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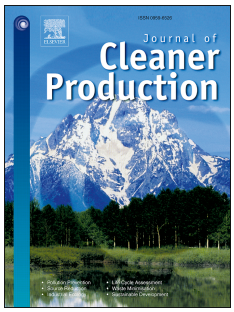

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PII: S0959-6526(18)30611-5

DOI: 10.1016/j.jclepro.2018.02.279

Reference: JCLP 12226

To appear in: *Journal of Cleaner Production*

Received Date: 6 February 2017

Revised Date: 23 February 2018

Accepted Date: 25 February 2018

Please cite this article as: Sinakou E, Boeve-de Pauw J, Goossens M, Van Petegem P, Academics in the field of Education for Sustainable Development: Their conceptions of sustainable development, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.02.279.

Academics in the field of Education for Sustainable Development: their Conceptions of Sustainable Development.

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Recent policy and academic voices in the field of Education for Sustainable Development put forward the importance of a holistic approach to the concept of Sustainable Development. We investigated the personal understanding of 'Sustainable Development' of scholars involved in teacher training programs and in the academic field of Education for Sustainable Development. To this purpose, an on-line survey was conducted based on the principle of comparative judgement. After careful selection, 249 academics were found to fit the specific profile for inclusion into the study. All of them were invited and56 of them participated. The instrument consisted of 16 statements built specifically to reflect different interpretations of sustainable development: fragmented, separated, holistic and integrated perspectives. Each participant compared 12 pairs of statements and were asked to decide which one better represented their interpretation of the concept of Sustainable Development in the context of Education for Sustainable Development. Using the D-PAC methodology for comparative judgement, our results show that the statements that were most often chosen prioritized an understanding of Sustainable Development according to which two or three of the dimensions of the concept (environment, society, economy) are seen as separated to each other and less often in an integrated way. The scale reliability was equal to 0.79, indicating good quality of the measurement. The results show that academics in the field of Education for Sustainable Development do not conceive of the concept of Sustainable Development holistically. There is also a tendency towards social and economic aspects of Sustainable Development. Implications for Education for Sustainable Development research and teacher training are discussed.

Keywords: Education for Sustainable Development; the concept of Sustainable Development; holistic approach; academics' conceptions

1. Introduction

Sustainable Development (SD) is often considered as an integrated concept of three pillars: environmental, economic and social (Giddings, Hopwood & O'Brien, 2002). Accordingly, Education for Sustainable Development (ESD) addresses sustainable development issues, which are not only environmental problems, but also social and economic ones (e.g., Corney & Reid, 2007). Rauch (2002) described what could be perceived as sustainable within each dimension. He identified environmental SD as the preservation of natural resources, which ensures the natural function of local eco-systems and of nature in general. He outlined social SD as solidarization and cooperation with other communities. Economic SD ensures quality of life through economic self-determination and self-development of both individuals and societies. The UN's publication *Transforming our World: the 2030 Agenda for Sustainable Development* contains 17 Sustainable Development Goals, which, according to the agenda are "*integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental* (UN, 2015, para 2, 5, 18 & 55). In addition to this, many scholars in the field of ESD consider a holistic approach to the SD concept important (see, for example, Sandell, Öhman & Östman, 2005; Boeve-de Pauw, Gericke, Olsson & Berglund, 2015;).

This study is an attempt to respond to the call in the final report of the UN Decade of Education for Sustainable Development (DESD), entitled *Shaping the Future We Want*. The final report raised the issue of monitoring ESD practice (UNESCO, 2014a). The focus of this study lies in initial teacher training programmes. Initial teacher education has an impact on ESD teaching at school (Nolet, 2013), partly because it influences teachers' conceptions (Stodolsky, 1993). Trainee teachers can be seen as university students, who are future citizens and leaders (Collins, 2017; Lozano, 2006). Trainee teachers are those educating students in the near future. Student teachers' understanding of sustainability is an important prerequisite for cultivating teachers' skills in ESD (Firth & Winter, 2007; Hofman, 2012). However, student teachers and teachers do not hold a holistic understanding of SD (e.g., Birdsall, 2014). Initial teacher education may provide us with explanations for this.

Student teachers' learning is based on university-based sources of learning, such as academic literature, discussion sessions and other activities during the university courses, which are aimed at subject learning (Corney & Reid, 2007). Academics engaged in teacher training programmes (ETUCE, 2008) play an important role since they provide student teachers with learning experiences (European Commission, 2013). They influence student teachers through both how and what they teach (Loughran & Berry, 2005). They function implicitly, or not, as role models for trainee teachers (Lunenberg, Korthage & Swennen, 2007). As Loughran (1997) argued, teacher educators give student teachers the opportunity to understand and experience teaching. It is then, the role of the student teachers to make their personal decisions as to how to incorporate this (Loughran, 1997). The ESD specialists who give ESD courses in teacher training programmes are responsible for educating students in the concepts and approaches of SD (Lozano, 2006; Yuan, Zuo, Huisingh, 2013). Academics who give ESD courses to trainee teachers need to hold a holistic view of the SD concept in order to communicate it to student teachers (Hofman, 2012; ETUCE, 2008).

In the field of teacher education in ESD, no research has been conducted so far on the personal conceptual SD understanding of academics teaching student teachers and, thus, the aim of this study is to determine the degree to which the SD conceptions of academics in the field of Education for Sustainable Development, who teach trainee teachers, are considered holistic. To do so, it is necessary to determine "…*the center of gravity between these three dimensions*…", as proposed by Borg et al. (2014, p. 530).

The research questions for this study are:

1. To what extent do academics in the field of Education for Sustainable Development, who teach trainee teachers, conceive the concept of Sustainable Development in a holistic way?
2. Are there any differences in their conceptions of Sustainable Development?

2. The Concept of Sustainable Development in ESD

The concept of SD became familiar to the public with the report 'Our Common Future', which was published in 1987 by the World Commission on Environment and Development. In the report, also known as the 1987 Brundtland Report, sustainable development was defined as '…development that meets the needs of the present without compromising the ability of the future generations to meet their own.' (WCED, 1987, p. 41). This definition addresses the environmental issues, but it also focuses on their social and economic implications (Berglund, Gericke & Rundgren, 2014). Many scholars put emphasis on the interconnections of the three dimensions. Among them were Giddings et al. (2002), who argued about the multi-level structure of the concept. They held the view that the economy depends on society and, in turn, society depends on the environment. Lozano (2003 in Lozano, 2006) provides a definition, which nicely integrates all three aspects: ''…a change process, in which the societies improve their quality of life, reaching dynamic equilibrium between the economic and social aspects, while protecting, caring for and improving the natural environment. This integration and equilibrium among these three aspects must be taught and transferred from this generation to the next and the next".

The concept of SD is not static but rather dynamic, meaning that the concept of SD can be understood in several ways, according to different perspectives (Haubrich, 2007; Makrakis, 2010). Due to the dynamic nature of the concept, there is no tangible definition (Berglund et al., 2014). Therefore, the researcher who examines SD should give a detailed description of the meaning, which she/he assigns to it (Bonnett, 1999; Berglund et al., 2014).

Teaching based on a holistic approach to the content of ESD aims at distinguishing the implications of SD issues within each dimension from different points of view (Boeve-de Pauw et al., 2015; Olsson, Gericke & Chang Rundgren, 2015; Berglund & Gericke, 2016). If we deal with each dimension separately, the contradictions among the dimensions will not be obvious. However, we have to deal with the conflicting implications of the dimensions, when we have to take decisions. We end up having to set priorities among the dimensions in order to be able to reach a decision (Berglund & Gericke, 2016). The adoption of a holistic approach to ESD was criticized by Kopnina (2014) who argued that it lets students focus on economic and social aspects of SD issues and eventually, distracting them from

environmental issues and this obscures eco-centric perspectives. However, Boeve-de Pauw et al. (2015) found that when teachers adopt a holistic approach during teaching, students have a greater degree of knowingness of environmental issues. This refers to only to factual knowledge but it has also an affective based component (Olsson & Gericke, 2016; Olsson et al., 2015). Research in ESD considers two ways of seeing the SD concept holistically. That is, all three dimensions are involved either in a separate way (e.g., Boeve-de Pauw et al., 2015; Berglund & Gericke, 2016) or in an integrated way (e.g., Giddings et al, 2002; Berglund & Gericke, 2016).

To unravel a holistic understanding of the SD concept, innovative teaching approaches should be applied (Du, Su & Liu, 2013). Du, Su & Liu (2013) argued that teaching approaches, such as self-regulated learning, active learning, experiential learning theory based on Kolb's learning circle, constructive learning, problem-based and project-based learning promote a holistic understanding of SD. This holds true for inter-disciplinary teaching approaches as well (Ferrer-Balas et al., 2010; Lozano, 2010). As an attempt to develop a holistic understanding of the SD concept, an exploratory study was conducted by Pappas, Pierrakis and Nagel in 2013. They developed a curriculum model based on the Bloom's Taxonomy of educational objectives (1956). They allowed students to understand the interrelations among the dimension by using a systems perspective. Jensen (2015, 2016) proved that participatory action research educational programmes could help integrate all three pillars in an ESD curriculum. Action research educational programmes are suitable for social settings with conflicting values and interests as SD issues (Herr & Anderson, 2005). By applying a pluralistic teaching approach to ESD, students are encouraged to critically consider different perspectives and interests when dealing with SD issues. This approach is considered vital for the students to understand SD holistically (Öhman, 2008; Sterling, 2010; Borg et al., 2012). Accordingly, action research educational programmes have the potential to apply a pluralistic approach. It is possible that action research could appear in instruments that can be used in other settings as well (Herr & Anderson, 2005; Jensen, 2015, 2016).

3. Teachers' conceptions of SD

Öhman & Öhman (2012) suggested examining how teachers perceive the relationships of SD dimensions (as cited in Berglund & Gericke, 2016). An overview is presented in the following paragraphs and it is shown in Table 1. This will make it possible to compare their perceptions with those of the ESD academics, as well as detect differences.

Few researchers have investigated how teachers understand the interconnections of the three dimensions of SD. Upper secondary school teachers in Sweden have difficulties integrating the three dimensions of the concept of SD (Borg, Gericke, Höglund & Bergman, 2014). Student teachers, as well as in-service primary teachers in New Zealand, hold a shallow and simplistic understanding of sustainability (Birdsall, 2014), while primary teachers in Greece hold misconceptions about the concept of SD (Spyropoulou, Antonakaki, Kontaxaki & Bouras, 2007). Finally, upper secondary school teachers in Sweden do not promote a holistic understanding of SD when teaching ESD, due to a shortage of good practices to inspire them and a lack of expertise on SD (Borg et al., 2014; Borg, Gericke, Höglund & Bergman, 2012).

The teachers recognize the environmental dimension of SD the most. This means that from all three dimensions, the teachers identify the environmental one as being closer to the idea of SD. This is the case with student teachers in science and geography in UK studies (Summers & Childs, 2007; Summers, Corney & Childs, 2004), student teachers in New Zealand (Birdsall, 2014), Turkish science student teachers (Kilinc & Aydin, 2013) and science and social science teachers in Sweden (Borg et al., 2014). Upper secondary teachers and student teachers give the least priority to social factors (Borg et al., 2014; Gustafson, Engström & Svenson, 2015; Summers et. al., 2004; Summers & Childs, 2007). This is not consistent with the results of the study by Berglund and Gericke (2016), who found that when students deal with the dimensions separately, they give priority to social factors. Borg et al. (2014) found that teachers feel uncertain about the economic factors associated with SD issues. This may explain the uncertainty of students as to the economic implications of SD (Berglund & Gericke, 2016). In contrast to the above studies, the study of Ärlemalm-Hagsér and Sandberg (2011) revealed a more holistic approach to SD. They concluded that pre-school teachers view a SD issue as an environmental or democratic issue, with particular emphasis on topics that not ecological per se, such as children's views, social relations, gender equality and cultural diversity.

Table 1
Studies on teachers' conceptions of SD

Focus	Education level	References
Conceptual understanding of sustainable development in relation to their subject discipline.	Upper secondary school teachers from different subjects.	Borg, Gericke, Höglund & Bergman, 2012; Borg, Gericke, Höglund & Bergman, 2014.
Views of SD, their own beliefs and how they teach SD.		Gustafson, Engström & Svenson, 2015.
Conceptions of sustainable development.	Student science teachers. Postgraduate student science teachers.	Kilinc & Aydin, 2013 Summers, Corney, & Childs, 2004; Summers & Childs, 2007.
Conceptual understanding of sustainability and the level of self-awareness of their understanding.	Primary student teachers.	Birdsall, 2014.
Perceptions about environmental issues and attitudes towards ESD.	In-service primary teachers.	Spyropoulou, Antonakaki, Kontaxaki & Bouras, 2007.

Concept understanding of sustainable development and pedagogical practices.	Preschool teachers	Ärlemalm- Hagsér & Sandberg, 2011.

4. Methods

4.1. Participants

The participants' who were chosen for this study were researchers in the field of ESD/EfS (Education for Sustainability), who, at the same time, gave ESD courses in teacher training programmes (e.g., Department of Educational Sciences). Whether they fulfilled the criteria was determined based on their academic profile as it was described on the website of the affiliated institute or on the biographical notes of the articles. We applied a multi-stage random sampling process. It is considered to be an objective procedure, which results in a sample representative of the population and, thus, the collected data may be used for inferential purposes (Singh, 2006).

4.1.1. The Multi-stage sampling process

4.1.1.1. Stage one: Selection of journals

The first step of the sampling process was to look for participants among the authors in academic journals in the field of ESD, EfS and EE. EE and ESD are distinct, but complementary (McKeown & Hopkins, 2003). EE focuses more on environmental protection, whereas ESD takes into consideration economic and human development related to environmental protection (McKeown & Hopkins, 2003). Lang (2004) pointed out that ESD and EfS should not be used interchangeably; ESD focuses on the learning process in order to promote SD, whereas EfS puts emphasis on building capacity to live more sustainably. However, in this study, the authors use the term EfS to determine which academics are engaged with EfS; viewing it as equivalent of ESD. EE is included, since the authors accept that it lies at the origin of ESD. Table 2 shows the chosen journals, which were a random selection from a range of possible journals. In the Supplementary Material, the reader can find the Scopus Metrics for the journals of Table 2, which are included in Scopus Metrics. Table S.3. shows the journals without metrics., Journals in areas like democracy and education, citizenship, social justice, economic development, etc., were excluded. ESD is seen here as an autonomous academic field and as such has its own academic staff. Moreover, the journals on the aforementioned topics do not host specific articles on ESD, as this is clear from their aim and scope, in comparison to journals in the field of ESD, EfD/ EE. Journals in Table S.1. in the Supplement Material were examined to see whether they met the selection criteria (mentioned in the following paragraph) or not. We found that only one hosted an article about the concept of Sustainable Development as such. This confirmed our hypothesis that journals

in democracy, citizenship, social justice, economic development and education do not regularly host articles in ESD.

4.1.1.2. Stage two: Selection of articles

The second step was to choose research articles, which were concerned with the topic of the study, that is, traces of the SD concept in the context of ESD. Specifically, abstracts of the articles were selected, which included the terms Sustainability and/or Sustainable Development and, also, the concepts of SD and sustainability, such as concept, notion, term, idea of SD/Sustainability, conceptualization/conceptual understanding of SD/Sustainability, views on SD/Sustainability, (mis)conceptions/perceptions about SD/Sustainability and educational content around SD/Sustainability.

4.1.1.3. Stage three: Selection of academics invited

Whether the authors were also academic staff training teachers was determined based on their academic profile, as described on the website of the affiliated institute or on the biographical notes of the articles. In total, 249 panellists were invited and the final number of participants was 56. They worked in higher education institutions, which offer initial teacher education programmes, in the U.S.A., Canada, South Africa, Botswana, Australia, New Zealand, Jamaica, Malaysia, the Republic of Korea, Japan, Israel, Turkey, Egypt, Brazil, Mexico, as well as in a number of European countries, such as the UK, France, Finland, Sweden, Germany, Iceland, Cyprus, Greece, Spain, the Czech Republic, Malta, Denmark, Ireland, the Netherlands, Germany, Belgium, Austria, Latvia, Lithuania, Poland, Italy, Switzerland, Norway, and Estonia. The Supplementary Material included: (a) information on the number of the ESD academics invited per country (Figure S.1.), (b) the affiliations of the academics (xls file), (c) their positions at the university (Figure S.2.) and the number of their ESD publications as found on their personal website or on Google scholars' metrics (Figure S.3.).

Table 2
Academic journals as resources for sampling

Journals	Number of articles[a]	Journals	Number of articles[a]
The Journal of Environmental Education	14	Applied Communication and Environmental Education	4
Environmental Education Research	33	Environment and Behaviour	-
The Journal of Education	9	Research in Science and Technological Education	6

for Sustainable Development			
Journal of Teacher Education for Sustainability	5	International Journal of Science and Environmental Education	1
Australian Journal of Environmental Education	5	Sustainability, Section of Sustainability Education and Approaches	3
Canadian Journal of Environmental Education	5	International Journal of Geographical and Environmental Education	1
Discourse and Communication for Sustainable Education	4	International Journal of Early Childhood Environmental Education	3

Note. [a] The number of articles in each journal which refer to the concepts of SD and sustainability.

4.2. The procedure

4.2.1. The choice of the Comparative Judgement Methodology

In order to receive answers to our research questions, an on-line survey was conducted. The aim of the first research question was to explore the ESD academic staff's conceptions collectively. Thus, the construction of a ranking of conceptions was required. At the same time, the paper seeks to pinpoint the differences with regards to the conceptions of the participants. We decided to use the method of comparative judgement (CJ) . In CJ, the participants examine several representations of a construct and they decide which ones are closer to the latter (Thurstone, 1927) and all the comparisons are considered collectively. The final scores and the rank order of the representations depict the shared consensus of the participants (Lesterhuis, Verhavert, Coertjens, Donche & De Maeyer, 2017). The differences among the judgments of the participants do not cause problems to the final scores and rank order (Bramley & Gill, 2010). The different perspectives are instead taken into consideration in the final result (Lesterhuis et al., 2017).

4.2.2. The D-Pac tool

The on-line D-PAC tool[1], which utilizes a comparative judgment methodology, was used (Mortier, Lesterhuis, Vlerick & de Maeyer, 2015). In the beginning, the researchers informed the participants that they would encounter a series of statements expressing global SD issues, which could be incorporated in an ESD curriculum. The participants were called

[1] D-Pac stands for 'Digital Platform for the Assessment of Competences'. The D-Pac tool is a digital platform, developed in Flanders, which uses comparative judgments methodology for a variety of purposes with reliable and valid results. For more information go to the site http://www.d-pac.be/english/.

on to compare the statements pairwise and decide which statement better represented the idea of SD in the context of ESD. The tool randomly generated 12 pairs of statements for each participant taken from a list of all possible pairs. Due to the fact that pairs are randomly generated, the bias of inflating the reliability is prevented (Lesterhuis et al., 2017). In each comparison, the participants were given the opportunity to justify their choice by giving short explanations. The argumentation gave us feedback related to the judgment (Athanasou, 1999) and enabled us to control the validity of the judgments (Whitehouse, 2012).). Figure 1 shows the procedure, which was followed.

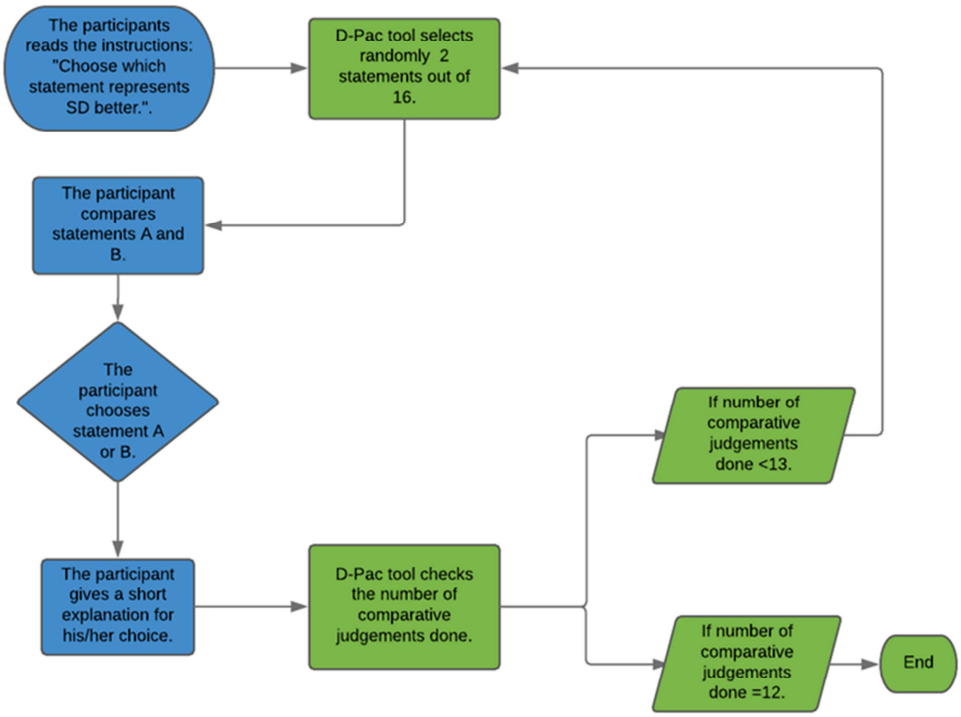

Figure 1. The steps the participants took in order to complete the survey. The participants were called on to compare 12 pairs of statements and to choose each time one represented SD better. The tool randomly generated 12 pairs of statements for each participant. In each comparison, the participants were given the opportunity to justify their choice by giving short explanations.

The Bradley-Terry-Luce model (Bradley & Terry, 1952; Luce, 1959), equivalent of the Rarch model, was used to generate rough ability estimates (estimated logit scores) for each representation (Lesterhuis et al., 2017). The estimated ability of the representations was measured on the basis of the number of times that each representation was thought to contribute to the construct (Lesterhuis et al., 2017). Based on the estimates and normal distribution, the rank order was created (Lesterhuis et al., 2017).

4.2.3.A reliable and valid approach

This approach guaranteed the reliability and validity (Whitehouse & Pollitt, 2012). Thurstone (1927) found that a judge, that is a person who forms an opinion or a conclusion about a piece of work, is more reliable when comparing two pieces of work, rather than attributing an absolute value to a piece of work. In order for the Rasch model to generate a reliable rank order, a pairwise comparison of all the statements is not necessary (Whitehouse & Pollitt, 2012). Moreover, the use of the Rasch model enabled us to identify outliers: the participants or representations, which had very different scores from the consensus. Thus, the Rasch-model allows the researcher to detect, not only different SD conceptions, but also whether a statement is unclear to participants (Whitehouse & Pollitt, 2012). However, the interpretation of the outliers may sometimes be problematic (Whitehouse & Pollitt, 2012). This is because the Rasch model is interpreted in terms of patterns of correct and wrong answers, while the method of comparative judgments is based on the assumption that 'A is better than B' or 'B than A' (Lesterhuis et al., 2017). The validity of the method lies in its holistic character; that the concept under investigation is viewed in an integrated way (Sadler, 2009). This makes it possible for the judge to see the SD concept as a whole. A pilot study was first conducted to test the practicability of the tool as a specific instrument with academics. The pilot study revealed that the tool was practical. Nine respondents took part in the pilot survey. All of them had the same concerns about the same two statements. They also expressed the concern that the initial question of the instrument was vague to them. This gave us directions as to how to rephrase it so that it would convey the same message more clearly to all the participants. We modified the two statements and the initial question accordingly. The explanations given by the respondents after each comparison allowed the authors to conclude that the rest of the statements were interpreted as intended by the authors. We ensured that the respondents were unable to guess the aim of this research to guarantee unbiased results.

4.3. The instrument

The instrument consisted of 16 statements, which were structured based on a series of SD issues raised in international ESD policy documents (Table 3). They were organized in four complexity levels of the SD concept (Table 4). The structure of the levels was based on the idea that "*an analytical framework has to include tools to examine where the center of gravity is between these three dimensions to be able to analyze to what extent a certain conception of SD can be said to be holistic"* (Borg et al., 2014, p. 530). Based on that idea, the authors created a multi-level tool. The following paragraphs describe the structure of the levels in detail.

The reader should see the tool as a skeleton consisting of four levels. The levels are structured based on: (a) the number of dimensions of the SD concept involved (i.e. the environmental, societal, economic dimension) and (b) on the relationships among the three aforementioned dimensions. . The levels are increasingly more complex. They form a hierarchy starting from a fragmented view of the SD concept to a more holistic and integrated view of it. Each level is divided into categories, which have a slightly different content regarding SD from each other.

The first level (labelled *level 0*) reflects the one-dimensional understanding of the

concept of SD. We argue, therefore, that level 0 represents a fragmented view of the SD concept. This level is divided into three categories, each for each dimension. That is, there is one category for the environmental dimension, one for the social dimension and one for economic dimension. This is shown in Table 5.

The second level (labelled *level 1*), in our perspective, represents a separate view of the concept because it is constructed from two dimensions, which are easily distinguished from each other: (a) the basic dimension, and (b) the basic dimensions' implication in relation to one of the other two dimensions of SD. This level approaches SD issues from two aspects. It includes six categories. Each dimension is prioritized in two categories and it is combined with another dimension in each case. Table 5 shows the six categories of level 1. For instance, the category *Environmental-Social*, refers to environmental issues, which have social implications. The first dimension is always this one, which is prioritized against the second one.

The third level (labelled *Level 2*) refers to all three dimensions. Level 2 is structured based on: (a) the basic dimension and (b) its implications related to the other two dimensions. Though all the dimensions are considered, one is foregrounded. The dimensions are easily distinguishable from each other. We argue, therefore, that Level 2 represents a holistic but separated view of the SD concept. This level includes three categories, which are presented in Table 5. For example, the category *Environmental- Economic-Social* refers to environmental issues with economic and social implications. The first dimension is always this one, which is prioritized against the other two.

The last level (labelled *Level 3*) includes all three dimensions, which exist in a balance. The three dimensions are not distinguishable from each other. Level 3 depicts a holistic, as well as integrated, view of the concept. Level 3 contains one category, which refers to all three dimensions in an integrated way (Table 5).

Based on the purpose of each category, as just described, the authors have developed each statement. The content of each statement is then based on the SD issues as raised in international ESD policy documents (Table 3).

Table 3

The international policy document used to development the instrument

The UNESCO document *Framework for the United Nations Decade of Education for Sustainable Development: International Implementation Scheme* (2006).
The Bonn Declaration, which was the outcome of the UNESCO World Conference on Education for Sustainable Development in 2009.
The UN's document *Transforming our world: The 2030 Agenda for Sustainable Development* (2015), which is supported by the Global Action Programme, issued at the World Conference on ESD in 2014 (Aichi-Nagoya, Japan).

Table 5
Statement per complexity level of the SD concept.

Table 4
The structure of the complexity - levels of the SD concept

	Basic dimensions	Implications [a]	Perspective
Level 0	1	0	Fragmented
Level 1	1	1	Separated
Level 2	1	2	Holistic-Separated
Level 3	3	0	Holistic-Integrated

Note.[a] Implications of the basic dimensions.

Level 0	Perspective	Category[a]	Statements
1	Fragmented	Environmental	Sea level rise has a negative impact on coastal terrestrial vegetation.
2	Fragmented	Social	Access for the disabled to buildings and places, as well as goods and services.
3	Fragmented	Economic	Facilitating local business development.
Level 1			
4	Separated	Environmental-Social	Due to water depletion and desertification, large parts of a population of people emigrate.
5	Separated	Environmental-Economic	Declining fishery resources threaten the livelihood of fishermen.
6	Separated	Social-Environmental	Sufficient food supplies for all by sustainable agriculture.
7	Separated	Social-Economic	Provision of health and wellness for all can contribute to the economic development of a community.
8	Separated	Economic-Environmental	Overconsumption of solid fuels and energy causes depletion of natural resources.
9	Separated	Economic- Social	Eradication of poverty ensures well-being for all.
Level 2			
10	Holistic-Separated	Environmental-Economic-Social	Frequent droughts due to climate change cause economic disasters for farmers and, thus, affects their well-being.
11	Holistic-Separated	Social-Environmental-Economic	Securing tenure rights by big landowners and companies leads to a shortage of soil and arable land and, thus, prevents eradication of poverty.
12	Holistic-Separated	Economic-Environmental-Social	Sustainable economic growth in urban areas ensures access to education and health services for all.
Level 3			
13	Holistic-Integrated	All three dimensions in an integrated way	Promoting the import of goods from developing countries with fair trade strategies.

14	Holistic-Integrated	All three dimensions in an integrated way	Energy efficiency and use of energy for the industry without depriving households of access to affordable energy.
15	Holistic-Integrated	All three dimensions in an integrated way	Promoting tourism and recreational activities in rural areas without damaging them.
16	Holistic-Integrated	All three dimensions in an integrated way	Local communities should acquire rights and associated duties to use and control land, fisheries and forests.

Note. [a]The first dimension is this one which is prioritised against the other(s).

5. Results

5.1. The degree up to which ESD academics hold a holistic view of SD.

The conceptions of ESD academics were found to be represented by statements depicting a separated view of the SD concept (Level 1) or a holistic view of it, that is, either separated or integrated (Levels 2 & 3). A rank order of the statements was created. This rank order showed how well each statement reflects the idea of SD in ESD in comparison to the others (Figure 2). The y-axis represents the estimated scores expressed in logits (from now on scores) and they are indicated with dots. The rank order starts with the statements with low scores (negative discrimination, starting from -0.80 up to -0.07) and ends with high scores (positive discrimination, starting from 0.20 up to 1.06). Thus, the rank order reflects the extent to which a statement loses or wins in comparison with a zero (mean) reference. The statements with low scores represent the idea of SD in ESD to a lesser extent. However, the statements with high scores depict the idea of SD in ESD better (table 6). Table 7 shows the dimensions relevant to the statements with high scores.

Since the data deriving from comparative judgments can be analyzed by using the Bradley-Terry-Luce model (Bradley & Terry, 1952; Luce, 1959), an equivalent to the Rasch model (Andrich, 1978), the Rasch separation reliability can be calculated. To indicate the reliability of the rank order, the scale separation reliability (SSR) was calculated, resulting in SSR=0.79. The SSR provides an indication of the stability of the rank order (Verhavert, De Maeyer, Donche & Coertjens, 2016). One may argue that the Cronbach's Alpha and KR-20 reliability coefficients should be used. Cronbach's Alpha and KR-20 pertain to the classical test theory, whereas Rasch and IRT pertain to latent trait theory. Estimations of LTT-models are more reliable when the differences between raters are smaller (Andrich, 1982), as in this study.

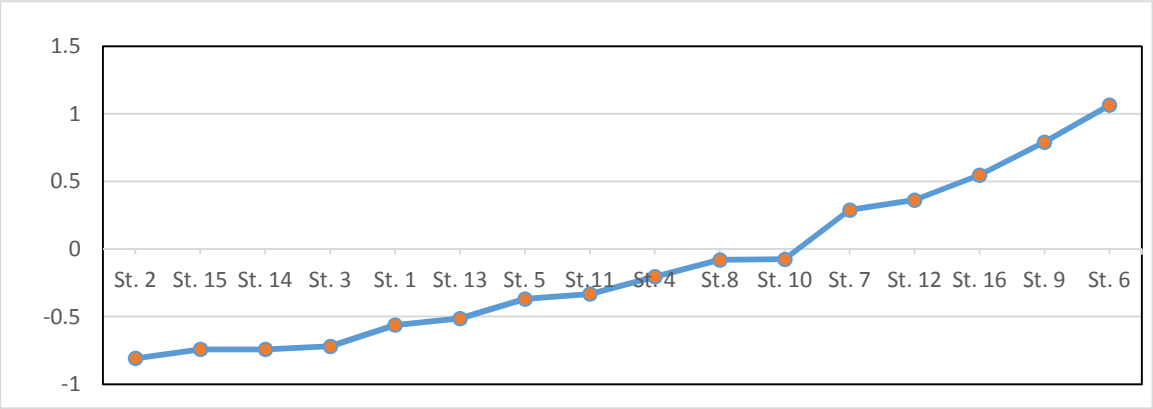

Figure 2. How well each statement depicts the idea of Sustainable Development in ESD in comparison to the others. "St." stands for the number of each statement. The y-axis represents the estimated scores expressed in logits (the dots). The rank order starts with the statements with low scores and ends with high scores. It reflects the distance of the score of each statement from the mean (zero). The statements with low scores represent the idea of SD in ESD less well, while these higher scores depict the idea of SD in ESD better.

Table 6

Statements with low and high scores

Statements with low **scores**		
Number of statement[a]	Level[b]	Statement
2	0	Access for the disabled to buildings and places, as well as goods and services.
15	3	Promoting tourism and recreational activities in rural areas without damaging them.
14	3	Energy efficiency and use of energy for the industry without depriving households of access to affordable energy.
3	0	Facilitating local business development.
1	0	Sea level rise has a negative impact on coastal terrestrial vegetation.
13	3	Promoting the import of goods from developing countries with fair trade strategies.
5	1	Declining fishery resources threaten the livelihood of fishermen.
11	2	Securing tenure rights by big landowners and companies leads to a shortage of soil and arable land and, thus, prevents eradication of poverty.
4	1	Due to water depletion and desertification, large parts of a population of people emigrate.
8	1	Overconsumption of solid fuels and energy causes depletion of natural resources.

10	2	Frequent droughts due to climate change cause economic disasters to farmers and thus affect their well being.
Statements with high **scores**		
7	1	Provision of health and wellness for all can contribute to the economic development of a community.
12	2	Sustainable economic growth in urban areas ensures access to education and health services for all.
16	3	Local communities should acquire rights and associated duties to use and control land, fisheries and forests.
9	1	Eradication of poverty ensures well-being for all.
6	1	Sufficient food supplies for all by sustainable agriculture.

Note. [a]The number of each statement. [b] The level which each statement belongs to.

Table 7

The levels of the statements with high scores and the dimensions involved

Statement	Level	Perspective	Category [a]
7	1	Separated	Social-Economic
12	2	Holistic-Separated	Economic-Environmental-Social
16	3	Holistic-Integrated	All three dimensions in an integrated way
9	1	Separated	Economic-Social
6	1	Separated	Social-Environmental

Note. [a] The first dimension is this one which is prioritised against the other(s).

The respondents had the opportunity to justify why they had chosen the aforementioned statements. Their argumentation for each of their choices gave feedback related to each judgment (Athanasou, 1999), which provides evidence for the validity of this instrument (Whitehouse, 2012). The respondents provided two types of arguments for their choices. Both demonstrated that they had understood the statements and the initial questions of the instrument as the authors intended. The first one concerned the structure of the statements, that is, whether they viewed SD issues in a holistic way or not and the second one was regarding content-oriented arguments. Table 8 illustrates these two types of argumentation. Their argumentation supported their choices and pointed out aspects of SD, which were less or more important for them. Their argumentation was consistent with the rank order. The arguments with low scores were in line with the respective statements. The same went for the arguments with high scores. To sum up, the fact that the argumentation was consistent with the rank order of the statements lead us to conclude that: (a) the statements were understood and (b) the participants had answered the survey as expected.

Table 8

Types of arguments which support the participants' choices

Types of arguments	Examples
SD issues	Arguments for low scores

structure in terms of dimensions	Either only human-centred or social aspects or natural environment centred aspects or economic-centred aspects of SD issues are taken into consideration. Arguments for high scores All three dimensions (environment, economy, society) are taken into consideration. Cultural and political aspects of SD are taken into consideration as well.
Content-oriented arguments	Arguments for low scores The depletion of natural resources is considered less important than nutrition and well-being. Concerns about sustainable tourism and recreational activities, as well as fair trade practices. Businesses, local or not, more often than not, exploit the natural resources. Thus, they should consider social and ecological justice. Arguments for high scores Social justice and distribution of wealth are key issues in ESD since SD aims at ensuring well-being for all humans. Nutrition and eradication of poverty suggest well-being and they are included in the Sustainable Development Goals (SDGs). Public participation ensures well-being and health, as well as environmental and economic sustainability. Sustainable agriculture suggests environmental protection, efficient energy use, as well as the equitable treatment of workers.

5.2. Differences of SD conceptions among ESD academics

Since comparative judgment methodology makes use of the BTL-model, a number of quality measures can be calculated. To answer our second research question, the model's data fit was analyzed by using chi-squared (2) goodness of fit statistics (Rasch, 1993). Based on the residuals, these statistics made it possible to quantify how far judgments differed from what the model predicts (Lesterhuis et al., 2017). Two types of fit statistics exist, the infit and the outfit. According to Linacre and Wright (1994), the infit statistics is less prone to occasional mistakes and, therefore, it is the preferred one. A large infit for participants means that they consistently judge away from the consensus (Pollitt, 2012).

Figure 3 indicates the distribution of the infit statistics of the participants. We can see the dispersion as an indication that some ESD academics do not completely agree with what can be seen as the general consensus (the line at point 0 in Figure 2). The line at point 1 shows the average deviation of all the ESD academics. The black line, the misfit cut-off, is two standard deviations above the mean. An infit that lies two standard deviations from the mean is considered large (Pollitt, 2012). A large infit for participants means that they consistently

judge away from the consensus (Pollitt, 2012). Once above this line, one is considered a misfitting respondent. In this case, it is a participant who made only two comparisons instead of 12.

We have also calculated the distribution of the infit statistics of the statements. A statement with a high infit could contain something unusual (Bramley, 2007). The infit statistics for each of the statements lies around the mean, which implies that the statements do not contain something irrelevant to the SD concept or something hard to be understood, or strange on the part of the ESD academics.

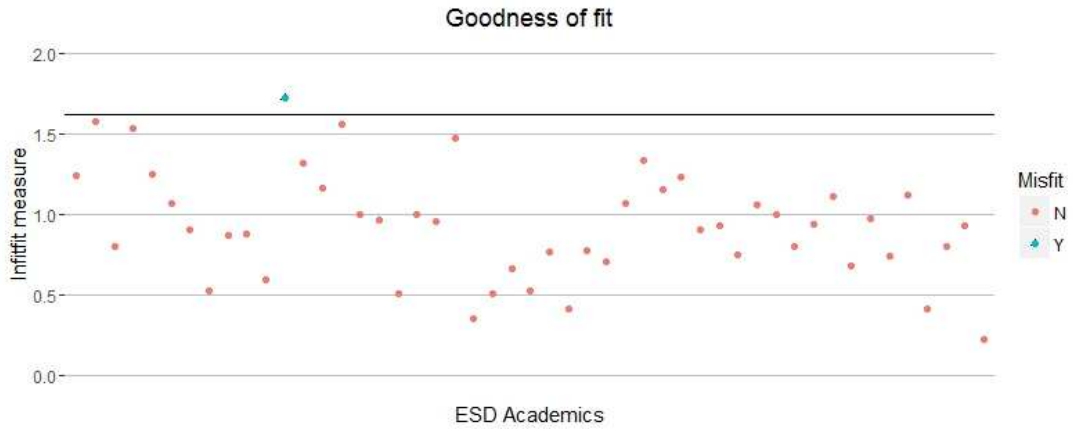

Figure 3. The distribution of the infit statistics of the participants shows the extent to which each ESD academic deviated from the group consensus. Each circle represents an academic from the sample. Y stand for 'Yes' and N stands for 'No' as a response to the infit measure. The line at point 1 shows the average deviation of all the ESD academics. The black line is the misfit cut-off, above which a participant is considered a misfitting respondent, in this case, it was a participant who made only two comparisons instead of 12.

6. Discussion

In this section, the results of the study are discussed. The main finding of the study is that the academics in the field of ESD, who teach trainee teachers, do not conceive of the concept of SD holistically. Furthermore, there is a tendency towards the social and economic aspects of SD. Thus, it seems that there is an even greater distinction between EE and ESD and that the latter is gradually becoming a more diversified subject. This is in contrast with what Stables and Scott (2002) claimed about fifteen years ago. They considered ESD to be an extension of EE and argued that the latter tends to see sustainability issues through EE lenses. However, as early as in 1995 when the ESD discourse was starting, Smyth claimed that, while EE focuses on environmental concerns without much attention given to social and human development issues, ESD includes social and economic development issues alongside with their environmental aspects. This distinction between EE and ESD is apparent on the academics' personal websites or in the biographical notes of their publications. By comparing the findings of this study and what can be found on the academics' personal websites or in the biographical notes, the authors conclude that ESD academics pay greater attention to social factors than EE academics do.

In line with the results of the rank order, the argumentation of ESD academics showed that the social and economic issues are prioritized against the environmental ones, with

nutrition, eradication of poverty, well-being for all humans and social justice being emphasized more than environmental protection. Even sustainable agriculture is not related to environmental protection alone but also to the equitable treatment of workers, which is a socio-economic issue. However, ESD academics seem to be sceptical about sustainable tourism and recreational activities as well as about fair trade practices, even if both are considered strategies of sustainable development in international policy documents (e.g., UNESCO, 39C/ Resolution 5; UNESCOb, 2014; UN, 2015).

It appears that the international policy documents, which shaped the field of ESD, have had an influence as to how ESD academics view the concept of SD. The Johannesburg Declaration was the first to outline that "*…the interdependent and mutually reinforcing pillars of SD (economic and social development and environmental protection) should be strengthened…*" (UN, 2002, para 5). The Bonn Declaration is the policy document which makes it clear that a balanced relationship between the environment, society and economy is a means towards SD and even puts emphasis on ESD rather than EE, according to Lotz-Sisitka (2009). The latest policy documents, the agenda 2030 and the GAP, which promote the agenda in education, emphasize a holistic and even integrated understanding of the SD concept (Sinakou, Boeve-de Pauw & Van Petegem, 2017). Nevertheless, our results indicate that this is not the case among academics in the ESD field. It seems that the great emphasis put on the integrated and balanced relationship among the three dimensions in regard to the structure of the SD concept, made academics focus more on the social and economic aspects of SD issues rather than the environmental ones, which had been the case 15 years ago. One would expect a more holistic and integrated view of SD after the appeal of all the above policy documents and especially the last one. Yet, this is not the case. This seems to support Kopnina's arguments that a holistic approach to SD distracts from environmental issues (2014). However, one could argue that this is an attempt to balance their position among the three dimensions. This can be seen as a response to the strong discourse in ESD that it is away from a merely environmental understanding of SD issues.

This study confirms that SD conceptions of ESD academics differ enormously from one another. This is definitely in line with the discourse of the SD concept in ESD. SD can be interpreted in various ways depending on the different disciplines or social and cultural contexts (Fien & Tilbury, 2002; Berglund et al., 2014), ethical assumptions (Andersson, 2008) and philosophical and political views (Stables & Scott, 2002).

The authors do not declare that they aim at measuring SD conceptions of ESD academics. As Cotton, Warren, Maiboroda & Bailey (2007) argue, it is really difficult to design an instrument to measure views on a multilevel and contradictory concept like SD. What is more, it is hard to measure the conception of academics directly since "*they are often held unconsciously*" (Visser-Wijnveen, Van Driel, Van der Rijst, Verloop & Visser, 2009, p. 675). Our aim was to determine "*the center of gravity between the dimensions*" in order to identify "*to what extent a certain conception of SD can be said to be holistic*" (Borg et al. 2014. p. 530).

The issues included in the statements are an attempt to operationalize a holistic view of SD. Our attempt to explore SD conceptions among ESD academics in an intuitive way led us to make use of SD issues in order to structure the statements. Some may argue that the results are biased due to the content and, perhaps, if different SD issues had been included, the

results would have been different. To answer this question, research should examine SD conceptions by making use of other issues or even in other ways. The authors would like to add, however, that the issues used were raised in international policy documents. Moreover, this means that the SD issues used are global, that is, they do not refer to local problems but to issues that all people on the planet can somehow relate to, to a greater or lesser degree. The International Implementation Scheme (2006) refers to SD issues as "*global issues of sustainability*", which play a significant role in the lives of individuals at a local level, are central in ESD (UNESCO, 2006, p. 7). What is more, the recently launched UNESCO Roadmap for Implementing the Global Action Programme on Education for Sustainable Development (UNESCO, 2013) puts an emphasis on global aspects of SD, as Öhman (2016) claims. Another argument for using SD issues as the basis for the statements is the fact that even the policy documents, such as Agenda 2030, do not determine the SD concept by providing definitions but rather by exposing the means of its implementation (Sinakou et al., 2017). Likewise, this instrument makes use of SD issues as a means of making sense of the SD concept.

6.1. Implications for teacher training

To a certain extent, the results of our study are in line with the recent research on trainee teachers' and teachers' conceptions of the SD concept. Academics in ESD do not conceive the SD concept holistically; teachers and trainee teachers do not either (e.g., in Sweden, Borg et al., 2014). Nonetheless, they put a different emphasis on the three dimensions of the SD concept. The ESD academic staff appears to show a tendency towards the social and economic aspects of SD, whereas both trainee teachers and teachers recognize the environmental and economic dimensions, but not the social ones (Borg et al., 2014; Summers et al., 2004; Summers & Childs, 2007; Gustafson et al., 2015).

One would expect the alignment of ESD academics' SD conceptions with those of student teachers and teachers. As far as trainee teachers are concerned, one explanation might be that the teaching approaches used by the academics in their courses do not allow the student teachers to unravel a holistic understanding of the SD concept. Smyth (1995) argued in favour of creating opportunities for teachers to collaborate with scholars so as to give them the chance to develop a profound understanding of SD. Bearing in mind the findings of this study, one might think that this may be problematic. However, the interaction of the academics with student teachers and teachers may help the latter, who emphasize the environmental aspect, to find a balance among the three aspects. It seems that the academics do not apply innovative teaching approaches to ESD. As Lozano et al. (2013a, b) have argued, teaching approaches that follow a traditional reductist thinking are not appropriate for unravelling a holistic understanding of SD. Attending ESD courses in teacher training is most probably the first opportunity for trainee teachers to come to terms with SD and ESD in an systematic way. This will form a solid basis for understanding and interpreting SD issues. The way an academic teacher conceives of SD will influence the selection, the interpretation and the way they approach SD and SD issues when teaching trainee students. In turn, the way that SD is presented in class influences the conception of student teachers regarding SD. Student teachers' conceptions in turn appear during teaching at school and they are translated into

curriculum planning and teaching (Stevenson 2006; Birdsall 2014, 2015). However, we do not argue that what they have been taught during training is isolated from other factors that most probably influence their conceptions of SD.

As regards in-service teachers, it could be that they have not recently undergone ESD training, which would have allowed them to keep track of the latest policy tendencies. Moreover, it might be that they are sceptical about the knowledge generated by ESD academics (Herr & Anderson, 2005). Applying participatory action research programmes gives the opportunity to all stakeholders involved in each case to develop a collective understanding of SD issues in a particular context. This facilitates a *consensus* as to what 'teaching-the-teachers' scenarios should entail (Jensen, 2015, 2016).

6.2. Implications for Education for Sustainable Development research and practice

The instrument presented in the paper gives ESD the chance to explore SD conceptions in terms of content. Except for ESD academics, it can also be applied to explore the SD conceptions of policy-makers, teachers, student teachers and students in secondary schools. Since (a) the SD concept is highly evolutionary among academics and policy-makers and (b) teachers and students should attribute their personal views to the concept (Sinakou et al., 2017), it is always relevant to explore SD conceptions among the various ESD stakeholders.

Academics in the ESD field should develop discussions about their own SD conceptions and share their views. This may contribute to mapping the conceptions in the field. This does not necessarily lead to a consensus as to the meaning of the SD concept. On the contrary, as claimed elsewhere (Sinakou et al., 2017), such discussions would lead to broader explorations of the concept. Such discussions would also help ESD research to decide if, and to what degree, ESD international policies have been successful. Also, academics of other disciplines like STEM would benefit by these discussions in collaboration with ESD academics in getting a more holistic understanding of SD. Higher education institutions should develop strategies to monitor progress in terms of understanding SD by all relevant stakeholders: administration, academics and students. A specialised unit equipped with SD specialists should take up this role. Such a unit would be perfectly suited to monitor progress and support administration, academics and students towards shaping a holistic understanding of SD.

7. Conclusion

The concept of Sustainable Development is central to Education for Sustainable Development. A holistic understanding of the SD concept on the part of the several stakeholders is of high importance. This paper explores the degree to which SD conceptions of academics in the field of ESD worldwide is holistic, and if there are any differences among them. If academics do not hold a holistic view of SD, it is most possible that their courses, as part of teacher training programmes, will not convey a holistic understanding of the SD concept. However, this study provides evidence that academics in the field of ESD do not see the SD concept holistically. Their tendency to recognize the social and economic dimensions more than the environmental ones, allows us to distinguish ESD

teaching from an EE tradition, which may have implications for ESD research and practice. In addition to this, there is no consensus among the academics as to the meaning of the SD concept. Academics have diverging SD conceptions, which may have implications for teacher training programmes as well.

Further research is now needed to examine how the SD conceptions of ESD academics influence student teachers' conceptions. Future research should also examine the SD conceptions of other university stakeholders and their influence on trainee teachers' SD conceptions. Such stakeholders are administrators, fellow trainee students, and the academic staff of other subjects (e.g., STEM, social sciences, arts), who also teach in teacher training programmes.

Overall, the findings of this study are an attempt towards answering the call in the UN's Decade of Education for Sustainable Development (DESD) final report for monitoring ESD practice. The target group of this study was academics in the field of ESD, which was looked at from an individual perspective, that is, a perspective that, to our best knowledge, had not been considered before. Empirical studies are also missing from the discourse around ESD (Boeve-de Pauw et al., 2015). The instrument developed for this study could also be used for other target groups allowing us to monitor ESD implementation at a conceptual level. This instrument adopts a holistic approach towards the SD concept as this is presented in the latest international policy document shaping the ESD field, namely the Agenda 2030 and the GAP and, thus, it is in alignment with the latest ESD discourse. Our results open up new perspectives as to how to consider the SD concept in ESD research and they confirm that the understanding of the SD concept is changing compared to the relevant discourse.

Acknowledgments

The authors acknowledge the financial support of Alexander S. Onassis Public Benefit Foundation, Greece, through a grant awarded to Eleni Sinakou [grant number F ZL 089-1, 2015-2016]. The foundation is not engaged in designing, conducting and reporting this study. The authors would also like to thank the three anonymous reviewers for their supportive and challenging comments on earlier versions of this paper.

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