# Education for Sustainable Development in Germany: Not Just Desired but Also Effective for Transformative Action

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**Abstract:** Despite its role as a key factor for transformation, there is still a lack of large-scale studies on the effects of Education for Sustainable Development (ESD). The aim of this study is to predict sustainable behavior based on reported implementation of ESD as well as psychological (e.g., attitudes, emotions) and socio-demographic variables. Descriptive statistics and a multiple regression model were used to analyze data from 2564 young people from different formal educational fields and 525 teachers from Germany. Both learners and educators desire a distinctly higher amount of ESD within formal educational settings compared to the status quo. The multiple regression model explains 26% of variance in sustainable behavior. By far the strongest predictors are, firstly, connectedness with nature, followed by emotions regarding sustainability and ESD implementation on the content level (making connections between past, present and future, the local and the global, and ecology, economy and the social). One implication of the research findings is an "update" for ESD: Emphasizing the emotional dimension of education and relating the didactics of "controversial issues" to ESD.

**Keywords:** education for sustainable development (ESD); environmental education (EE); sustainable behavior; pro-environmental behavior; connectedness with nature; emotions; teaching controversial issues

## 1. Introduction

The presence of sustainable development (SD) has moved well beyond niche issues and become an almost omnipresent topic in which physical and social mega-trends [1] are part of a SD "mega-discourse" [2] (p. 32). This has been catalyzed not only by the critical attitude but also, most importantly, by the action of the young generation, becoming manifest in Fridays For Future and similar movements. Nevertheless, public problem awareness and positive attitudes concerning SD from the majority of the population neither automatically nor necessarily translate into transforming relevant sectors of society, including the education system, as a key driver of such a societal shift [3].

SD is thereby understood as a safe as well as a just operating space for humanity [4], achieved by the deep structural—as well as individual—changes needed for that. Education for Sustainable Development (ESD) manifests in "empowering learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity. It is about lifelong learning, and is an integral part of quality education. ESD is holistic and transformational education which addresses learning content and outcomes, pedagogy, and the learning environment. It achieves its purpose by transforming society" [5] (p. 12).

Promoting SD as well as education can target two different levels: that of freedoms (to be able to choose between alternatives) and that of concrete behavior. These levels reflect the central distinction

made by the capabilities approach [6–8] between capabilities—as the set of options someone has for doing or being something—and functionings—as the options or freedoms that have been realized on the level of behavior. For example, while young people had the capability to express themselves politically and to demonstrate for SD issues in all countries with freedom of political expression, some turned that capability into a functioning when they engaged with Fridays for Future. There is a tendency for educational settings to aim for capabilities [9], while in the sustainability discourse, it is people's functionings that are expressed, e.g., through ecological footprints [10] that determine whether we secure planetary boundaries or realize the political vision of the Sustainable Development Goals.

ESD is precisely where stressing freedoms vs. concrete behavior meet in a distinct way and have to be calibrated given the value of autonomy, quite rightly stressed within education, and the value of behaving in accordance with the safe and just operating space for humanity [4], an issue that is also highly relevant to autonomy. Underscoring the importance of behavior, at least for high-income countries such as Germany, there is no lack of freedoms supporting SD, but there is a gap on the level of respective functioning. For example, many people have the capability to live on a plant-based diet and thereby relevantly decrease individual $CO_2$ emissions, but only a minority realize this freedom on the level of functioning.

In that vein, the recently launched United Nations Educational, Scientific and Cultural Organization (UNESCO) program "ESD for 2030" not only targets the level of freedoms (enabling all learners by providing knowledge and skills for critical (self-)reflection), but also directly addressing the level of behavior by "encourag[ing] learners to undertake transformative actions for sustainability" [11] (p. 4) and stating the need to disrupt the current way of life and behavior.

In line with the importance of the behavioral level for SD, the analysis presented in this article takes this as a focus, analyzing sustainable behavior and its determinants. In doing so, it expands commonly used determinants of sustainable behavior such as knowledge, attitudes, or emotions by also including self-reported ESD implementation in formal educational settings. Thereby, the study has a descriptive dimension—analyzing, the explanatory power of several determinants of SD-relevant behavior—as well as a normative dimension: Increasing insights into what are effective ways to foster and mutually reinforce the strongest predictors for sustainable behavior. ESD has been operationalized based on a scale devised by Boeve-de Pauw et al. [12] differentiating between content and methods. The operationalization of current ESD implementation is complemented by questions gathering the desired ESD implementation of young people and educators.

Firstly, the research is embedded in the state of the art concerning classical determinants of SD-relevant behavior and the effects of environmental education (EE) and ESD on behavior (Section 2). The methodology (Section 3) includes the main hypothesis stating that ESD is, along with more frequently researched determinants, significantly connected to sustainable behavior and a description of the context of the study and the German-wide sample as well as measures and the statistical technique. This is followed by the results (Section 4) including a comparison between actual and desired extents of ESD implementation (descriptive statistics) and determinants of sustainable behavior (multiple regression analysis). The article proceeds with a discussion of the results (Section 5), including the study's strengths and limitations. It concludes and offers an outlook (Section 6) by drawing on the consequences that can be derived from these results for an "updated" ESD, which provides opportunities for SD-related emotional resonance and a specific educational space for dealing with emotions. Didactical implications for that can be transferred from the field of teaching controversial issues, while the role of imagination and wonder seems essential for shaping the future in a constructive and motivating way.

## 2. Theoretical and Empirical Background

### 2.1. Determinants of Pro-Environmental and Sustainable Behavior

A meta-analysis ($n$ = 57 samples) that remains highly influential revealed that behavioral intentions have the highest predictive power for pro-environmental behavior, explaining 27% of its variance [13]. Central predictors of those behavioral intentions are attitudes ($r$ = 0.29), perceived behavioral control ($r$ = 0.31)—the assumed ability to perform the given behavior—and moral norms ($r$ = 0.29) [13]. Problem awareness is also an important, but not directly connected predictor of pro-environmental behavior and is therefore dependent on mediating variables like moral and social norms, attribution processes, and guilt [13,14]. This significant, but distant connection between problem awareness and behavior contributes to a better understanding of the knowledge-action gap. It provides an essential insight for educational interventions, which still often merely target knowledge or awareness gains. Thus, according to the meta-analysis [13], educational interventions intending to influence behavior should also target behavioral intentions, attitudes, perceived behavioral control, and moral norms. It is important to note that guilt was the only emotion addressed in this meta-analysis and was found to influence the central predictors mentioned above. At the same time, the importance "of analyzing the impact of ´moral´ emotions (author´s note: e.g., contempt, anger, shame, guilt) on pro-environmental intentions in future studies" was indicated [13] (pp. 21–22).

With regard to sustainable behavior, Michalos et al. [15] were able to explain 25% of its variance for young people with knowledge and attitudes, with knowledge displaying a stronger connection to behavior ($r$ = 0.46) than attitudes ($r$ = 0.35). Angarita-Cala [16] also found knowledge to be a stronger predictor for young adults, explaining 20% of the variance in behavior alone, while attitudes were insignificant. The non-coherent findings concerning the importance of knowledge for pro-environmental and sustainable behavior might be due to differences in operationalization, a core distinguishing feature being the use of fewer predictors in the studies analyzing sustainable behavior, which might lead to a biased importance of knowledge. Specifically, behavioral intentions and all the mediating variables between knowledge and behavior from the meta-analysis of Bamberg and Möser [13] were not included.

Even though Bamberg and Möser [13] included guilt in their meta-analysis, the aforementioned studies exemplify that emotions are not systematically included as a predictor of behavior, which is surprising given that behavioral motivation is a core function of emotions (e.g., [17]). According to a study by Carmi et al. [18], the influence of environmental knowledge on environmental behavior is fully mediated by environmental emotions, which is why they emphasized "the important role of emotions in the learning process" (p. 183). So do Raeisi et al. [19], who showed that emotions have a higher predictive power than knowledge for sustainable behavior (see also [20]). They conclude that "a favorable level of the SEB (sustainable environmental behavior) would not be possible without investing on [sic] emotional and sentimental environmental components." [19] (p. 151).

Besides the predictors on a psychological level, as illustrated above, sociodemographic variables can also be important in predicting pro-environmental and sustainable behavior. Blankenberg and Alhusen [21] provided a systematic review ($n$ = 158) showing a combined influence of psychological and sociodemographic variables, which underscores the importance of multivariate analysis of influencing constructs on different levels. Age displayed a U-shaped progression over lifespan [21] as well as U-shaped progression within adolescence with respect to sustainability consciousness [22,23]. Coherent results concerning gender show that across nations, women report higher pro-environmental behavior [21] as well as higher sustainability consciousness (e.g., [16]). In addition to analyzing age and gender, the review considered levels of education; education was found to increase pro-environmental behavior [21]. A relativization of this correlation lies in the connection between education and income, which in turn coincides with, for example, higher $CO_2$ emissions [24,25].

While the influence of education on pro-environmental behavior has only rarely received attention within social and environmental psychology, there are relevant analyses from the field of educational

sciences focusing on EE and ESD. Other educational concepts that are close to ESD, such as Global Citizenship Education, are not included due to a lack of quantitative outcome studies on effects on sustainable behavior.

## 2.2. Effects of EE on Behavior

Ardoin et al. [26] reviewed 20 years of literature ($n$ = 119) concerning the outcomes of different formats of EE on K-12 students (Range = 5–18 years old). The majority of studies (68%) used knowledge as an outcome measure whereby many studies reported multiple outcome variables. Of all the studies reviewed, 94% showed at least one positive environment-related outcome of EE (e.g., environmental knowledge, behavior). At the same time, 40% of studies also reported null findings of certain outcome variables of EE. It is important to note that studies measuring behavioral outcomes found fewer positive effects than studies focusing on knowledge outcomes, underscoring that it is more difficult to influence behavior within EE than to provide knowledge gains. Unfortunately, effect sizes are missing in this review.

Varela-Candamio et al. [27] built a model integrating theories concerning morale, rational choice, habits, social norms, and education and therefore include multivariate psychological and social factors. They concluded that EE serves as "a powerful tool in order to generate green behavior among citizens" [27] (p. 1573). Informal EE (media and internet use and social interactions concerning the environment; $r$ = 0.60) and intentions ($r$ = 0.28) were shown to be the main drivers of pro-environmental behavior. Besides the direct impact of informal EE on behavior, it also impacts awareness, attitudes, and motivation. Because only informal and not formal EE was measured, the authors state that "future lines of this research could shed light on the connection between formal education and green behavior" (p. 1570), which is an aim of the present study.

Also, within EE research, emotions are rarely included, as is the case in the studies referred to above. Otto and Pensini [20], however, showed for example with fourth to sixth graders ($n$ = 255) that the combination of knowledge and connectedness to nature mediates the influence of EE on ecological behavior, which offers a way out of the knowledge-action gap by also focusing on the emotional dimension within EE. With 69% of explained variance through connectedness to nature, the emotional aspects had a much stronger influence on behavior than the cognitive aspects, which explained 2% of the variance.

## 2.3. Effects of ESD on Behavior

"While ESD is being implemented in formal education all over the world, large-scale empirical research on its effects and effectiveness are scarce and strangely absent in the literature" [12] (p. 15,698). This desideratum still exists, despite the ever-expanding research interest in the field [28].

Some large-scale studies (e.g., [29–31]) have not evaluated actual ESD implementation, but compared schools with and without ESD profiles. The overarching results are heterogeneous and inconsistent. A positive influence on behavior was shown for the green school program in Ireland [16], but green schools in Taiwan did not enhance sustainability consciousness more than non-green schools [23]. In Sweden, sixth-grade pupils from ESD profile schools showed a slightly higher sustainability consciousness than pupils from non-ESD profile schools, but the effect was reversed in ninth graders [31]. These inconsistent results may partly be explained by the findings of Uitto et al. [32] concerning self-efficacy, another possible outcome measure of ESD besides behavior: there are differences between students depending on the school culture with respect to ESD, but the differences within a school are much higher than the differences between schools. These results underline the need for an analysis of actual ESD implementation independent of the school profile. This need is also supported by results from national monitoring in Germany, according to which ESD implementation tends to be driven within single subjects and by individual engaged teachers [33].

The effectiveness of ESD was shown by a large-scale study in Sweden, where 2413 pupils from 51 schools were questioned about their sustainability consciousness in addition to the ESD implementation

in class [12]. The ESD implementation was measured using a 7-item scale differentiating ESD with respect to content (holism: including connections between past, present, and future; the local and the global; ecology, economy, and the social) and with respect to method (pluralism: participation with regard to the content, classroom discussions with an openness to various views, forming one's own opinion, and critical thinking) independent of the profile of the school. This scale is also used for the present study (see Sections 3.3 and 4.1). Key results from Boeve-de Pauw et al. [12] are that ESD implementation tends to be stronger the older the pupils are (grade six vs. grade nine vs. grade twelve) and that the holistic dimension of ESD (content) is realized more often than the pluralistic (method). Participation regarding the content of class had by far the lowest mean score from all single items and only occurred rarely. Classroom discussions, in contrast, were on average reported to take place often. Interestingly, in terms of content, ESD had a higher correlation with knowledge ($r = 0.221$), whereas in terms of methods, it showed a higher correlation with behavior ($r = 0.238$). All other correlations between holism and pluralism and the facets of sustainability consciousness had small effect sizes. The connection between holism and pluralism was near the medium size range ($r = 0.273$).

The present study contributes to the state of research presented above via a "full-scale nationwide approach focusing on the effects of the implementation of ESD" [31] (p. 180), using self-reported measurement of ESD implementation based on the 7-item scale of Boeve-de Pauw et al. [12] and adding well-established psychological and socio-demographic constructs as predictors. Additionally, an insight into bottom-up demand for ESD is given by the measurement of desired ESD implementation in young people and teachers.

### 2.4. Sustainable Behavior and Its Relation to Education

The different constructs that are represented in the empirical studies above can be assigned to different theories according to an overview of Varela-Candamio et al. [27] (p. 1567) differentiating intrapersonal, motivational, interpersonal, and educational theories. The analysis presented here focuses, besides education, on intrapersonal theories including awareness, attitudes, and emotions. At the same time, theories of education in general and of ESD in particular outline these dimensions as educational aims: Education strives for enabling a person for constructive and flourishing interactions with the world and to deal with challenges that might occur (see for example [34,35]). While the specific aims of educational concepts vary, in general, they seek to promote skills or competencies that revolve around necessary cognitive-socio-emotional and ethical resources for being and feeling capable of specific behavior, in the case of ESD sustainable behavior (for an overview, see e.g., [36]). This overlap between theories of behavior and of education supports a closer examination of the predictors of sustainable behavior, explicitly including ESD as a separate predictor.

## 3. Materials and Methods

### 3.1. Hypotheses and Procedure

The central aim of the present study is to predict sustainable behavior in young people via a multiple regression analysis using the amount of ESD in their educational institution as well as several psychological and sociodemographic constructs as predictors.

**Hypothesis.** *It is assumed that besides the well-established predictors of sustainable behavior (emotions and attitudes regarding sustainability, connectedness with nature, problem awareness, gender), both facets of ESD (holism and pluralism) in formal educational settings are positively connected with sustainable behavior in young people.*

Additional to the predictors derived from the empirical state of the art, exploratory analyses of connectedness with humanity, age, and money at disposal are integrated as further predictors of sustainable behavior.

### 3.2. Study Context and Participants

The analyzed data are taken from the national ESD monitoring in Germany, which is part of the German strategy to implement the UNESCO Global Action Programme on ESD (for further information see [37]). The national monitoring is composed of three main pillars: desk research, qualitative studies and quantitative studies. The data presented here have been derived from a quantitative study in formal educational settings and is based on the same sample as an earlier analysis by the authors [38].

In March and April 2018, 2564 young people (M = 19.7 years; SD = 2.6 years) and 525 teachers (M = 42.9 years; SD = 12.7 years) were questioned concerning several (E)SD-relevant constructs via an online access panel. The study was thus conducted before the movement of Fridays for Future became visible in Germany. Using this methodology, it was possible to recruit a sample of teachers that is representative in terms of gender (63% female, 36.8% male, 0.2% "other"). Given the federal structure of the German educational system, at least 80 young people from every federal state have been included in the survey. Given this requirement, representativeness regarding gender could not be assured for this group: 74.7% of the young people are female and 24.8% male (0.5% "others", which had to be excluded for the regression analysis to achieve dichotomy). The results are controlled for gender differences (see Section 4.2). Three formal educational areas are captured within the sample of young people: school (31.6%), vocational education and training (21.6%), and university (46.8%). Most pupils visit grammar schools (74%), followed by intermediate (11%), comprehensive (8%), and general secondary schools (2%), which points to a bias towards higher levels of education in comparison with the distribution of the population. Within the sample of teachers, 82.5% work in schools, 17.5% in vocational education and training. The teachers report an average professional experience of 12 years.

### 3.3. Measures

Sustainable behavior was measured with 11 items (5-point Likert) questioning the respondents with regard to their behavior within the last three months as well as the last year. The scale has sufficient internal consistency ($\alpha_{\text{young people}} = 0.736$) while the screenplot underlines the unidimensionality. Thematically, the scale focuses on high-cost as well as low-cost behaviors. Items capture, among other things, engagement for SD, sustainable consumption (meat consumption, buying fair trade products, green energy), mobility, green banking, and donations. It therefore includes the social, the economic and the ecological dimensions of sustainability. As a whole, the scale was designed for the study based on items slightly adapted from existing scales [39,40]. For explorative analysis of the differences between predicting high-cost and low-cost behavior, two 3-item scales were build, whereby the low-cost scale (comprising active information seeking, reflecting on one's behavior, and sensitizing others) has sufficient internal consistency ($\alpha_{\text{young people}} = 0.716$;), but the high-cost scale (comprising sustainable finance, sustainable consumption, and donating money) has poor internal consistency ($\alpha_{\text{young people}} = 0.474$;) which might be due to the high item difficulty and related ceiling effects for high-cost behavior items.

ESD Implementation was measured using the scale from Boeve-de Pauw et al. [12] operationalizing ESD on two dimensions: holistic approach to content and pluralistic approach to teaching. Two adaptations were made in comparison to the original scale. Firstly, participants were additionally asked about their desired ESD implementation (by questioning the ideal manifestation of each item). Secondly, the questions were not framed for school specifically, but for the formal educational institution the participants attended at the time of the study (also suited for university and vocational education and training-contexts). Internal consistency is acceptable to good for the scales measuring desired ESD implementation: holism $\alpha_{\text{teachers}} = 0.879$, $\alpha_{\text{young people}} = 0.780$; pluralism $\alpha_{\text{teachers}} = 0.745$, $\alpha_{\text{young people}} = 0.737$. With regards to the actual ESD implementation, internal consistency is questionable to good: holism $\alpha_{\text{teachers}} = 0.818$, $\alpha_{\text{young people}} = 0.716$; pluralism $\alpha_{\text{teachers}} = 0.638$, $\alpha_{\text{young people}} = 0.696$. The much lower internal consistency of the actual implementation scale in comparison to the desired implementation scale might be due to a varying realization of the different facets of ESD, e.g.,

participation on the level of deciding what to study is far less common than the other facets of pluralistic ESD implementation (classroom discussions, forming one´s own opinion through critical thinking).

Emotions regarding sustainability have been measured on a 7-item scale (5-point Likert), capturing guilt, pride, admiration, worry, indignation, and 2 items concerning anger, all of them related to SD issues (scale based on [41,42]). The multidimensionality of SD is represented in some of the items by explicitly referring to the term "sustainability", which was defined at the beginning of the questionnaire as integrating ecological, social, and economical perspectives to create just living conditions for present and future generations. Here too, sufficient internal consistency has been ensured ($\alpha_{\text{young people}}$ = 0.717) while the unidimensionality is questionable: a second factor might exist, consisting of a single item measuring anger. Excluding this item would have achieved only a very small increase in $\alpha$. For this reason and because of the indistinct factor structure, no items were excluded from the scale.

Connectedness with nature and humanity were each measured using a single item 7-point Venn diagram informed by the "Inclusion of Nature in Self (INS)" scale from Schultz [43].

Attitudes regarding sustainability were measured using a four-item scale (5-point Likert) referring to Cotton et al. [44], Michalos et al. [45,46], and Strathman et al. [47]. Internal consistency of the scale is poor ($\alpha_{\text{young people}}$ = 0.521), which could be due to the combination of the shortness of the instrument and the complexity of sustainability.

Social desirability was controlled using a 6-item scale ([48]; see also [49]) measuring self-deception and deception of others. In cases where results were biased by social desirability, individuals who showed this tendency were excluded according to cutoff scores [49]. This is the case for 8.4% of teachers with regard to self-deception and 13.7% of teachers for deception of others as well as 7.6% of young people with regard to self-deception and 14.5% of young people with respect to deception of others.

Ecological problem awareness was measured with implicit reference to the planetary boundaries concept [50]. The participants were asked to estimate the endangerment of the climate system and biodiversity on a 10-point slider scale.

Money at one's disposal was measured within the group of young people using an open answer format, enquiring as to the amount of money they have at their disposal per month.

*3.4. Statistical Technique*

Descriptive statistics (means and standard deviations) of holistic and pluralistic ESD implementation were identified to compare both actual and desired ESD implementation as well as the different educational areas. Additionally, the present data was compared to data from Sweden [12]. Exploratively, correlations between desired ESD implementation, socio-demographic variables, and sustainable behavior were calculated.

In order to test the main hypothesis, a multiple regression analysis was conducted and statistical requirements were examined (see Appendix A). Besides the assumptions of a linear connection between predictors and criterium, the interval scale level of the criterium, and a non-zero variance of the predictors, the following requirements should optimally be met: no multicollinearity, homoscedasticity, independence, and normal distribution of residues [51]. Parameters can be estimated reliably when linearity, independence, and normal distribution of the residues are given [52]. Multiple regression analysis is relatively robust against a violation of the other requirements [52].

Additionally, for an explorative analysis of low- and high-cost behaviors, two distinct multiple regression analyses were constructed (see also [53]). This is due to the fact that "each determinant can either be positive or negative, given the specific type of analyzed behavior (low- vs. high-cost behavior)" [21] (p. 2).

## 4. Results

*4.1. Actual and Desired ESD Implementation in Formal Educational Settings in Germany*

Descriptive statistics of actual (*a*) and desired (*d*) ESD implementation in formal educational settings are listed in Table 1.

**Table 1.** Means and standard deviations of actual (*a*) and desired (*d*) Education for Sustainable Development (ESD) implementation according to teachers and young people.

|  | Teachers (*n* = 421) | Young People (*n* = 2049) |
|---|---|---|
| **Holistic approach to content** | *a* = 3.02 (0.75)<br>*d* = 3.50 (0.76) | *a* = 2.76 (0.82)<br>*d* = 3.43 (0.75) |
| In school *, we look at the connections between the past, the present, and the future as regards various issues. | *a* = 3.13 (0.85)<br>*d* = 3.54 (0.79) | *a* = 2.82 (1.02)<br>*d* = 3.45 (0.87) |
| In school, we look at both local and global problems and the connection between them. | *a* = 3.00 (0.88)<br>*d* = 3.51 (0.86) | *a* = 2.82 (1.00)<br>*d* = 3.47 (0.89) |
| In school, we look at how economics, social issues, and environmental problems are connected. | *a* = 2.92 (0.88)<br>*d* = 3.44 (0.87) | *a* = 2.64 (1.05)<br>*d* = 3.37 (0.94) |
| **Pluralistic approach to teaching** | *a* = 3.33 (0.63)<br>*d* = 3.71 (0.66) | *a* = 3.04 (0.80)<br>*d* = 3.60 (0.74) |
| When we have class discussions, it is possible for many different views to emerge. | *a* = 3.29 (0.95)<br>*d* = 3.76 (0.88) | *a* = 3.15 (1.09)<br>*d* = 3.62 (0.96) |
| When we read texts in school, we usually take a critical look at the content. | *a* = 3.34 (0.99)<br>*d* = 3.71 (0.94) | *a* = 3.17 (1.16)<br>*d* = 3.51 (1.03) |
| In school, we are encouraged to take a stand and have our own opinions on the issues at hand. | *a* = 4.05 (0.82)<br>*d* = 4.27 (0.77) | *a* = 3.44 (1.13)<br>*d* = 3.99 (0.97) |
| We decide what we study ourselves, with support of the teacher. | *a* = 2.63 (0.88)<br>*d* = 3.11 (0.92) | *a* = 2.39 (1.06)<br>*d* = 3.30 (1.00) |

\* "In school" is the original framing. It was adapted to fit the three different formal educational settings.

The descriptive statistics show that for both the holistic and the pluralistic ESD dimensions, just as for each single item in both groups, the desired ESD implementation is higher than the actual extent of implementation. On the level of scales, the effect sizes range between *d* = 0.589 (pluralistic teachers) and *d* = 0.853 (holistic young people) and are therefore medium to large. Both teachers and young people do report on a higher number of pluralistic dimensions of ESD practice compared to the holistic dimension. A consistent pattern can be observed in which teachers perceive the current implementation of the single facets of holistic and pluralistic accounts of ESD to be realized slightly more often and to be slightly more desirable than young people.

Mean scores and standard deviations regarding the three single items of the holistic scale are fairly homogeneous. Teachers and young people report that on average, the three holistic aspects are realized "sometimes".

More divergence reveals the pluralistic scale on which having one's own opinion is relatively widespread (teachers report it "often" on average, young people "sometimes–often"). Participation on the level of deciding what to study is, however, less frequent, while the desire for more participation is also low compared to the other pluralistic facets. On average, young people would "sometimes"

(M = 3.3) prefer to decide for themselves what to study and "rarely" (M = 2.39) have the chance to do so.

Across all educational domains, the correlation between holism and pluralism is $r = 0.369$ ($p < 0.001$) for the sample of young people and $r = 0.483$ ($p < 0.001$) for teachers, which is considerably higher than in the study undertaken in Sweden, which recorded $r = 0.273$ [12].

Table 2 illustrates the comparison of young people according to different educational institutions.

**Table 2.** Means and standard deviations of actual (*a*) and desired (*d*) ESD implementation according to young people from different formal educational settings.

|  | Secondary Level (*n* = 649) | Vocational School (*n* = 443) | University (*n* = 957) |
|---|---|---|---|
| Holistic approach to content | *a* = 2.81 (0.75) *d* = 3.46 (0.73) | *a* = 2.61 (0.84) *d* = 3.36 (0.77) | *a* = 2.80 (0.84) *d* = 3.44 (0.75) |
| Pluralistic approach to teaching | *a* = 3.04 (0.74) *d* = 3.64 (0.72) | *a* = 2.85 (0.77) *d* = 3.48 (0.75) | *a* = 3.12 (0.84) *d* = 3.64 (0.75) |

It is clear that the ESD implementation based on the dimensions of holism and pluralism is fairly similar when comparing secondary level students and university students. Solely standard deviations are slightly higher for university students, which might reflect the high heterogeneity of disciplines accompanied by a higher variety of content and methods. Students from vocational schools report both less actual and less desired ESD implementation for the two dimensions.

Compared with data from Boeve-de Pauw et al. [12], it becomes clear that German secondary level school students (mainly between 15–18 years old) reported scarcer ESD implementation compared to Swedish ninth and twelfth graders in 2013. Even the desired holistic ESD implementation in Germany was lower than the actual holistic ESD implementation in Sweden in 2013.

The differences between teachers from general education schools (*n* = 348) and teachers in vocational education and training (*n* = 73) are very minor and sometimes non-existent.

Exploratively, correlations were calculated between desired ESD implementation, socio-demographic variables and sustainable behavior. Young people have a stronger desire for ESD regarding both content and method when they themselves behave more sustainably ($r_{holism} = 0.332$, $r_{pluralism} = 0.241$) and when they rate their current knowledge regarding sustainability as higher ($r_{holism} = 0.095$, $r_{pluralism} = 0.090$). Additionally, young women have a slightly higher desire for ESD than young men ($r_{holism} = 0.076$, $r_{pluralism} = 0.090$). No connection was found between money at their disposal and desired ESD implementation ($p_{holism} = 0.235$, $p_{pluralism} = 0.452$).

Teachers also report a stronger desire for ESD when they themselves behave more sustainably in their everyday lives ($r_{holism} = 0.454$, $r_{pluralism} = 0.298$). Additionally, women have a slightly higher desire for ESD on the level of methods ($r_{pluralism} = 0.100$), whereas no gender difference was found regarding ESD on the level of content. No significant connection was found between the desire for ESD and age, professional experience, and subjective knowledge concerning sustainability.

*4.2. Predictors of Sustainable Behavior in Young People*

The multiple regression analysis explains 25.9% of the variance of sustainable behavior and therefore has high explanatory power [54] (Table 3 and Figure 1; see Appendix A for the analysis of statistical requirements). The predictors with the highest predictive power are connectedness with nature ($b = 0.238$), emotions regarding sustainability ($b = 0.227$), and holistic ESD implementation ($b = 0.179$).

Attitudes regarding sustainability and ecological problem awareness are significant predictors with absolutely and relatively small effect sizes. The amount of money at one's disposal is also a significant predictor, but its effect size is very small. Age, gender, pluralistic ESD implementation,

and connectedness with humanity do not contribute significantly to predicting sustainable behavior in young people in this model.

While the general model described above included both low- and high-cost behaviors, exploratively, two independent models for low-cost and high-cost behaviors were also calculated. The same set of predictors is able to explain 29.0% of the variance in low-cost sustainable behavior. The importance of the different predictors is approximately the same as in the general model, with the three strongest predictors being connectedness with nature ($b = 0.233$), emotions regarding sustainability ($b = 0.220$), and ESD holism ($b = 0.203$). Attitudes ($b = 0.121$) and problem awareness ($b = 0.091$) also rose with respect to their predictive power.

At the same time, the explanatory power of the same predictors is much worse for high-cost behaviors, explaining only 15.4% of variance. Here, connectedness with nature ($b = 0.189$) and emotions regarding sustainability ($b = 0.188$) have similar predictive power, followed by ESD holism ($b = 0.125$). Attitudes are still statistically significant in explaining high-cost behaviors ($b = 0.063$), but problem awareness is not. The only variable which increased in importance in comparison with the general model is the money at one's disposal ($b = 0.053$).

**Table 3.** Coefficients of the multiple regression analysis predicting sustainable behavior in young people ($n = 2034$).

| Variable | *ß* | *SE* | *b* | *p* |
|---|---|---|---|---|
| Connectedness with nature | 0.10 | 0.009 | 0.238 | < 0.001 |
| Emotions regarding sustainability | 0.22 | 0.024 | 0.227 | < 0.001 |
| ESD holism | 0.12 | 0.014 | 0.179 | < 0.001 |
| Attitudes regarding sustainability | 0.07 | 0.004 | 0.081 | = 0.001 |
| Ecological problem awareness | 0.02 | 0.005 | 0.077 | < 0.001 |
| Money at disposal | < 0.001 | < 0.001 | 0.044 | = 0.022 |
| Age | statistically non-significant (n.s.) | | | |
| Gender | | | n.s. | |
| ESD pluralism | | | n.s. | |
| Connectedness with humanity | | | n.s. | |

Adjusted $R^2 = 0.259$ ($p < 0.001$).
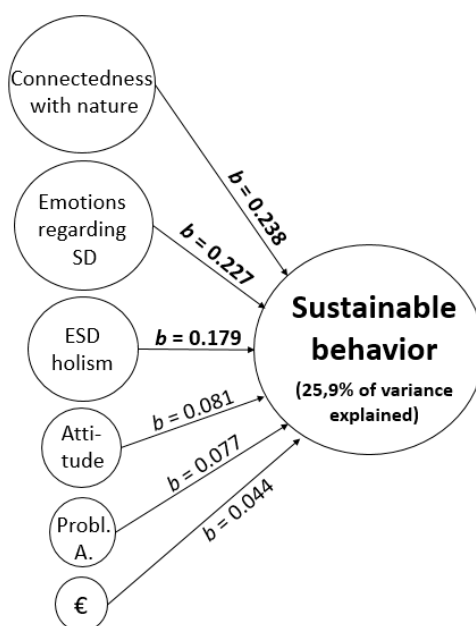


**Figure 1.** Probl. A. = Ecological problem awareness; € = Money at disposal.

## 5. Discussion

### 5.1. Methodological Strengths and Limitations

In general, the sample provides robust information for different educational settings in Germany. The results are generalizable, since the multiple regression analysis meets the central statistical requirements (no multicollinearity, homoscedasticity, independence, and normal distribution of residues). Thereby, this large-scale study provides novel and unique insights into the extent and quality of ESD implementation and avoids the drawbacks of data gathering via institutions where relevant self-selection biases of decision makers within these institutions can occur. Due to the time limitation on answering the questionnaire (30 min) and the overall high number of constructs captured by the study, the selection of scales and items covered many crucial, but not all constructs that have been empirically demonstrated to be highly predictive for environmental behavior. This concerns for example intentions for behavior [13,55], habits [14] or the orientation of people close to one self (for family orientation: Corral-Verdugo et al. [56]).

The method of sampling and deriving data from an online access panel study includes advantages (e.g., size and differentiating criteria of the sample according to educational setting, federal state, etc.) and limitations (e.g., constrained reliability of self-report data for measuring sustainable behavior [57]) and are also discussed in an earlier publication by the authors [38].

The representativeness of online-studies can be challenged by, firstly, coverage in terms of the exclusion of offline-households and secondly, a self-selection bias of the respondents (see [58]). Concerning the first challenge, according to Blom et al. [58], online studies "that do not account for the non-Internet population are susceptible to coverage bias if this population differs from the Internet population on characteristics that are related to key survey topics" (p. 500). According to another study, the group of offline-households in Germany consists predominantly of older and at the same time less educated persons ([59], see also [60]). It thereby largely differs from the target sample of this study—young people and teachers, while for teachers, a broad variance of age and of job experience is covered by the study. Therefore, this concern of non-representativeness due to offline-household-exclusion does not seem to apply to a relevant extent for the sample of this study. Concerning the second challenge, certain differences between an online-only sampling in comparison to a design combining online and offline data gathering have to be assumed. The online to offline bias in other studies varied among topics and was higher where the topic under question was more closely linked to media use itself, such as e.g., TV-consumption [61]. Since media use -related questions were not part of this study, this reason for bias is not expected to be very significant.

Concerning the regression model, the operationalization of sustainable behavior and its predictors already gives the model considerable explanatory power. This could be increased even more by further narrowing the thematic focus of the operationalization: Carmi et al. [62] found that a higher predictive power occurs when items are formulated in specific terms, in other words, with increased domain-specificity.

Furthermore, the scale capturing attitudes regarding sustainability revealed poor internal consistency, which could be due to the combination of the compact instrument and the complexity of sustainability. Here, it should be noted that, in comparison to other analyses [13,15], the connection between attitudes and behavior found in this study was smaller. However, this could also be due to the inclusion of emotions that could lead to a shift in the explanatory power of other variables which are mostly not considered in studies that report on a stronger connection between attitudes and behavior.

Within the research field presented in Section 2, mere cross-sectional correlations are sometimes framed as influences, which can be misleading with regard to attributions of causation. Also, the present study does not permit any causal inferences. Nevertheless, for most young people, a causal relationship between holistic ESD implementation and sustainable behavior is very plausible, especially for the educational field of secondary school education. The ESD implementation that they encounter is rarely a consequence of what they have chosen—based on different degrees of sustainability

consciousness—given the compulsory nature of school. For vocational education and training and university students, a certain self-selection bias might exist—e.g., students interested in sustainability choose courses addressing SD to a higher degree. However, the multiple regression analysis shows a similar model for secondary level students (holistic ESD implementation being the third strongest predictor for sustainable behavior) in comparison with the whole sample, which supports the assumption that ESD is the cause and sustainable behavior is the effect.

*5.2. General Discussion of the Results*

### 5.2.1. Fostering SD-Related Emotional Resonance

The central insights from this analysis confirm the results of other studies by underlining the importance of connectedness with nature (see [63,64]) and emotions regarding SD as important predictors of sustainable behavior. Both variables can be understood as statistically sufficiently independent from one another (no multicollinearity was found between the predictors), but on a conceptual level they might be part of a broader category of emotions. This is supported by the conceptualization of Kals and Maes [42] who describe three emotion-related categories in the context of SD: emotional affinity towards nature (here: connectedness with nature); ecological fear; and moral emotions such as anger and guilt (here: emotions regarding sustainability). In that vein, Sothmann and Menzel [65] operationalized emotional and cognitive aspects of nature connectedness and found that the emotional aspects of it have a higher predictive power for environmental concern compared to its cognitive aspects. This underscores not just the reciprocal impact of emotions and connectedness to nature, but also their entangledness. Hence the two best predictors of sustainable behavior could be summarized as emotion-focused predictors, pointing towards what can be called SD-related emotional resonance.

As for the connection between these two main predictors with the third-strongest predictor ESD, it can be said that the educational concept addresses and fosters both pro-sustainability emotions and, to varying degrees, connectedness with nature. This means that ESD cannot be entangled from them in terms of its constituents, the process level, and its aims. Tracing these plausible mutual influences necessitates a study of educational processes based on a longitudinal study design to understand the patterns of these educational processes in more detail. Current research, such as the theory of transformative learning [66,67], also stresses the importance of a process perspective on these emotions in education or *Bildung*, whereby the type and intensity of emotions and feelings vary significantly during the process.

Interestingly, connectedness with humanity did not appear to be a significant predictor of sustainable behavior. One of the various possible reasons for that might be a rather ambivalent connection to humanity perceived by people already behaving sustainable and their recognition that a large fraction of mankind is responsible for grave challenges, but is insufficiently engaging in appropriate solutions.

### 5.2.2. Holistic ESD Trickles down to the Level of Action, Pluralistic ESD does not

The state of research has been extended by including self-reported ESD implementation in formal education, while ESD regarding content proved to be the third-strongest predictor of sustainable behavior and ESD regarding method had no significant predictive power.

Given these differences between the two dimensions of ESD, it is important to once again bear in mind the research object as the behavioral dimension of ESD-processes. Within a different or broader consideration of other dimensions of ESD-related "output", such as empathy or SD-related self-reflexivity, the pluralistic dimension could be much more important. Differing from the results mentioned here, in the study by Boeve-de Pauw et al. [12], ESD on the level of method was a better predictor of behavior compared to the content level. This, however, could be explained by the higher number of variables included in this study and their effect on the significance of single variables in

both studies. Another reason for the lack of a linear correlation between the methodological level and sustainable behavior could be found in a difference between the holistic and the pluralistic scale in terms of where the optimal or target range is situated. Here, too high a level of participation could be counterproductive in terms of supporting sustainable behavior: based on valuable core ideas of education, such as fostering autonomy, a misplaced or misdosed emphasis on participation can occur. The motivation to distance oneself from passive and hierarchy-driven didactic styles could lead to overcompensation and conflict with other methodological aims of ESD such as conveying content knowledge in a didactically skillful and reflected way. Concerning the holistic ESD-dimension, the danger of "overdosing" here seems less pressing in comparison. The target range of the holistic dimension might not be limited per se, but points towards the maximum of the scale when the content is conveyed in an age-appropriate way. In other words, for these two subscales, it seems adequate to aim for high holistic ESD values, while this may not be the case for pluralistic ESD values.

The scale based on Boeve-de Pauw et al. [12] has recently been extended by action orientation ([68], for the importance of action-related items is underlined by Roczen et al. [69]). The scale applied here without focusing on action already has considerable explanatory power concerning behavior, while it can be assumed that its extension would lead to an increase. Further useful extensions of the scale of ESD implementation concern the inclusion of emotional aspects (such as being encouraged to express emotions within ESD settings), which has been applied in a recent study of ESD in non-formal and informal settings [70].

Turning from the predictors to the criterium, the exploratory analysis revealed a lower explanatory power of all variables for high-cost behavior. This is in line with other research [53]. This has to be viewed cautiously because the statistical requirements of the high-cost model are not met sufficiently, mostly due to ceiling effects. This could limit the possibility of finding strong linear correlations. Connected to this, ESD (as well as other predictors of behavior) might simply be limited in evoking changes within the challenging category of high-cost pro-sustainability behavior. This also includes the still under-researched connection between SD-related high-cost behavior on the one hand and high-impact or disruptive and transformative individual behavior on the other. Enabling and motivating dealing with what tend to be disruptive behavioral transformations, as targeted in ESD for 2030, thus appears to be a promising field of competence development within ESD and one that remains underestimated.

### 5.2.3. Current and Desired ESD Implementation

The aim of upscaling ESD has been a political program, and its progress has been measured by academia. That the desired levels of both holistic and pluralistic dimensions of ESD significantly exceed the currently implemented extent adds an important legitimation basis for the advancement of ESD. While there is also evidence for the general consensus on and interest towards aiming for sustainability among young people in Germany [71–74], this research provides empirical evidence for the clear nationwide wish for ESD. This complements the political support for ESD from both sides of the educational process (including learners and educators, except for universities, where only students were surveyed). The data was gathered before the Fridays for Future movement, which created a novel quality of visibility, attention to, and engagement with sustainability issues. This increased general interest in sustainability plausibly also intensified the desire for its inclusion in formal education.

### 6. Conclusions and Outlook

Based on the results of the study and the strong links among the three main predictors of sustainable behavior, the question can be raised as to how connectedness with nature and sustainability-related emotions are already related to the practical level of ESD and how this relationship can be deepened. Several studies already point to the relation between them: Otto and Pensini [20] for instance have shown the importance of nature-based environmental education (including excursions, interactions with animals etc.) as a much stronger predictor of behavior compared to the cognitive aspects of

environmental knowledge. Ojala [75–77] also emphasizes the prevalence of negative emotions among young people such as worry, anger, frustration, and anxiety in connection to climate change and the global future. Verlie [78] also argues for a need for "affective adaptation" as "openness to emotional challenges, a capacity to endure, live through, welcome and encourage changes and to guide others in their efforts" (p. 760). At the same time, the importance of the emotion-related dimension within educational processes in general is increasingly being researched and promoted (e.g., by the OECD: [79]). This trend is captured by the growing fields of emotional education or socio-emotional education (see [80] for an overview). Here, the learners are enabled to understand and manage emotions, set and accomplish goals, feel and expressing empathy and create and maintain good relationships with others ([80] p. 37, referring to [81]). This reveals clear overlaps and synergies with ESD, therefore an integration of these so far interestingly disconnected research fields appears worthwhile and effective. For the field of SD, this need for skillfully dealing with emotions appears even more pronounced given the immediate existential dimension these issues touch upon since they concern how habitable the world will be and the quality of live for humans and other species. Since this renders SD and therefore ESD especially emotionally charged, the role of this existential dimension in ESD settings and its implications on the level of both content and methods appear to be a promising future research field.

Despite growing and widespread agreement that there should be more SD on a general level, there are diverging opinions regarding concrete ways of changing the socio-environmental-technical systems. Conflicting aims, values and prioritizations have to be negotiated and therefore the concrete, solutions-focused content level of ESD often concern controversial issue. Here, the growing research field of teaching controversial issues (so far, often related to political or historical issues, see e.g., [82,83]) offers constructive didactical methods. Controversial issues can be understood as "disputes or problems which are topical, arouse strong emotions, generate conflicting explanations and solutions based on alternative beliefs or values and/or competing interests, and which, as a result, have a tendency to divide society. Such issues are often highly complex and incapable of being settled simply by appeal to evidence" [84] (p. 13). These are often identity-relevant, and thus emotionally charged issues, pointing to tensions or even (potential) suffering and therefore often provoke negative emotions (grief, anger etc.). This makes them highly relevant for the questions as to how to deal with SD-related emotions—especially in a way that appears not just adequate, but also meaningful and therefore resonant. In line with the research results, controversial issues require addressing beyond the intellectual realm, on the socio-emotional level [83] (p. 237).

Many teachers feel they are frequently confronted with controversial issues but are ill-prepared for teaching them. They see great value in being able to address them better, especially on the basis of methods that foster multi-perspective thinking [82] (p. 24). Teaching such controversial issues "makes considerable demands on teachers, even under supportive conditions" [83] (p. 230). Not seldomly, these topics are seen as a risk for teachers for several reasons, and hence they try to avoid them [83]: they can lead beyond teacher's expertise, to "inflammatory discourse" (ibid.) or to losing control over the classroom in terms of climate and discipline [84] (p. 17). Here, it is important to promote trust and provide room for emotional responses ([83], p. 230). A concrete didactical way of fostering multiperspectivity, highly relevant to ESD, is to use e.g., the constructivist method of structured academic/controversial dialogue, whereby learners have to reverse the roles they initially took in polar discussions on controversial issues [82].

The research presented in this article was conducted amidst the rapidly growing dynamic of SD issues. This goes hand in hand with a broad shift in awareness from evidence- and legitimation-driven approaches to sustainability to a largely problem-aware phase that has no shortage of solutions and roadmaps for large-scale shifts, but cannot supply the preconditions for de facto redesigning the real-world level, optimally in a prudent, motivated, and even inspired manner. Accounting for this dynamic, certain aspects of formal ESD become even more vital, others less so, while there is also a need for new ones to be taken up. This is why we argue for a need to "update" ESD in the sense of

(re-)emphasizing certain aspects of ESD practice and connecting them with the insights provided by this study and teaching controversial issues.

How should we answer to the growing pressure on the increasing quantity and quality of acting required for SD (shifting from a general need to act to urgency to disruptiveness)? It is not despite, but precisely because of the challenging and thus often avoidance-attracting circumstances that educators and researchers should ask what Pace [83] suggests: how can the risky business of dealing with emotions be turned into a teaching opportunity? On the basis of this study and the broader state of the art, some central features of such an updated ESD can be outlined: the growing awareness of wicked sustainability issues is often accompanied by strong—and often negative—emotional reactions that should be embedded in professionally led educational settings instead of being considered the business of the educand. Informed by research on socio-emotional education and the didactics of teaching controversial issues, careful dealing with these emotions and creating "emotionally literate classrooms" [85] is for example enabled by: supporting group cohesion through good relationships, creating an atmosphere that is warm and supportive, engagement in learning activities that are perceived as meaningful, and humor given its importance in bonding and building trust [83] (p. 248f) [85].

Similarly, the role of connectedness with nature entails an update insofar as it stresses the classical dimension of EE and ESD in terms of direct experiences with nature. An even more promising approach, and a basis for further research, would be to combine this update with the revival of another classical dimension of education, the role of imagination and (contemplative) wonder. The potential gravity of the topics related to SD challenges and the negative emotional connotations that can go hand in hand with them mean that imagination and wonder appear to be an especially constructive way of approaching these issues. Wonder can be understood as a "mode of consciousness in which we experience that which we perceive [...] as strange, fundamentally beyond the limits of our comprehension, yet worthy of our attention for its own sake. The experience is suffused with a vague but strong sense of importance and (often, though not always) meaning; it engages us fully, and touches us at an existential level." [86] (p. 296). This is not just in an instrumental way of increasing motivational aspects despite its intrinsic motivational capacity; instead it involves cultivating a sense of wonder and imagination directly links back to the level of education focusing on freedom- or capabilities. Here, people can be enabled to, at best, envision the motivating and inspiring possibilities of pro-sustainable behavior that feed into emotionally resonant relations with the world. This is an end in itself, and a key component of deep-rooted Bildungs-experiences. Overcoming the "distinct lack" of "powerful 'awe and wonder' experiences" [87] (p. 394) in education is, at the same time, more than an end in itself. Rather, the structured practice of imagining futures is seen as a key component for designing resilient tomorrows amidst the need for deep and spirited solutions for sustainability (see [88]).

## Appendix A

**Table A1.** Test of the statistical requirements of the multiple linear regression models.

| Statistical Requirement | Young People (*n* = 2049) |
|---|---|
| Linearity (theoretically assumed) | Yes |
| Normal distribution of the residues (integrative analysis of histograms and Shapiro-Wilk Test) | Yes (histogram looks good even though Shapiro Wilk test is significant which is due to big *n*) |
| Independence of residues (when Durbin Watson score is between 1.5 and 2.5) | Yes (2.004) |
| Homoscedasticity (diagram with ZRESID in Y und ZPRED in X) | Yes |
| No multicollinearity (when tolerance is > 0.10) | Yes (lowest tolerance is 0.593) |
| No zero variance of the predictors and independent measurements | Yes |

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