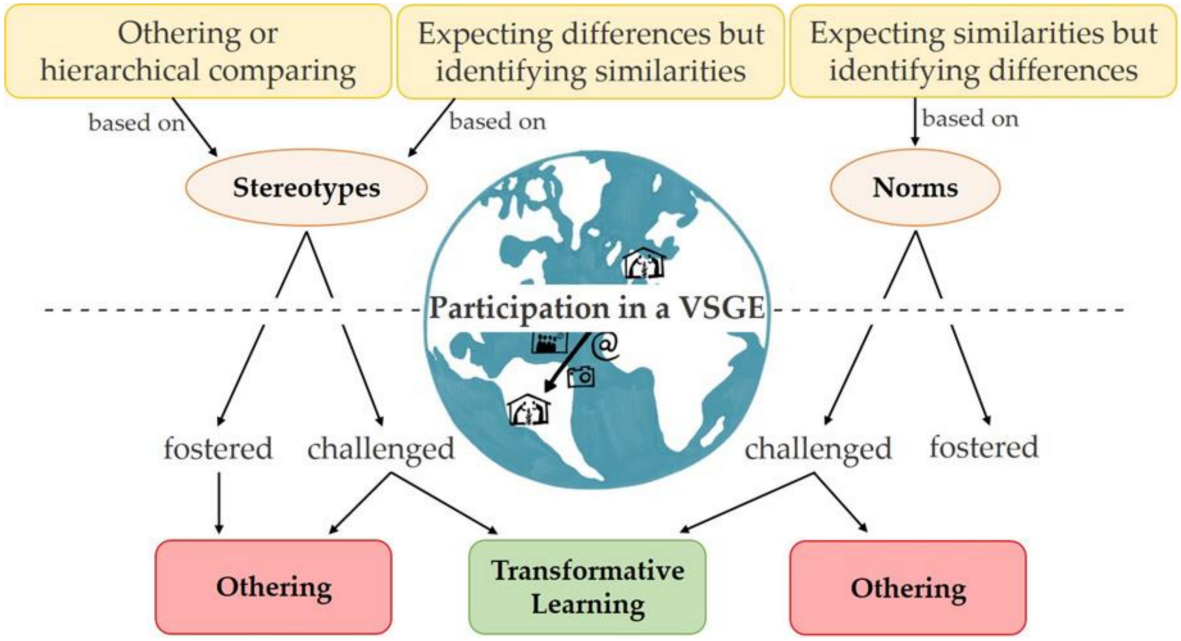

Figure 8. Three different ways of learning about differences and similarities. These are based on stereotypes or norms, which were fostered and/or challenged while learners participated in the VSGE and led to further Othering and the creation of new stereotypes and/or Transformative Learning.

While these challenges might appear similar in all kinds of VEs, we will now address the peculiarity of VSGEs through the focus on school gardens. Our findings pointed out many learning outcomes that were specifically induced by the fact that all learners engaged in gardening. As mentioned in the beginning of this paper, school gardens have different historical backgrounds and different objectives in the Global South and North [15]. Mostly, the interviewees' descriptions of the school gardens matched these objectives.

We can generally say that learning about gardening in other countries widened learners' horizons. They gained new knowledge and horticultural competencies. Nevertheless, their learning varied a lot. It was influenced by their school gardens' different purposes and the different realities of their lives as well as stereotypes and norms. For some learners, gardening was a new experience, whereas for others, gardening was a regular day-to-day activity. Before participating in the VSGEs, some learners from the Global South thought that gardening was practiced only by them in the Global South. Other learners from the Global South learned through the VSGE that their knowledge and competencies with respect to gardening—which, until then, they had viewed as normal—are something special compared with their peers from overseas. These are two examples of learning that arose from the focus on gardening. The thematical focus brought about opportunities but also challenges. Global food production—including gardening—is deeply anchored in power relations and historical context, as these examples demonstrate. Overall, this study demonstrates that VEs based on school gardens provide opportunities to connect and learn from and with each other and ideally initiate the transformation of frames of reference.

Nevertheless, this study has certain limitations. First, the sample included only 16 VSGEs implemented between 2001 and early 2019. These projects are very far apart in time, which might have had an effect on the results. It is likely that more projects exist, and new ones may have been implemented since then. The difficulty in finding these projects is due to the lack of a common terminology for VSGEs and language limitations [12]. A larger and updated sample might have brought in new perspectives on learning outcomes in VSGEs. Second, the data consisted of educators' observations that were collected in interviews. Interviewees were aware that these would be analyzed. Therefore, there was a risk of socially desirable answers. Furthermore, as situations in schools are highly complex, observations can never be complete [57]. Additionally, the roles of educators are special, as

they are the principal influencers in VSGEs and in a way part of the group. A triangulation of the perspectives of teachers, parents, and the learners themselves might have been more accurate. This led us to emerging and remaining questions.

Encouraging, supporting, and conducting more studies in this still underrepresented area of VSGE research will add to our understanding of the different contexts, general drivers, and barriers of learning in VSGEs. Research on assumptions and stereotypes as well as the pedagogical competencies [59] and learning outcomes of the educators themselves would be interesting, as they are the key drivers of the exchanges. As there have been differences between the VSGE educators' intentions and observations of learners' learning outcomes, further research might analyze if the recognition of differences lead to a change regarding their implementation of VSGEs. Additionally, a follow up study including a pre- and post-test particularly focusing on the norms and stereotypes of learners could provide further insights regarding Othering and Transformative Learning. Furthermore, a question that emerged was whether a different thematical focus would influence the learning outcomes, e.g., on climate change. Additionally, it would be interesting to draw a comparison between learners/educators from the Global South vs. North regarding their learning outcomes, emotional reactions, stereotypes, and norms. For such research questions, the research design and particularly the sample would need to be different. Furthermore, the sampling was closed before the coronavirus pandemic began. Due to the new situation the role of digitalization and digital learning in schools have changed substantially, and a follow up study with more recent data would most probably lead to new insights into this field.

To sum up, we aimed to answer the question of whether a VSGE is an example of good ESD practice. VSGEs offer a relatively new and, as yet, not well-defined practice for introducing the global perspective of ESD in school gardens and for connecting learners globally. The results indicate that VSGEs foster the knowledge, competencies, and values of learners related to ESD (cf. [1,2]). There is a strong connection between learning in school gardens and sustainability. Additionally, local and global perspectives on themes related to school gardens and the lives of others are addressed during VSGEs (cf. [3–6]). Even though the objectives of VSGEs and ESD are largely congruent—as seen in the example of the eight key sustainability competencies [2]—"only" half of them were intended to be fostered and were observed in VSGEs. VSGEs provide space for collaboration, self-reflection (critical thinking and self-awareness competencies), and the identification of interconnectedness (systems-thinking competency). The other four competencies—normative, anticipatory, integrated problem-solving, and strategic competency—go beyond VSGEs in their current form. Achieving these might require longer exchanges and perhaps a concrete project that goes beyond "simple" school gardening, for example, by providing a specific link to the climate crisis and the initially mentioned Fridays for Future movement. In this way, the future-orientation could become clearer, and learners might be able to train their anticipatory and/or their strategic competencies. Nevertheless, it is not the aim of good ESD practices to always address all key sustainability competencies. Fostering the four abovementioned competencies might be the strength of VSGEs. Apart from this, VSGEs are spaces in which students can learn about differences and similarities. While differences have been described as a source of learning, similarities seem to be the basis for connection. Nevertheless, the stereotypes and norms of VSGE participants were found to enormously influence their way of interacting and added to the minefields mentioned by Andreotti and da Souza [39]. They can lead to Othering as well as to Transformative Learning (see Figure 8). Othering goes against the ESD objectives, as it is, e.g., nearly the opposite of the collaboration competency, which is based on "the ability to learn from others; to understand and respect the needs, perspectives and actions of others (. . .); to understand, relate to and be sensitive to others" (p. 10, [2]). By contrast, Transformative Learning contributes to the objectives of ESD and is a key pedagogical approach in ESD [2]. We can therefore conclude that VSGEs can be a good ESD practice, but it depends on many factors. The guidance and sensitization of learners to reflect on and recognize their stereotypes and

norms could be a first step, and this presupposes that the educators have the corresponding (ESD) competencies [59]. For this, among others the acknowledgment of diversification and complexity instead of simplification and Othering is needed, as well as solidarity instead of charity and a lot of room for reflection.

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References

1. UN. *Transforming Our World: The 2030 Agenda for Sustainable Development*; United Nations: New York, NY, USA, 2015.
2. UNESCO. Education for Sustainable Development Goals. Learning Objectives. 2017. Available online: http://unesdoc.unesco.org/images/0024/002474/247444e.pdf (accessed on 20 April 2021).
3. Rieckmann, M. Chapter 2—Learning to Transform the World: Key Competencies in ESD. In *Issues and Trends in Education for Sustainable Development*; Leicht, A., Heiss, J., Byun, W.J., Eds.; United Nations Educational, Scientific and Cultural Organization: Paris, France, 2018; pp. 39–59. ISBN 9231002449.
4. Rieckmann, M. Future-oriented Higher Education: Which Key Competencies should be Fostered through University Teaching and Learning? *Futures* **2012**, *44*, 127–135. [CrossRef]
5. Scheunpflug, A.; Asbrand, B. Global Education and Education for Sustainability. *Environ. Educ. Res.* **2006**, *12*, 33–46. [CrossRef]
6. *Curriculum Framework: Education for Sustainable Development*, 2nd ed.; Schreiber, J.-R.; Siege, H. (Eds.) 2nd Updated and Extended Edition; Cornelsen: Berlin, Germany, 2016.
7. Felgendreher, S.; Löfgren, Å. Higher education for sustainability: Can education affect moral perceptions? *Environ. Educ. Res.* **2018**, *24*, 479–491. [CrossRef]
8. Pauw, J.; Gericke, N.; Olsson, D.; Berglund, T. The Effectiveness of Education for Sustainable Development. *Sustainability* **2015**, *7*, 15693–15717. [CrossRef]
9. Lochner, J.; Rieckmann, M.; Robischon, M. Any Sign of Virtual School Garden Exchanges? Education for Sustainable Development in School Gardens since 1992: A Systematic Literature Review. *J. Educ. Sustain. Dev.* **2019**, *13*, 168–192. [CrossRef]
10. Bowker, R.; Tearle, P. Gardening as a learning environment: A study of children's perceptions and understanding of school gardens as part of an international project. *Learn. Environ. Res.* **2007**, *10*, 83–100. [CrossRef]
11. Lochner, J. Globales Lernen in Lokalen Schulgärten durch Virtuellen Schulgartenaustausch: Erfahrungen, Herausforderungen und Lösungsansätze. Master's Thesis, Europa-Universität Viadrina, Frankfurt Oder, Germany, 2016.
12. Lochner, J. Virtual School Garden Exchange—Thinking Globally, Gardening Locally. In Telecollaboration and Virtual Exchange across Disciplines. In *Service of Social Inclusion and Global Citizenship*; Turula, A., Kurek, M., Lewis, T., Eds.; Research-Publishing.net: Voillans, France, 2019; pp. 41–47. ISBN 9782490057429.

13. Lochner, J. Educators' Intentions for Learning in Virtual School Garden Exchanges: A Comparison with the Aims of Education for Sustainable Development. *Environ. Educ. Res.* **2021**. [CrossRef]
14. Mayring, P. Qualitative Content Analysis. Qualitative Methods in Various Disciplines I: Psychology. *Forum Qual. Soc. Res.* **2000**, *1*. [CrossRef]
15. FAO. *A New Deal for School Gardens*; Food and Agriculture Organization of the United Nations (FAO): Rome, Italy, 2010; ISBN 978-92-5-106615-7.
16. Milicevic, M.; Nowikow, U. School Garden Root Network. Available online: https://www.grueneliga-berlin.de/wp-content/uploads/2017/08/School-Garden-Root-Network-Magazin.pdf (accessed on 20 April 2021).
17. Dados, N.; Connell, R. The Global South. *Contexts* **2012**, *11*, 12–13. [CrossRef]
18. Wolsey, T.D.; Lapp, D. School Gardens: Situating Students within a Global Context. *J. Educ.* **2014**, *194*, 53–60. [CrossRef]
19. Barth, M.; Rieckmann, M. Experiencing the Global Dimension of Sustainability: Student Dialogue in a European-Latin American Virtual Seminar. *Int. J. Dev. Educ. Glob. Learn.* **2009**, *1*, 22–38.
20. Pekrun, R. Progress and open problems in educational emotion research. *Learn. Instr.* **2005**, *15*, 497–506. [CrossRef]
21. Pekrun, R.; Goetz, T.; Frenzel, A.C.; Barchfeld, P.; Perry, R.P. Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemp. Educ. Psychol.* **2011**, *36*, 36–48. [CrossRef]
22. Marchand, G.C.; Gutierrez, A.P. The role of emotion in the learning process: Comparisons between online and face-to-face learning settings. *Internet High. Educ.* **2012**, *15*, 150–160. [CrossRef]
23. Rieckmann, M. Chapter 3—Key Themes in Education for Sustainable Development. In *Issues and Trends in Education for Sustainable Development*; Leicht, A., Heiss, J., Byun, W.J., Eds.; United Nations Educational, Scientific and Cultural Organization: Paris, France, 2018; pp. 60–84. ISBN 9231002449.
24. De Haan, G. The development of ESD-related competencies in supportive institutional frameworks. *Int. Rev. Educ.* **2010**, *56*, 315–328. [CrossRef]
25. Wiek, A.; Withycombe, L.; Redman, C.L. Key Competencies in Sustainability: A Reference Framework for Academic Program Development. *Sustain. Sci.* **2011**, *6*, 203–218. [CrossRef]
26. De Haan, G. The BLK '21' programme in Germany: A 'Gestaltungskompetenz'-based model for Education for Sustainable Development. *Environ. Educ. Res.* **2006**, *12*, 19–32. [CrossRef]
27. Glasser, H.; Hirsh, J. Toward the Development of Robust Learning for Sustainability Core Competencies. *Sustain. J. Rec.* **2016**, *9*, 121–134. [CrossRef]
28. Brundiers, K.; Barth, M.; Cebrián, G.; Cohen, M.; Diaz, L.; Doucette-Remington, S.; Dripps, W.; Habron, G.; Harré, N.; Jarchow, M.; et al. Key competencies in sustainability in higher education—Toward an agreed-upon reference framework. *Sustain. Sci.* **2020**, *4*, 213. [CrossRef]
29. UNESCO. *Aichi-Nagoya Declaration on Education for Sustainable Development*; Aichi-Nagoya; UNESCO: Paris, France, 2014.
30. UNESCO. *SDG 4—Education 2030. Education for Sustainable Development Beyond*; UNESCO: Paris, France, 2019.
31. Pickering, S. What do children really learn? A discussion to investigate the effect that school partnerships have on children's understanding, sense of values and perceptions of a distant place. *Geogr. Educ. Res. Pract.* **2008**, *2*, 3.
32. Krogull, S.; Scheunpflug, A. Gute Absicht allein reicht nicht. *Forsch. Mitt. DFG* **2013**, *38*, 10–13. [CrossRef]
33. Martin, F. North-South Linking as a Controversial Issue. *Prospero* **2005**, *11*, 47–54.
34. Wagener, M. *Globale Sozialität als Lernherausforderung*; Springer Fachmedien Wiesbaden: Wiesbaden, Germany, 2018; ISBN 978-3-658-18821-4.
35. Leonard, A.E. School Linking: Southern Perspectives on the South/North Educational Linking Process: From Ghana, Uganda and Tanzania. Ph.D. Thesis, University of London, London, UK, 2014.
36. Krutka, D.G.; Carano, K.T. Videoconferencing for Global Citizenship Education: Wise Practices for Social Studies Educators. *J. Soc. Stud. Educ. Res.* **2016**, *7*, 109–136.
37. Peiser, G. Overcoming barriers: Engaging younger students in an online intercultural exchange. *Intercult. Educ.* **2015**, *26*, 361–376. [CrossRef]
38. Selby, D. Global Education as Transformative Education. *Z. Int. Bild. Entwickl.* **2000**, *23*, 2–10.
39. Andreotti, V.; de Souza, L.M.T.M. Translating Theory into Practice and Walking Minefields: Lessons from the project 'Through Other Eyes'. *Int. J. Develop. Educ. Global. Learn.* **2008**, *1*, 23–36. [CrossRef]
40. Derman-Sparks, L. *Anti-Bias Curriculum. Tools for Empowering Young Children*; A 1988–1989 Comprehensive Membership Benefit; National Association for the Education of Young Children: Washington, DC, USA, 1989; ISBN 978-0935989205.
41. Derman-Sparks, L. What I learned from the Ypsilanti Perry Preschool Project: A teacher's reflections. *J. Pedagog.* **2016**, *7*, 93–106. [CrossRef]
42. Terkessidis, M. Rassismuskritik in Deutschland—Ein Überblick. In *Reden über Rassismus in Deutschland*; Kleff, S., Terkessidis, M., Eds.; Aktion Courage e.V: Berlin, Germany, 2017; pp. 5–18. ISBN 978-3-933247-68-1.
43. Tajfel, H.; Turner, J.C. The Social Identity Theory of Intergroup Behaviour. In *Psychology of Intergroup Relations*, 2nd ed.; Worchel, S., Austin, W.G., Eds.; Nelson-Hall: Chicago, IL, USA, 1986; pp. 7–24. ISBN 978-0830410750.
44. Hammond, R.A.; Axelrod, R. The Evolution of Ethnocentrism. *J. Confl. Resolut.* **2006**, *50*, 926–936. [CrossRef]
45. Dervin, F. Cultural Identity, Representation and Othering. In *The Routledge Handbook of Language and Intercultural Communication*; Paperback ed.; Jackson, J., Ed.; Routledge: London, UK, 2014; pp. 181–194. ISBN 9780203805640.

46. Allport, G.W. *The Nature of Prejudice*; Addison-Wesley Publishing Company: Cambridge, MA, USA, 1954.
47. Spivak, G.C. *A Critique of Postcolonial Reason. Toward a History of the Vanishing Present*; 4. Print; Harvard University Press: Cambridge, MA, USA, 1999; ISBN 0674177630.
48. Kay, A.C. Predicting the Future. *Stanford Eng.* **1989**, *1*, 1–6.
49. Mezirow, J. Transformative Learning: Theory to Practice. *New Dir. Adult Contin. Educ.* **1997**, *1997*, 5–12. [CrossRef]
50. Cranton, P. Teaching for Transformation. *New Dir. Adult Contin. Educ.* **2002**, *2002*, 63–72. [CrossRef]
51. Cranton, P.; King, K.P. Transformative Learning as a Professional Development Goal. *New Dir. Adult Contin. Educ.* **2003**, *2003*, 31–38. [CrossRef]
52. Singer-Brodowski, M. Transformative Bildung durch transformatives Lernen. Zur Notwendigkeit der erziehungswissenschaftlichen Fundierung einer neuen Idee. *ZEP Z. Int. Bild. Entwickl.* **2016**, *39*, 13.17.
53. Singer-Brodowski, M. Transformatives Lernen als neue Theorie-Perspektive in der BNE: Die Kernidee transformativen Lernens und seine Bedeutung für informelles Lernen. In *Jahrbuch Bildung für Nachhaltige Entwicklung—Im Wandel*; Umweltdachverband GmbH, Ed.; Forum Umweltbildung im Umweltdachverband: Vienna, Austria, 2016; pp. 130–139.
54. Schnell, R.; Hill, P.B.; Esser, E. *Methoden der Empirischen Sozialforschung*; 4., Überarb. Aufl.; Oldenbourg: München, Germany, 1993; ISBN 3486227289.
55. Shulman, L. Knowledge and Teaching: Foundations of the New Reform. *Harv. Educ. Rev.* **1987**, *57*, 1–23. [CrossRef]
56. Grossman, P.L. Teacher's knowledge. In *International Encylopedia of Teaching and Teacher Education (Resources in Education)*, 2nd ed.; Anderson, L.W., Ed.; Pergamon: Oxford, UK, 1995; pp. 20–24.
57. De Boer, H. Pädagogische Beobachtung: Pädagogische Beobachtungen machen—Lerngeschichten entwickeln. In *Beobachtung in der Schule—Beobachten Lernen*; de Boer, H., Reh, S., Eds.; VS Verlag für Sozialwissenschaften: Wiesbaden, Germany, 2012; pp. 65–82. ISBN 978-3-531-17761-8.
58. Flick, U. *An Introduction to Qualitative Research*, 3rd ed.; Reprinted; SAGE Publications: Los Angeles, CA, USA, 2007; ISBN 9781412911467.
59. Corres, A.; Rieckmann, M.; Espasa, A.; Ruiz-Mallén, I. Educator Competences in Sustainability Education: A Systematic Review of Frameworks. *Sustainability* **2020**, *12*, 9858. [CrossRef]