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Review

Designing Powerful Learning Environments in Education for Sustainable Development: A Conceptual Framework

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Abstract: Policymakers have pinpointed the importance of living in a more sustainable society. Education for Sustainable Development aims at developing future citizens competent to take actions in order to cope with Sustainable Development issues. The instructional design that teachers apply in class play a crucial role in students' learning. This study is a conceptual analysis based on a narrative review of the literature in the field of Environmental Education/Education for Sustainable Development. It makes use of the CLIA-model (Competence, Learning, Intervention, Assessment), developed by De Corte, Verschaffel and Masui in 2004 to prescribe how a powerful learning environment in Education for Sustainable Development (ESD) could be developed. In particular, the study focusses on the Intervention component. Holistic, pluralistic as well as action-oriented teaching in Education for Sustainable Development are thought to be effective in cultivating students' action competence. This paper presents first the Action-oriented ESD framework. This framework consists of five components: (a) action-taking, b) students' leadership in their learning and teaching, c) peer interaction, (d) community involvement and e) interdisciplinarity. We then integrate the Action-oriented ESD framework with Holism and Pluralism into the Holism-Pluralism-Action-orientation in the ESD framework. Integrating holistic, pluralistic as well as action-oriented teaching in ESD is highly important in theoretical discussion as well as in instructional design. The Holism-Pluralism-Action-orientation ESD framework addresses the lack of an integrated conceptual framework in the field of ESD. This framework is motivated by a growing consensus on the importance of these three approaches in ESD teaching. The Holism-Pluralism-Action-orientation in ESD Framework is based on more than three decades of efforts to define knowledge on Environmental Education/Education for Sustainable Development teaching and on the rich and growing body of research on effective ESD teaching.

Keywords: Education for Sustainable Development; action-competence; instructional design; powerful learning environments

1. Introduction

Policymakers have highlighted the importance in putting our efforts towards a more sustainable society. Sustainable Development focuses on enhancing the quality of environment and quality of life via an equitable economic growth. Education for Sustainable Development (ESD) allows teachers to reveal the complexity of Sustainable Development (SD) in education to students [1]. ESD aims at developing skilled and active citizens, informed and motivated to live sustainably and act towards a more sustainable society (e.g., [2,3]).

SD is considered as an integrated concept of three pillars: Environment, Economy and Society [4]. According to the most often used definition of Sustainable Development, namely the Brundtland definition, Sustainable Development is "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" [5](p. 41). Accordingly, ESD addresses sustainable development issues including environmental as well as social and economic problems (e.g., [6]). The United Nations 'Transforming our World: The 2030 Agenda for Sustainable Development' puts emphasis on the integration and balance among the three dimensions of SD [7].

Yet many scholars have foregrounded the interrelations of the three dimensions. Among them, Giddings et al. [4], who pinpoints the multi-level structure of the concept. The concept of SD is not static but rather dynamic. This means that the concept of SD can be understood in various ways, according to different views [8,9]. SD issues are complex due to the interrelations among them and the interconnections between social, natural and economic systems [10]. Apart from complexity, uncertainty characterises SD, as well. It is impossible to completely predict which practices will lead to future change and what will be their consequences [11]. Because of the dynamic nature of the SD concept, there is no tangible definition [12]. Teachers are responsible for students gaining knowledge and skills which enable them to cope with SD issues [13]. The learning environment, which teachers develop in class, is closely related to successful learning in ESD [14].

2. Powerful Learning Environments

To create powerful instructional settings which help students to gain knowledge and skills, we should take into account the current understanding of instructional design [15]. In the field of learning and instruction research, there is now a broad consensus that effective learning occurs when learning environments are 'powerful' stimulating learning which is "*constructive, cumulative, self-regulated, goal-oriented, situated, collaborative' and taking into account 'individually different process of meaning construction and knowledge building*" [16] (p. 106). De Corte, Verschaffel and Masui [15] developed a model for designing powerful learning environments, namely the CLIA-model. They pinpoint that any theoretical model concerning instruction should include: (a) specific educational goals, that should be achieved (Competences in a specific domain); (b) a theory-based background as to what learning processes needed to achieve the competences (Learning); (c) it should propose specific principles and methods upon teaching encouraging to encourage the learning processes (Intervention) and d) it should consider assessing the outcomes (Assessment). All four of these components are interconnected (Figure 1) [15].

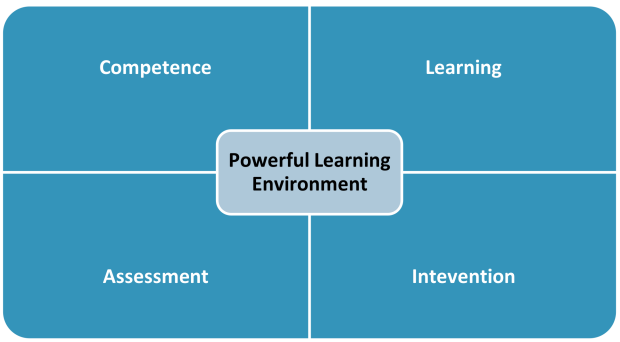

Figure 1. The CLIA-model (Competence, Learning, Intervention, Assessment) on designing Powerful Learning Environments.

In this study, we make use of the CLIA-model to frame our understanding as how a powerful learning environment in ESD could be designed. The next paragraphs explain how the four components are seen for this study in ESD: Competence, Learning, Intervention and Assessment.

2.1. Competence

ESD is often viewed as an action competence approach aiming at empowering students to take action in order to tackle with complex issues related to SD [17]. An action should then "be directed at solving a problem and it should be decided upon by those preparing to carry out the action" [18] (p. 326). The objective of ESD is not limited to students' behaviour change but goes further by enabling them to take sustainable decisions in the future through social learning [1]. Jensen and Schnack [18] defined action competence as the ability to act. In this case, it is about being able to act so as to solve SD-related problems. They claim that the aim is "to make students capable of acting on a societal as well as a personal level" (p. 164).

2.2. Learning

A teacher should particularly focus on the learning conditions expected to develop action competence [17]. The objective of ESD is not a behavioral change but rather the development of skills such as participatory and active citizenship skills, cooperative skills and independent and autonomous thinking and learning so that students are capable of dealing with the complex and changeable reality. Learning is thought to be transformative due to the mediation of a critical, pluralistic and democratic way of thinking [17]. It has been argued that an ESD approach incorporates both cognitive and affective components of learning [19,20]. Sandell and colleagues [20] state that teaching aiming exclusively at knowledge or exclusively at values and attitudes does not seem to be sensible. This is because when the aim is knowledge, even then, values and attitudes are implied.

2.3. Intervention

Instructional design based on holistic and pluralistic approaches to ESD is often considered of high importance [see for example [20,21]] and necessary for the development of students' action competence (e.g., [22]). In what follows, we explain how holistic and pluralistic approaches in ESD are understood.

2.3.1. Holistic Approaches to SD in ESD

A holistic approach to SD includes all three dimensions of SD that is, environmental, social and economic, and puts emphasis on their interconnections [21,23,24]. Time and space perspectives are also taken into consideration [21,23,24]. In ESD teaching, connections with the past, the present and the future as well as implications in local, regional or global level should be also considered [24].

Research has been done on whether teachers and students view the SD concept holistically in terms of the three aforementioned dimensions. It seems that neither teachers nor students hold a holistic view of the SD concept. Both of them recognise the environmental dimension most. This was the case among sixth and twelfth graders in Sweden (Berglund et al., 2014) and among UK geography students at the age of 14 and 15 [25,26]. However, Berglund and Gericke [27] found that when students deal with the dimensions separately, they give priority to social factors. Student teachers in science and geography in UK studies [23,28], student teachers in New Zealand [29,30] Turkish science student teachers [31] and science and social science teachers in Sweden also recognise the environmental dimension the most. The economic dimension is less recognised by students [12,25] and students have vague perceptions of how economy is related to SD [27]. In line with students' conceptions of the economic dimension [27], teachers feel unsure about economic factors related to SD issues [31]. It is hard for teachers to integrate the three dimensions of the concept of SD [31]. Teachers often hold a shallow and oversimplified understanding of sustainability [29], or they hold misconceptions about the concept of SD [32]. They also appear to recognise SD issues at local and national level and to underestimate these at global level [32].

In practice, when teaching ESD, teachers do not help students to develop a holistic view of SD [31,33]. Borg et al. [31,33] and Boeve-de Pauw et al. [22] showed that there is an absence of good practices to inspire teachers as well as a lack of expertise on SD. At the same time, it could also be

claimed that the environmental aspect is less complex and thus easier for students to grasp [25,34]. Research on this has showed that: (a) students often recognise the three pillars of SD but they have only a superficial understanding of them [35] and (b) students have problems in describing relationships between the three aspects of SD [34].

2.3.2. Pluralistic Approaches in ESD

Pluralistic approaches in ESD teaching recognise complexity, value conflicts and uncertainty [36]. Pluralistic approaches are open and encourage critical thinking and dialogue so as to make students form their own opinion (e.g., [37–42]). Mogensen [43] (p. 239) defines critical thinking as "reflective and evaluative thinking which must lead to a reasoned judgement". Secondary and upper secondary teachers acknowledge students as political subjects who question authorities, evaluate sources, and develop their own opinion [44]. The fact that students are able of questioning factual/scientific knowledge means that they have the skills: (a) to acknowledge how it is developed and (b) to evaluate its validity and relevance [44]. Furthermore, it makes them become responsible for their own learning. In that way, students will form their own standpoints [44]. Harness and Drossman [45] and Varela-Losada et al. [46] also agree that students get much information inside and outside school which should be acquired to analyse and interpret. These skills enable students to make informed decisions regarding SD issues [47]. This is absolutely necessary because SD issues are complex in nature [48]. Furthermore, students need to reflect on the political structures which reproduce power and wealth inequalities [49].

In this perspective, students should acknowledge various perspectives when they are dealing with SD issues (e.g., Boeve [22]). The most discussed research way in ESD to put a pluralistic approach into practice is the deliberative discussions (e.g., [36,39,50,51]). The deliberative communication model of ESD by Englund et al. [51] is based on rational discussions and argumentation. Englund's [51,52] model includes a series of characteristics: a) arguments from different/contesting perspectives regarding the topic of discussion are presented and competing one another; b) respect for the involved actors while actively listening to others' viewpoints; (c) the students involved reach an agreement to some extent on the topic discussed or they understand better others' perspectives and they are not tolerant. This is particularly important because SD problems do not have one solution well-supported by argumentation (see [53]) and (d) student question and challenge taken-for-granted habits, norms and traditions. The role of the teacher then is to create adequate conditions which will allow students to put all these in practice [36].

There is a debate in the ESD literature regarding whether the teacher should present the controversial SD issues in a balanced way or not. Treating all arguments as equal is an attempt to avoid indoctrination toward predetermined goals [54]. However, balanced perspectives and neutrality are criticised due to the risk of relativism that most possibly prevent students from caring and get committed to any particular moral or political standpoint and finally, taking part in decisions [55,56]. The objective of deliberative discussions is that "*different arguments are encouraged and considered, and no particular standpoint is privileged*" [39](p. 106). As Ojala [36] has supported, during such a discussion some arguments, possibly the best-supported ones, will be accepted by most students if not approved [36].

2.4. Assessment

The fourth component of the CLIA-model is Assessment. Assessment should address not only the competence, in this case, action competence towards SD issues, but also, the learning conditions (e.g., knowledge, values, attitudes and skills) as described above [15]. Assessment in ESD addresses the learning conditions (often called factors) which influence the attainment of action competence. This is done under the prism of educational effectiveness research in ESD (e.g., [22]). Assessment should integrate instruction, learning and the competences intended to be achieved [15,57,58]. The assessment should then adjust the instructional design, according to the needs of the students [58]. In that sense,

formative assessment will substantially inform the learning environment at competence, learning and instruction level [15,58].

3. Purpose and Aim of the Study

ESD teaching is implemented in different ways by teachers [59]. Even though there is now an increasing amount of work on ESD implementation, the instructional design in formal education settings developed is still not well understood (e.g., [2,14,60–65]). One of the reasons for the lack of research in implementation of ESD practice may be the lack of a conceptual framework for designing powerful learning environments in ESD. This study endeavours to cover this gap in the literature by presenting an integrated conceptual framework that can be operationalised to measure the instructional design in ESD in future empirical research.

Two aspects of the Intervention component of the CLIA-model, namely holistic and pluralistic approaches to ESD, are already discussed above. Although holism and pluralism are seen as perquisites for the development of students' action competence in the framework of ESD (e.g., [22]), it seems that an important aspect of the Intervention component, namely action-orientation is lacking. Action-orientation is thought to be highly significant when it comes to the cultivation of action competence [40,66]. Indeed, the review of Varela-Losada, Vega-Marcote, Pérez-Rodríguez and Álvarez-Lires [46] reveals a third dimension of ESD teaching and learning, namely action-orientation. As Wilhelm, Förster and Zimmermann [67] argue, since empowering 'change agents' is an educational objective, then teachers should develop action-oriented ESD learning environments.

This study elaborates further on action-orientated approaches in ESD by presenting a narrative review. This review ends up in a conceptual framework as to what action-oriented approaches in ESD should be taken in account, namely the Action-oriented ESD framework. The aim of developing of the Action-oriented ESD framework is to integrate it then to a broader framework, which includes holism and pluralism, as well.

The following research question guided the review:

1. What are the components of an action–oriented framework in Education for Sustainable Development according to the literature?
2. What are the components of an integrated framework in Education for Sustainable Development developing a powerful learning environment according to the literature?

In what follows, we present the methodology used to answer to the first research question. The results section present the components of an action-oriented approach in ESD, that is, the Action-oriented ESD framework. In the discussion section, we present the integrated framework in ESD teaching, namely, the Holism-Pluralism-Action-orientation ESD framework, which leads us to the answer to the second research question.

4. Methodology

The present study builds on a recent review of Varela-Losada and her colleagues [46], which refers to educational practices which seem to contribute to the development of action competence in ESD. The review of Varela-Losada and her colleagues points out that the educational programmes pay particular attention to five educational practices that promote action competence: (a) student's active participation, (b) reflection on the complex SD issues, (c) student's critical thinking, (d) autonomous and responsible decision-making and (e) the involvement of communities. Varela-Losada et al. [46] provided theoretical evidence that these practices could indeed promote action competence. They analysed the educational Environmental Education (EE)/ESD programmes published in two research journals with the greatest impact on the field of EE/ESD from 2008–2013. They created a framework to analyse educational proposals within the context of action competence based on literature well-established in the field. Table 1 shows the aforementioned framework. With this review as one of our major sources

of data and also based on other sources as explained in what follows, we developed a conceptual framework about action-oriented approaches in ESD.

Table 1. The components of the framework of Varela-Losada et al. (2016).

Participation	It encourages the participation of students, which includes from formulation of questions or making suggestions to decision-making in solving the problems or in the process of teaching and learning, where students are involved actively, they express their opinions and take part in the decision-making, individually and collectively, in the process.
Involvement of the student body	It arises from students' needs and concerns, aiming to connect with their interest.
Social learning	It uses learning in groups and cooperating teams.
Real issues	It practices relations with the real world (through real experiences, hands-on learning, outdoors, etc.).
Interdisciplinary perspective	Issues are dealt from different inter-connected disciplines.
Complexity	It is based on the culture of complexity, that is, students tackle their own understanding of problems/complex situations and look for relationships, interactions, different points of view and consider possible actions.
Criticalthinking	It encourages critical analysis through different perspectives, reflecting on conflicts of interest. This approach can range from the critical handling of information to the analysis of the complexity of situations and be aware of their role in society.
Actions	They deal explicitly with the study of possible actions/solutions targeted at effecting real change regarding the environment, the analysis of student lifestyles, behaviour, decision-making and actions.
Community	It involves the community, different members of the educational community (not just the students), or even groups outside the educational community, and uses an approach based on social change.
Source: Varela-Losada et al. (2016) [47]	

The first step to this kind of analysis is to determine the sources of the inquiry. Data collection should meet specific criteria determined by the topic [68]. At the same time, data collection should be complete to ensure validity [68]. Accordingly, a literature search was conducted at the following electronic databases: Science Direct, EBSCO, ERIC, Scopus, and Google Scholar, five of the most often used in the field of education. Search terms were included: 'Education for Sustainable Development', 'Environmental Education', 'Environmental and Sustainability Education', Education for Sustainability', 'effective teaching approaches', 'effective teaching practices', 'instruction', 'educational effectiveness', and 'implementation effectiveness' and all of them in different combinations. Articles were read and assessed for relevance.

Literature themes were then broken down into more precise concepts as articles were reviewed according to their core findings. These concepts were deductively organised into theoretical perspectives determining the analytical framework—the crux of this article. We have also looked for references cited in this initial sample of sources (backward search), and for studies that cite our initial sample of studies (forward search). The process continued until we reached a 'saturation point'. The final conceptual framework received feedback from an expert in the field of ESD and it was revised accordingly. Figure 2 shows the procedure that was followed.

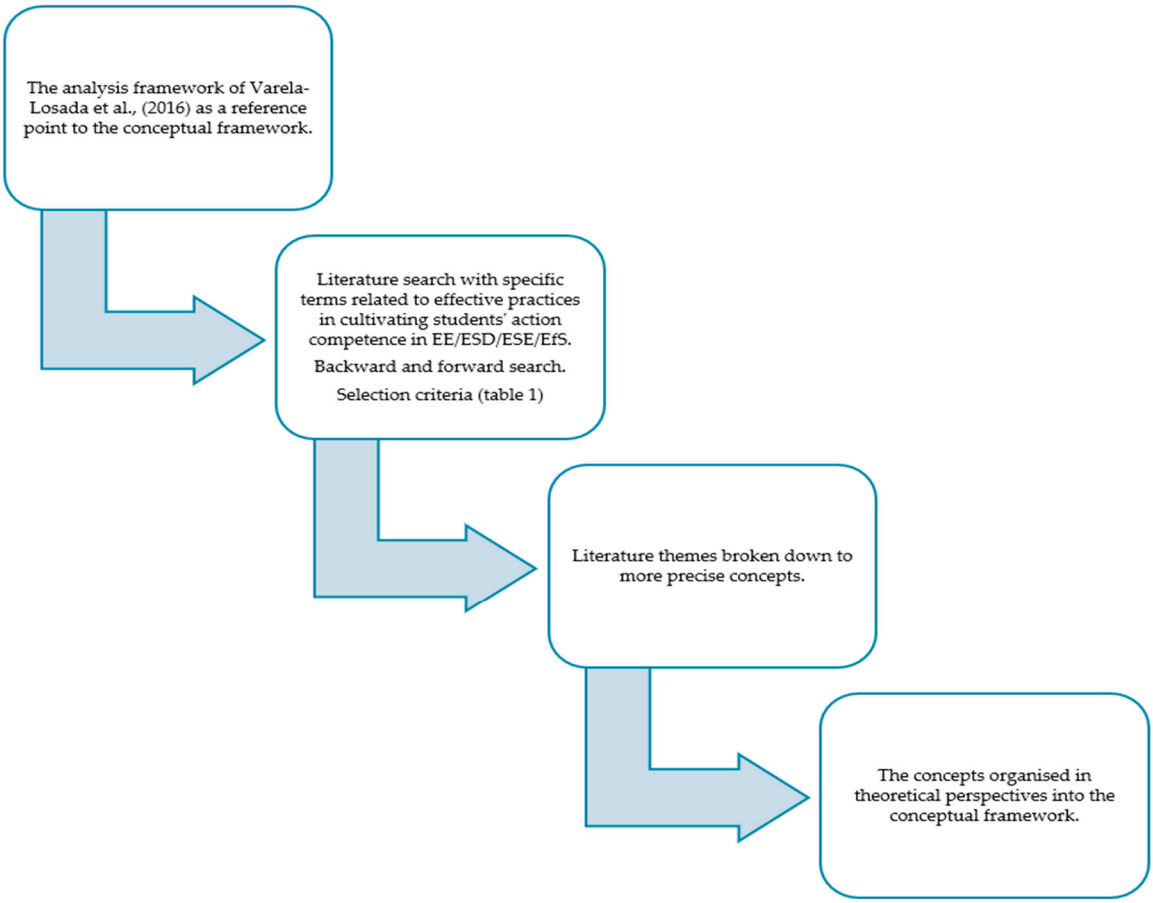

Figure 2. The procedure followed to reach to the components of the Action-oriented Education for Sustainable Development (ESD) framework.

The literature selected fulfils a list of criteria. The sources are based on empirical research or literature reviews, which refer to EE (Environmental Education)/ESD teaching with a specific focus in action competence in EE/ESD. EE and ESD are distinct but complementary [69]. EE focuses more on the environmental aspect of SD issues, whereas ESD takes into consideration economic as well social implications next to environmental aspects [69]. We excluded editorials, commentaries and prologues. Furthermore, all books and journals are peer reviewed and meet international publication and quality requirements and are often used as reference sources in the field of ESD. The studies may refer to formal or informal EE or ESD and are independent of the age of the target group. All sources are considered independently of the year of their publication, and thus, there is no limitation in the year of publication. Table 2 lists the inclusion criteria. Table 3 lists the reference sources for the framework.

Table 2. Inclusion criteria.

- Sources of the field of Environmental Education (EE)/ Education for Sustainable Development (ESD)
- Empirical or theoretical research
- Books, articles or theses. No editorials, commentaries and prologues.
- No limitation in the age of the target group
- Either formal or informal education
- Books, articles or theses independently of the year of their publication

Table 3. Reference Sources for our framework.

Journals	Number of Articles
Environmental Education Research	11
Sustainability	5
The Journal of Environmental Education	4
Journal of Environmental Psychology.	3
Journal of Cleaner Production	2
Cambridge Journal of Education	2
Journal of Teacher Education for Sustainability	2
Australian Journal of Environmental Education	2
Educational Researcher	1
Development Education Policy and Practice	1
Research in Science and Technological Education	1
Research in Environmental and Health Education	1
Children and Society Volume	1
Clearing	1
Electronic Journal of Environmental Education	1
Journal of 1Curriculum Studies	1
Journal of Environmental Planning and Management	1
NJAS - Wageningen Journal of Life Sciences	1
Books Publishers	
Routledge	2
Cambridge University Press	2
Springer	1
Sense Publishers: Rotterdam/Boston/Taipei	1
Pearson Custom Publishing.	1
Wageningen: Wageningen Academic Publishers	1
Lund: Studentlitteratur	1
Athens: Nisos	1
Brussels: International Academy of Education	1
Thessaloniki: Epikentro	1
Theses	
PhD thesis	1
Master thesis	1

5. Results

In this section, the Action-Oriented ESD framework (Section 5.1.) is first described. Then, the similarities and the difference between the Action-oriented ESD framework and the framework of Varela-Losada et al. [46] are explained.

5.1. Action-Oriented ESD Framework

The Action-oriented ESD framework explains how a learning environment should be constructed to employ an action-oriented approach in the framework of ESD. It consists of five components, namely: a) action taking, b) students' leadership in their learning and teaching, c) peer interaction, d) community involvement and e) interdisciplinarity. In what follows, we present the aforementioned concepts and how they can be applied in ESD teaching practice in detail. Figure 3 shows the Action-oriented ESD framework and its components.

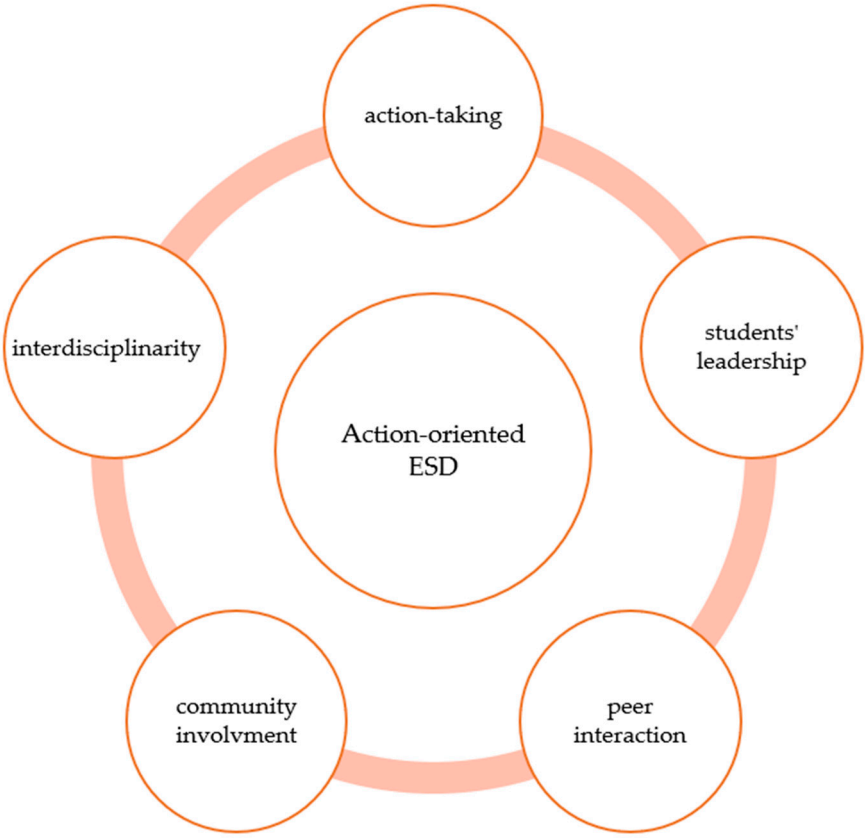

Figure 3. The Action-oriented ESD framework and its components.

5.1.1. Action-Taking

Action-taking is an important factor in an ESD approach [70,71]. Zint et al. [71] found that students gained action knowledge, actions skills and intention to act after students participating in an educational field trip. Students should, with the guidance of the teacher, set realistic goals and small-scale measurable outcomes [70,72]. Chapman [73] stated that a critical examination of values is essential for student action taking. At the same time, it is important that students study the causes of environmental problems within their societal context so as to understand them deeper and be able to take suitable actions [74]. The educational goal should be 'conscious action', as called by Colás-Bravo, P., Magnoler, P. and Conde-Jiménez [75] which combines action with consciousness. The latter is seen as perquisite for action [75]. The students who participated in action projects showed positive environmental attitudes [76]. Zint et al. [71] conclude that curricula lacking action cannot promote action competence.

An activity is not the same as an action. In an activity, students complete sustainability tasks that do not address the causes of the problems. For instance, an activity is about collecting litter whereas an action would aim at how to prevent litter [18]. Since the ultimate goal is the development of active citizens able to take part in community decisions, the role of the students is especially active [17]. Besides, the socio-cultural theory of Vygotsky [77] highlights that knowledge is a social construction which is dynamically formed through active participation in activities in a social context.

Impact of Action

The actions applied can be: (a) direct actions, which aim at solving the problem related to SD issues which students deal with or (b) indirect actions, which aim at influencing others to solve the problem under consideration [40]. Indirect actions which are actions in the society either by informing the local community or by asking pressure towards the authorities or by taking immediate action [40].

Sorting of garbage, construction of compost heaps, minimizing water or energy consumption are examples of direct action [40]. Letters to politicians or companies, debates or the distribution of leaflets or newspapers are examples of indirect action [40]. Jensen and Schnack [40] present one more case to explain the difference between direct and indirect actions in a clear way: a farmer reduces the consumption of fertilisers, which it is considered direct action. At the same time, the politicians legislated laws and taxes to influence the farmer to reduce the use of fertilisers and this is considered indirect action. On turn, the politicians are pressured by public groups which demonstrate against the use of fertilisers in agriculture (indirect action, too). We see thus, indirect actions lead to direct action. It is crucial that the teachers prepare students for taking both direct and indirect action [78].

Gardner and Stern [79] argue that both private and public sphere actions related to SD issues should be taken to individual level. However, they pinpoint that collective actions are most possibly more effective due to the complexity of SD issues. Likewise, Jensen [18] agrees that solutions to SD issues at private life level should avoid teaching simplistic causes and solutions at individual level. For instance, turning out the lights when leaving the classroom could be one form of action. However, ESD teaching should be not limited to actions at the individual level or the school level but go further to collective actions [40]. Connell and colleagues in 1998 [80] but also Stagel [81], Almers, Askerlund and Apelqvist some years later, in 2014 [81], showed that students had taken more individual actions in a private sphere while collective ones required for the democratic change of social structures tend to be excluded. Thus, students' gain little experience in public sphere action [81].

Context of Action

Action competence is cultivated by participating in political activities, either real or simulative (artificial 'as if' situations, e.g., role-playing) [82,83]. The final objective is the participation of the students in decision-making in dealing with sustainability issues [84]. Hammond [85] suggests that simulations do not allow students to get engaged with real world problems [86,87]. They serve nevertheless as stepping-stone for action in real context problems [87]. Direct involvement in real world projects, relevant to students with real world consequences are thought to have the potential to further develop students' action competence [85,87]. Action learning is about working on real issues aiming at solving a specific problem [88] (p. 11). Kyburz-Graber [89] points out that dealing with real context issues helps students to gain meaningful contextual knowledge, which gives them the opportunity to view an SD issue from multiple perspectives. Dealing with real problems makes students more independent learners since ensures that they are actively involved rather than passively getting factual knowledge. [89].

5.1.2. Students' Leadership in Learning and Teaching

The cultivation of action competence requires students to get actively involved in their learning (e.g., [17,20,59]). Taking responsibility for their own learning makes them act effectively in dealing with SD issues [59]. In the context of ESD, it is particularly important that students make decisions about their own learning. As Garrecht, Bruckermann and Harms [90] state, decision-making is a perquisite for action-taking when coping with SD issues. According to Kahneman [91], to make an informed and conscious decision is rather demanding, which then means that students should be engaged in the decision-making process rather early. Warburton [92] incorporates the aim of ESD in a few words: "Effective education for sustainability prompts students to reflect on their learning and leads to changes in values, attitudes and behaviors" [92] (p. 50).

If they are actively involved in coping with SD issues, they also get empowered to continue doing so [93]. Unlike lecture-based learning, participatory learning helps students to get engaged as well as to understand SD-related issues. Schelly, Cross, Franzen, Hall and Reeve [94] showed that when students are given the opportunity to take responsibilities and participate in decisions related to SD issues, they show greater environmental concern.

Shier [95] categorised the participation of students in five levels (Figure 4). Level 1: students listen to the teacher. Students are allowed to express their views but it is upon them and they are not encouraged to do so. Level 2: students express their views. The teacher encourages student to express their views. Therefore, the teacher should have effective communication skills and apply creative technique to make students express themselves (e.g., via visual methods, art activities, surveys and interviews). Students' views, however, are not taken into account but only heard. Level 3: students' views are taken into consideration in decision-making. This does not mean that every decision is taken according to students' wishes. However, students' views are one of the many factors that are taken into account and the teacher explains why the students' wishes were not possible to be accomplished. Level 4: students get involved in decision-taking. This level can be seen as a transition from consultation to active participation in the decision-making process. Until now, students have been encouraged to express their views but they do not have an active role at all stages of decision-making. The decision is made by the teacher. At level 4, the teacher and the students plan the activities of the scheme programme jointly. Level 5: they share with the teacher responsibility and power in when taking decisions. While at level 4, students are actively engaged, they do not have any real power. At level 5, though, the teacher is willing to give some of his power over to students. For instance, students take part in a committee as equals to the teachers. It is important that students share responsibilities that are developmentally appropriate for them. The teacher should then create a supportive environment. It is evident that the goals of ESD will be accomplished when ESD teaching will be directed to the high levels of students' participation [96]. However, it seems that it is a challenge for schools [97] to incorporate high levels of students' participation in ESD teaching.

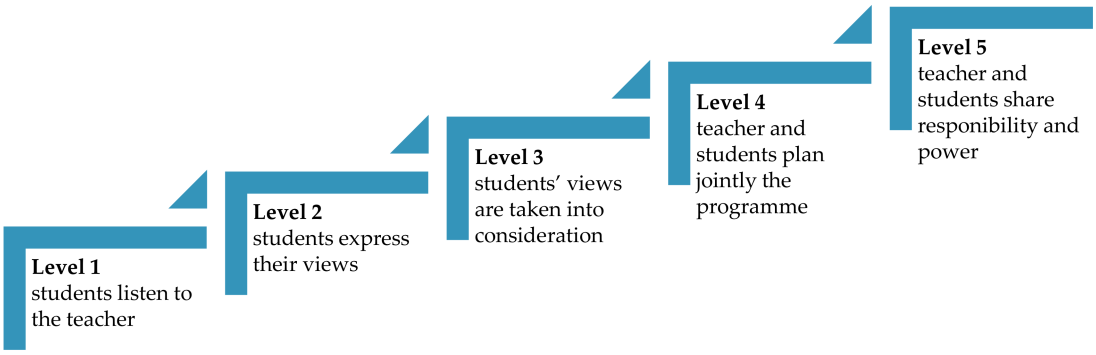

Figure 4. Shier's typology on students' Students' leadership in learning and teaching.

5.1.3. Peer Interaction

Another component of action-oriented ESD teaching approaches is peer interaction [46]. Working in collaboration with others is thought to be a crucial factor in the development of students' action competence in the framework of ESD [40]. Working in groups contributes to students social learning and socially constructed knowledge [38,98]. Social learning allows students to participate individually or in groups in the resolution of SD issues [99]. About half of the studies in the review of Varela-Losada et al. [46] make students work in groups [38,98]. In her thesis, Lee [100] argues that group work of different arrangements (i.e. whole group, sub-group and individual), afford opportunities for the development of different kinds of action-competence-associated attributes. Wals and Rodela [101] agree with Lee stating that dealing with sustainability issues requires the involvement of individuals, groups and collectives. However, it appears that group work helps students to develop skills needed to take up collective actions [100,102]. According to Wals and Rodela [101] engaging students in collective actions related to SD issues offer students with experiences on decision-making processes and taking an active role in the society.

5.1.4. Community Involvement

Another factor influencing students' action competence is the involvement of the local community, on the one hand, and the involvement of schools in the community, on the other hand. Some researchers adopt sociocultural views of learning in ESD such as situated learning theory [98]. Green and Somerville [62] found that teachers identified benefits by involving community members in their sustainability program. Hogan [103] argues that learning occurs in social interactions and participation in a community of practice. Students can learn that taking actions in a socio-cultural context by getting involved in environmental and sustainability agencies. By taking part in community-based approaches, students learn to take part in civic activities and decision-making processes [104]. This makes them more willing to get engaged and develops a strong sense of responsivity related to issues in the community [104].

Bascopé et al [105], in their systematics literature review, found that the term 'community' is used in various ways depending on the context, while it is not clearly defined. It may refer to the closer educational community (e.g., parents and neighborhood) or the local place in a more general sense. Nevertheless, they find that the involvement of the community is thought to encompass all actors related somehow to the school in order to address usually local SD issues through an action-oriented approach.

Uzzell et al. [106] and Uzzell [107] distinguish four types of relationships between the school and the community. EE/ESD is conducted in the class dealing with issues of the community via e.g., newspapers or students take actions in simulative activities (e.g., role-playing) (type 1). A first step towards a real communication between the school and the community is made when the school invites local community members in the school in order to explore action possibilities (e.g., inviting members of the local community for a speech) (type 2). Students may get out of the school to the community looking for action possibilities (type 3). Students might act as social agents when the community is present at school and students are active in the community in order to actually take actions (type 4). Similarly, in their literature review, Bascopé et al (2018) revealed three forms of community involvement: (a) learning from and about their own community through participating in life in community and communicating with community members; (b) acting upon issues in the community as an attempt to solve SD-related problems and (c) co-learning and acting with the community, means that community members (e.g., parents) cooperate with students to solve SD-related problems while they have themselves the opportunity to learn by taking part in this process. Bascopé et al [105] pinpoint that these three forms of community involvement do not exclude but complete each other.

5.1.5. Interdisciplinarity

Interdisciplinary approaches make students obtain competences through the integration of various fields of knowledge to address SD issues [105]. An interdisciplinary approach helps students to engage with an environmental, economic or social issue in a way that students can reveal the contribution of all disciplines to the understanding of different parts of the problem [82]. An interdisciplinary approach reveals all sorts of interactions and sees SD issues holistically [82]. As Walshe [26] points out, interdisciplinary teaching could make students consider SD issues from plural perspectives. An interdisciplinary approach is also important in action-oriented approaches in ESD [67]. However, applying an interdisciplinary approach is a challenge for teachers [33]. It seems that an interdisciplinary approach is not often part of the school culture and, therefore, it is not implemented often by the teachers. Another reason is the subject tradition of each teacher [33] for anything outside their discipline is difficult for teachers to understand [108]. Anyolo et al. [59] in their interviews with secondary school teachers found that some of the teachers are for the integration of ESD in their subjects. However, some of the teachers also suggested that ESD was taught as one subject, which means that they would have the chance to deal with SD in depth. Dimenas and Alexandersson [109] acknowledge that it is necessary for teachers to get competent so as to be able to handle the complexity of SD issues in an interdisciplinary way.

5.2. The Need for the Development of the Action-Oriented Framework

The Action-oriented ESD framework is to a high extent similar to that of Varela-Losada et al. [46] but also different at some points. The Action-oriented ESD framework does not represent only our understanding, but it also makes it possible to get operationalised in an instrument used for empirical research, which is the ultimate aim of this framework. On the contrary, the framework of Varela-Losada et al. was designed to be used for a literature review. Therefore, the reasoning of designing as well as using each of these two frameworks is completely different. Both share common concepts which describe learning environments thought to develop students' action competence in the framework of ESD. Both explain these concepts based on the theory in the field of ESD. However, these concepts are expressed in Action-oriented ESD framework in a way so that makes operalisation tangible.

To get a step closer to an easily operationalised framework, a series of steps was taken. First, since the purpose is to include holism and pluralism as instruments for the next study, components closely related to holism and pluralism should be excluded. In that way, the categories/scales in the instrument will be mutually exclusive. Therefore, the component of complexity, which relates to holism and the component of critical thinking which is included in pluralism are excluded. The critical thinking component is understood in a slightly different way. In the framework of Varela- Losada et al (2016), it is seen as analysis from different standpoints taking conflicting interests into account. Students need to critically analyze complex situations related to SD issues. We view critical thinking as recognizing students as political subjects who question authorities, evaluate sources and develop their own opinion [44]. We link then critical thinking to pluralism.

Second, the Action-oriented ESD framework elaborates on the component of action. It describes what action-taking means by dividing the concept into two sub-components, namely impact of action and context of action. These sub-components can easily then be operationalised, which is not the case with the description provided about the component of action in the framework of Varela-Losada et al. Furthermore, the component of real issues and the component of action in the framework of Varela-Losada et al. are integrated to the Action-oriented ESD framework. In terms of operationalization, this integration makes it possible to achieve the exclusiveness of the items in an instrument. The concept of real issues is implied in both sub-components. However, the focus of each of these two sub-components is different making the items mutually exclusive.

Third, the component of participation and the component of the involvement of students' bodies of the framework of Varela-Losada et al. are integrated into one component, namely leadership in teaching and learning. Shier's categorization [95] incorporates both concepts, that is, the participation and the involvement of students' body, as described by Varela-Losada et al. The categorization of Shier about the participation of students in five levels (as explained in Section 5.1.2.) could be then used for an instrument for empirical research.

Fourth, Varela-Losada et al. explain that social learning is an important characteristic of an action-oriented ESD. They interpret social learning as students working in groups. However, it seems (as in details explained in Section 5.1.3) that individual work can also contribute to the development of action competence. Therefore, in Action-oriented ESD framework various group arrangements are considered (individual, small groups, the class as one groups), which, in turn, should be used in an instrument.

Fifth, the Action-oriented ESD framework elaborates further on the community involvement. It offers two typologies about the relationships between the school and the community. The first typology is designed by Uzzell et al. [106] and Uzzell [107] and the second one by Bascopé et al. [105]. Both could be operationalised and used in an instrument. Last but not least, the components of interdisciplinary perspective (labelled 'Interdisciplinarity' in the Action-oriented ESD framework remains the same. Table 4 shows the reference sources of each framework.

Table 4. The sources used for the framework of Varela-Losada et al. (2016) and the sources for the Action-oriented ESD framework.

Action-Oriented ESD Framework	Sources Used for the Framework of Varela- Losada et al [a]	Sources Used for the Action-Oriented ESD Framework [b]
1. Action- taking		
1.1. Impact of action	Mogensen and Schnack 2010; UNECE 2005 [110]; NEEAC 2005 [111]; Wals 2007	Jensen and Schnack, 1997; Hodson, 2011; Gardner and Stern, 2002; Jensen, 2002; Connell and colleagues, 1998; Stagel, Almers, Askerlund and Apelqvist, 2014; Colás-Bravo, Magnoler, Conde-Jiménez, 2018
1.2. Context of action	Mogensen and Schnack 2010; UNECE 2005; NEEAC 2005; Wals 2007	Flogaitis, 2007; Dimitriou, 2009; Hammond 1997; Jensen 2004; McClaren and Hammond 2005; McGill and Brockbank, 2004; Kyburz-Graber, 1999
2. Students' leadership in learning and teaching	Mogensen and Schnack 2010; Barratt-Hacking, Barratt and Scott 2007 [112]	Mogensen and Schnack 2010; Sandell et al., 2005; Schelly, Cross, Franzen, Hall and Reeve 2012; Shier 2001; UNESCO, 2014b; Uitto, Boeve-de Pauw and Saloranta, 2015; Garrecht, Bruckermann and Harms, 2018
3. Peer interaction	Frisk and Larson 2011 [113]; Wals 2007; Lave and Wenger 1991	Lave and Wenger 1991; Wals 2007; Lee, 2014; Wals and Tore van der Leij, 2009; Wals and Rodela, 2014; Jensen and Schnack, 1997
4. Community involvement	Frisk and Larson 2011; Wals 2007; Hart 1992	Lave and Wenger, 1991; Hogan 2002; Uzzell, Davallon, Jensen, Gottensdiener, Fontes, Kofoed, Uhrenholdt and Vognsen, 1994; Uzzell 1999; Green and Somerville 2014; Bascopé et al, 2018
5. Interdisciplinarity	Mogensenand Mayer 2005 [114]; Hungerford et al. 2003; Wals 2007;	Dimitriou, 2009; Walshe 2016; Borg, Gericke, Höglund and Bergman, 2012; Stables and Scott, 2002; Anyolo, Karkaaien and Keinonen, 2018; Dimenas and Alexandersson 2012; Wilhelm, Förster and Zimmermann, 2019

Notes: [a] Reference sources on which the framework of Varela-Losada et al. (2016), is based on; [b] The Action-oriented ESD framework is based on the reference sources in this column.

6. Discussion

In this study, we make use of the CLIA-model (Competence, Learning, Intervention, Assessment). In Section 2, the Competence and the Learning components as well as the Assessment component were discussed. Two important aspects of the Intervention component were also described in Section 2, namely holistic approaches and pluralistic approaches in ESD. The study further zoomed in on explaining a third aspect; action-oriented approaches in ESD. This aspect was in detail described by presenting the Action-oriented ESD framework.

Action-taking, students' leadership, peer interaction, community and interdisciplinarity seem to be prerequisites for developing students' action competence regarding problems related to SD issues. It seems that an action-oriented approach in ESD is a crucial dimension for the development of a powerful learning environment in ESD. However, it appears to be necessary to integrate all three aspects of a powerful learning environment in ESD into one conceptual framework—the Holism-Pluralism-Action-orientation in the ESD framework (Figure 5). This is because each of them adds something different to our understanding to effective ESD teaching. The holistic approaches refer to the content of ESD teaching, whereas the pluralistic and action-oriented approaches refer to the pedagogical methods applied in ESD. If one of these dimensions is lacking, ESD teaching will fail at stimulating students' action competence in relation to SD issues.

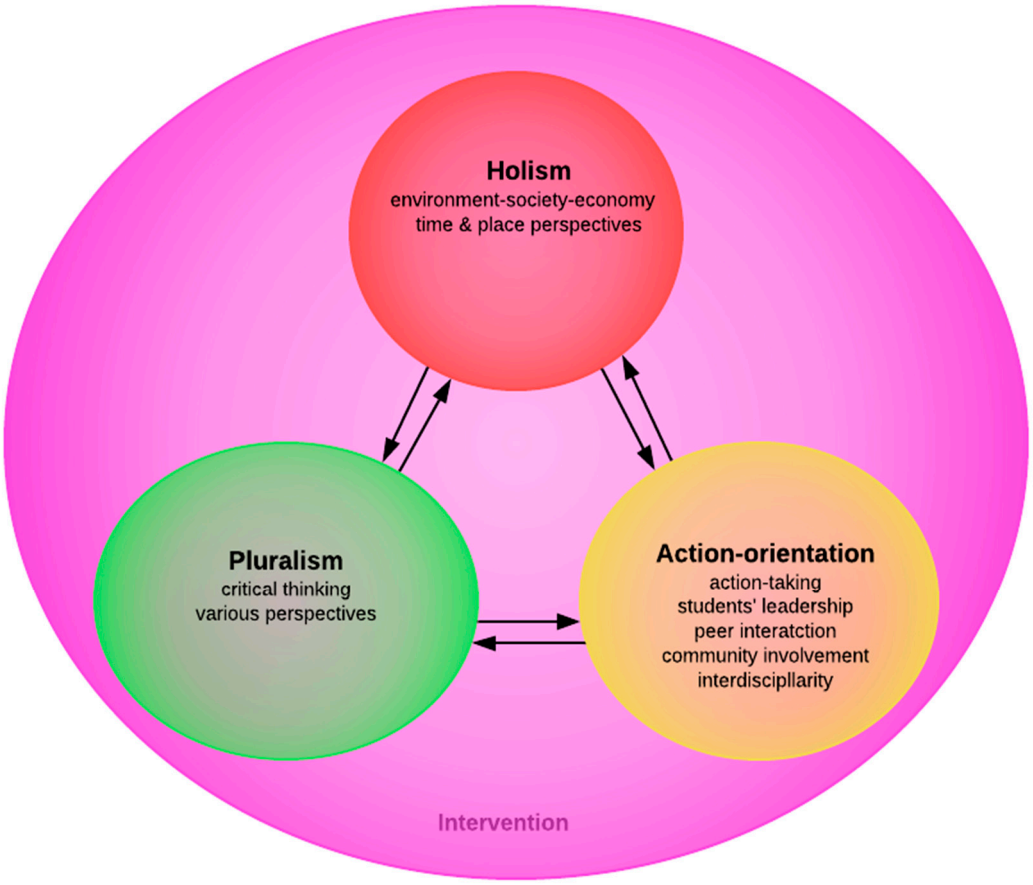

Figure 5. The Holism-Pluralism-Action-orientation in ESD framework.

Previous research (e.g., [22]) retains on two aspects; holism and pluralism, while the review of Varela-Losada et al. focuses exclusively on action-oriented approaches in ESD. The importance of integrating all three aspects lies on the fact that in that way we ensure that we are not applying holistic and pluralistic approaches without action-orientation. We avoid, therefore, the risk that students get only skilled to recognise and analyse SD issues but that they are not going further in doing something to actually cope with them. In that way, ESD learning would be limited to a rhetoric without acting. On the other hand, when isolating an action-oriented ESD teaching from holistic approaches to the content and from pluralistic approaches to handling SD issues, we run another risk. In that case, students would get skilled in taking actions but without enough reflection on the issue under consideration. Therefore, students would not be responsible for their actions and consequently, their action would be decided by teachers or parents. This means that students would learn to follow actions proposed by others without being able to form their own opinion first. The combination of two of the aspects of the framework is possible but if one approach is missing the cultivation of students' action competence in the framework of ESD seems not feasible.

Integrating holistic, pluralistic and action-orientated teaching in ESD allows to design powerful learning environments in ESD. The implementation of the Holism-Pluralism-Action-orientation ESD framework gives students the opportunity to develop that knowledge and these values, attitudes and skills which will enable them to take actions when dealing with SD issues. In other words, the implementation of the Holism-Pluralism-Action-orientation ESD framework creates these learning conditions (the Learning component) which, in turn, make students capable of taking informed and skillful actions (Competence component). The Holism-Pluralism-Action-orientation ESD framework can be used in assessing the instructional design in ESD, the learning conditions as well as students' outcome, that is, their action competence (the Assessment component). We see then, that the

Holism-Pluralism-Action-orientation ESD framework, which was created to explain the Intervention component of the CLIA-model can be used to guide the other components, as well. Thus, it has the potential to create powerful learning environments in ESD.

The Holism-Pluralism-Action- orientation ESD framework is motivated by a growing consensus on the importance of holistic, pluralistic as well as action-oriented teaching in ESD. These ways of teaching in ESD are well-recognised in the field. The framework is based on more than three decades of efforts to define knowledge on Environmental Education/Education for Sustainable Development teaching and on rich and growing body of research on effective ESD teaching. There is, however, the need to consider them in an integrated way.

Our conceptual framework can be operationalised in both qualitative and quantitative research designs. It seems that qualitative designs are by far and away the most commonly employed methodology in empirical studies in ESD implementation. In contrast, relatively few investigators have utilised quantitative approaches or mixed-method research designs which might be related to lack of instrument developments. Therefore, the Holism-Pluralism-Action-orientation in ESD framework can inspire the development of an instrument to measure the quality of learning environments and teaching practices in ESD. Even though United Nations Educational, Scientific and Cultural Organisation (UNESCO) [115] urges for research on monitoring, among others, the implementation of ESD initiatives [7], very few studies have focused on the implementation of ESD. Most research is done on teachers' perceptions (e.g., [6,23,28,31,116–118]) or teachers' attitudes towards ESD (e.g., [119]). However, it is important that recommendations as well as decisions made in the ESD policy and practice are based on empirical research on ESD implementation and effectiveness [14].

6.1. Implications for ESD Teaching Practice

We acknowledge that there is no single approach to integrate the three dimensions in teaching practice in a coherent way. Instead, there are various ways to integrate the components of the framework depending on when to stress a particular practice or idea. Teachers, even if they are familiar with ESD teaching [120], often feel uncertain and under-prepared about it [121–123].

One of the challenges, a teacher may face, is the way she or he and deals with different views, perspectives and values regarding an SD issue. This challenge becomes even greater when such a pluralistic teaching is accompanied by an action-oriented teaching. The teacher has to apply a nuanced way to reach to the solution respecting students' proposed solutions and then, she or he has to help students to translate into action, realistically and effectively. The personality and the personal views of the teacher may influence the students just because of the authority of their position. Andersson [119] found that student teachers are reluctant to express their standpoints and, in that way, influence students. However, as Sund [124] argues teachers convey unspoken messages and inevitably express particular thoughts and patterns of behaviour. On the other hand, dominant students may influence the rest of the students without solid argumentation. To avoid that, a teacher should develop learning conditions characterised by dedicated interlinks among speaking and listening [119]. The aim of a pluralistic teaching should be that students get involved in a common meaning-making process whereby alternative standpoints are respected.

Despite the above concerns, we argue that the teacher has the potential to avoid these pitfalls. As Chapman [73] stated, a critical examination of values and views is essential for student action-taking. We also see the implementation of pluralistic methodologies as a step before action-taking. Research revealed that students are capable of reaching a deep and nuanced standpoint, apply previous knowledge on a new context and connect knowledge values and experience [125–128]. Moreover, participatory active teaching methods such as, discussions, debates problem-solving, experiments, fieldwork, demonstrations and project-based learning [129–131] let students take responsibility of their own learning and effectively handle SD issues [59].

While the Holism-Pluralism-Action-orientation in the ESD framework is in the first place designed for research reasons, it could be used in teaching as well. Projects in real world problems and

'problem-based learning' are highly recommended in teaching sustainability through the use of the Holism-Pluralism-Action-orientation in the ESD framework. A teacher then should apply holistic teaching to the content of SD issues, and pluralistic and action-oriented teaching in terms of instructional design. Project-based learning in teams allow students to get actively engaged with dealing with SD issues and "not merely the study of second-hand abstractions" [132] (p. 2261). Also, action-research projects about an issue in the local community seeks to put practical solutions in practice through action and reflection [133] (p. 1). Another way to involve students in ESD is the use of methods such as role-play activities which will allow students to practice discussion and action-taking skills before applying them to the actual context [132].

It seems that the teachers get little support to teach ESD in an effective way. Teacher education and training opportunities for in-service teachers appears to be necessary. A recent study found evidence that innovative teaching approaches are not applied in teacher training programmes [134]. ESD teaching as envisioned by the Holism-Pluralism-Action-orientation in ESD framework requires that teachers have a strong understanding of the main concepts of the framework and are capable of applying appropriate practices to put it into practice. Particular attention should be given to the training on interdisciplinary methods.

6.2. Implications in ESD Research

Future research should focus on various levels to find evidence for the efficient implementation of the Holism-Pluralism-Action-orientation in the ESD framework in teaching practice. It should focus on: (a) teachers' knowledge and skills in teaching ESD; (b) students' abilities to follow the tasks determined by the framework and (c) other stakeholders that play a crucial role in an effective ESD implementation such as the school principals, school climate, curriculum and national policies as well as peers and the family.

Future research on teachers' level should examine how they can best learn to apply the framework in teaching at the beginning of their career and once they enter the profession. In addition to this, it should investigate what organizational, material, and human resources are necessary to support and sustain teacher learning over time. Anyolo et al. [59] showed that even if there are available recourses and material for ESD teaching, teachers have difficulty in applying their perceptions in instruction. As the authors conclude, there is the need for longitudinal and curriculum development studies to further investigate teachers' barriers at individual level and their pedagogical knowledge. Moreover, teachers/subject advisors provide teachers with professional support and therefore, they also play a crucial role in ESD teaching. Thus, how they support teachers, their perceptions about ESD teaching should also be examined. Research in ESD needs empirical evidence for effective teacher training, which should inform the discourse in the teacher training programmes and school curriculum, as well.

Future research on students' levels should focus on what progression of understanding and adoption of skills are realistic for each target group in terms of age or type of education. Research should aim at identifying how the nature and limits of children's cognitive abilities change with age and instruction. Students' preconceptions (possible misconceptions, as well) should also be examined and if and how conceptual change is possible. The effectiveness of the instructional approach used (e.g., curriculum materials, teaching practices, simulations or other technology tools, instructional activities)—and for what groups of students it is effective—should also be a matter for empirical research. Last but not least, assessing students' understanding and skills at the individual and collective level is also of high importance.

Research should also examine factors that enable or hinder the enactment of students' action competence, even if the teacher applies the most evidence based effective ESD teaching practices. For instance, parents or the cultural environment of the student may claim other life-style choices. This could inform ESD teaching. Research needs to consider three levels—system, school and classroom—in order to effectively inform future decisions.

7. Conclusions

The Holism-Pluralism-Action-orientation in ESD framework endeavours to move ESD further towards a more coherent vision of ESD learning environments succeeding in cultivating students' action competence regarding SD issues. The Holism-Pluralism-Action-orientation in ESD framework addresses the lack of an integrated conceptual framework in the field of ESD. It also addresses the interdisciplinary and complex nature of Sustainable Development by proposing a holistic teaching of SD issues in terms of their content. It identifies teaching which according to established literature promote students' action competence in the framework of ESD, namely pluralistic and action-oriented teaching. The integration of all three dimensions (holism, pluralism and action-orientation) is of high significance, for both research and teaching practice. The integrated framework should be applied in a coherent way at all levels of education in order to overcome potential barriers that prohibit teachers from applying it in teaching. Further research is needed with regard of the operationalising of the framework and use in ESD empirical learning environment research.

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