

## Article

# Consumption-Intention Formation in Education for Sustainable Development: An Adapted Model Based on the Theory of Planned Behavior

Deidre Bauer <sup>1,\*</sup>, Julia Arnold <sup>2</sup>  and Kerstin Kremer <sup>1</sup>

<sup>1</sup> Department for Biology Education, IPN-Leibniz Institute for Science and Mathematics Education, 24118 Kiel, Germany; kremer@ipn.uni-kiel.de

<sup>2</sup> Centre for Science and Technology Education, School of Education, FHNW University of Applied Sciences and Arts Northwestern Switzerland, 4132 Muttenz, Switzerland; julia.arnold@fhnw.ch

\* Correspondence: dbauer@ipn.uni-kiel.de; Tel.: +49-(0)431-880-3130

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**Abstract:** Global biosphere issues call for an education for sustainable consumption decisions. Enabling adolescent learners to form sustainable consumption intentions involves an understanding of underlying internal predictors. The theory of planned behavior (TPB) delivers a useful approach to this challenge. Understanding of the underlying motives behind sustainable consumption decision-making, however, requires knowledge and evaluation of three basic sustainability aspects, the generational, the coherence, and the spatial aspect. As yet, the TPB framework does not take account of those facets. In this paper, we propose an extension of the TPB that meets these shortcomings by integrating the sustainability aspects while including the concepts of sustainability knowledge and sustainability values into the existing model. Furthermore, we extended the functional range of the attitude construct to the three sustainability aspects. The objective of the present article is to introduce and discuss the adapted framework which can serve as a first step for an educational implementation of the concept of sustainable consumption.

**Keywords:** education for sustainable development; theory of planned behavior; sustainable consumption

## 1. Introduction

To maintain or improve living standards for both present and future generations, it is crucial that humanity's actions stay within the regenerative capability of the biosphere. This interrelation between generational justice and human actions is given emphasis in the definition of sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [1] (p. 43). Concluding, the concept of sustainability aims at preserving or creating such ecological, social, and economic conditions that allow for long-term and worldwide need fulfilment. Currently, global society's behavior opposes the concept of sustainability as our demands on the biosphere are exceeding the planet's regenerative capability [2–4]. The UN [5] calculated that by 2050 the equivalent of almost three Earths will be required to ensure present-day needs fulfilment. To “redirect humanity towards a sustainable path” [6] (p. 6), the UN adopted the Agenda 2030 presenting 17 Sustainable Development Goals (SDGs) [5]. The SDGs refer to critical global challenges that must be coped with to ensure humanity's survival [6] but also a good life for every human being [7]. The SDG framework emphasizes the crucial role of sustainable consumption in implementing the concept of sustainability. Not only is sustainable consumption itself listed as an SDG (SDG 12), it is also a requirement for achieving further goals (SDGs 2, 5, 6, 13–15). Within the field of private consumption, young consumers are a critical group in the effort to make a shift toward

a sustainable world. The habits people develop in their youth have a major impact on their consumption patterns as adults [8,9]. In addition to this, young consumers have the power to influence their parents' choices [10]. Thus, equipping young learners with the prerequisites to become sustainable consumers is a vital step in implementing the concept of sustainability. Here, education plays an important role [7,11]. For an Education for Sustainable Development (ESD) to reach its goal of empowering "learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations ( ... )" [9] (p. 12), however, we first require a better understanding of the internal factors and processes that underlie sustainability-related consumer actions.

As Bandura [12] states, the acquisition and maintenance of new behavior patterns is not simply based on intuition but rather relies on cognitive processes. Within those introspective processes, the intention to act is considered the most influential single determinant of reasoned behavior [13–15]. Rieß [15] even notes that any volitional behavior is based on the respective behavioral intention. Behavioral intention indicates "how hard people are willing to try, ( ... ) how much of an effort they are planning to exert, in order to perform the behavior" [16] (p. 181). It can be defined as the decision to act or not [17]. Meta-analyses found substantial correlations between intentions and behavior in different domains (e.g., correlation coefficient  $r = 0.47$ ) [18]. In their meta-analyses on determinants of pro-environmental behavior, Hines and colleagues [19] and Bamberg and Möser [20] found the intention to act to be the variable to correlate strongest with behavior ( $r = 0.52$ ;  $r = 0.49$ ). Clearly, forming a behavioral intention does not necessarily lead to performance of that behavior. This so-called intention-behavior gap is a prominent subject in academic literature. It must be clear, however, that, in the context of ESD, the aim is not to promote or change behavior but to enable young learners to take competent decisions. Providing learning opportunities that equip learners with the preconditions for competent consumption-intention formation first requires understanding of the central determinants that underlie the respective intention formation (decision-making). The theory of planned behavior (TPB) provides a useful approach to this challenge. The framework introduces the constructs of perceived control over the performance of a given behavior, social pressure, and attitudes toward the behavior as the main direct determinants of intention formation. The TPB was successfully applied for explaining intention formation of various behaviors including sustainability-related intention formation [21]. However, up to now, the TPB is not perfectly suitable for ESD as it lacks the integration of relevant facets like knowledge and evaluation of three sustainability aspects.

In the following, we will give a brief description of the TPB and point out the three sustainability aspects. We will then bring together both parts by introducing an adapted model on sustainable consumption-intention formation.

## 2. The Theory of Planned Behavior

The TPB proposes that behavioral intention can be predicted from three global latent constructs: attitude toward the behavior (ATT), perceived behavioral control (PBC), and subjective norm (SN) [22]. The ATT construct captures the degree to which an individual has a favorable or unfavorable evaluation of the behavior in question. PBC describes the extent to which a person finds it easy or difficult to perform a given behavior [13]. SN conceptualizes the perceived social pressure to perform or refrain from a behavior [16]. Within the SN construct, injunctive norms and descriptive norms can be distinguished [23]. In their recent version of the TPB, Fishbein and Ajzen [13] adopted this differentiation. Analogous to the construct of subjective norms in the theory of reasoned action [24], injunctive norms (IN) refer to an individual's perception that the behavior in question should or should not be performed. The concept of descriptive norms (DN) concerns the perceived prevalence of a behavior [21,25]. More specifically, it refers to the perception that important referent individuals (e.g., parents, friends, and teachers) or groups are themselves performing or refraining from performing a given behavior. An individual may want to act similarly to those others (or according to the perceived norm) because he/she wants to be like them or considers them experts [13]. The three global constructs, ATT, SN, and PBC, are not independent of each other but influence one another. Each construct is determined by specific sets

of salient beliefs concerning particular expectations and related evaluations relevant to the behavior. The TPB can, therefore, be understood as an expectancy–value theory.

Ajzen [16] explains how the ATT, the PBC, and the SN constructs are linked to those beliefs. He states that, for the ATT construct, a belief conceptualizes the expected behavioral outcome. The strength of any such belief is multiplied by the subjective evaluation of the respective expected outcome. The attitude toward the behavior is directly proportional to the sum of the resulting products. Concerning the PBC construct, beliefs capture the factors that may facilitate or impede performing the behavior. Those factors can be internal (skills, will power, etc.) or external (opportunities to perform behavior, availability of information, etc.). The subjective probability that a factor is present (belief strength) is linked to the respective factor’s influence on facilitating or impeding the performance (belief power) in a multiple fashion. Control beliefs underlie the PBC, as this construct is conceptualized as directly proportional to the sum over the products of belief strength and belief power [13]. In contrast to IN, injunctive normative beliefs do not involve a general social referent but refer to “beliefs that a particular referent individual or group thinks I should or should not perform the behavior in question” [13] (p. 134). Any such belief is determined by the perception about the extent to which a specific referent wants the subject to perform a given behavior multiplied by the subject’s motivation to comply with that referent [21]. The IN is then directly proportional to the sum of the products. Last, following the argumentation of Leeuw et al. and Heuckmann, Hammann, and Asshoff [26,27], a descriptive normative belief can be understood as the product of the perceived likelihood of a specific referent (group or individual) performing the behavior in question (belief strength) and the extent to which the subject considers the particular referent to be a behavioral role model. The DN is then directly proportional to the sum over the resulting beliefs.

The TPB provides a suitable descriptive basis for the purpose of explaining sustainable consumption decision-making. First, the TPB framework can explain substantial variance in behavioral intentions [18]. Second, the framework, as exemplifying attitude and behavior theories, aids the understanding of the causal mechanisms between motivational factors that influence behavioral intentions [28]. Furthermore, the TPB allows for assessing the strength of relationships between variables in various circumstances [29]. Then, even though a general behavioral model, the TPB has proven suitable to explain sustainability-related types of behavior. Among others, the TPB was applied to explain general pro-environmental behavior [26] as well as specific intention formation in the fields of travel-mode choice [30], individual consumption [8,31–33], and recycling behavior [34]. Last, the framework provides guidance for designing educational interventions [28] as it helps unravel the specific impact and interplay of the distinct determinants of a particular consumption intention. However, notwithstanding those merits, the TPB needs to be modified to thoroughly describe the factors that concretely underlie said intention. In the following, we will emphasize the necessity to expand the ATT construct concerning the three sustainability aspects and to integrate the constructs sustainability knowledge and sustainability values.

### 3. How to Adapt the TPB to the Requirements of Sustainability

The often-used Oslo definition of sustainable consumption as the “use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials, and emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations” [35] has been severely criticized in the academic field. In recent years, a number of scientifically based definitions of the term have been proposed [36,37]. However, several conceptual approaches often either focus on the impact a given behavior has on ecological, economic, or social systems or on the consumer’s intention to conserve or improve a condition whereby the literature focuses mainly on the ecological dimension [38].

In our adapted model, we address both approaches from the perspective of the individual by integrating knowledge about actual behavioral impacts, sustainability values and attitudes toward all three sustainability aspects as a direct determinant of behavioral intention. Gathering from the

requirements inherent in the sustainability and the sustainable consumption concepts (Section 1), besides its impact- and its intent-orientation, a decision-making model on sustainable consumption must take into account a behavior's consequences for contemporary and future generations (generational aspect). These consequences need to be recognized and evaluated for the local as well as the global level (spatial aspect) [7]. Third, to meet the demand for generational justice, the perception and evaluation of behavioral outcomes must apply for economic as well as ecological and social consequences (coherence aspect) [39]. In sum, sustainable consumption requires the recognition and evaluation of intra- and intergenerational behavioral outcomes concerning both spatial and coherence aspects. In summary, a model that aims to describe sustainable consumption intention formation must take account of three behavioral aspects and focus on both the impact and the intent-oriented character of sustainable consumption.

As yet, the TPB is mainly concerned with behavioral outcomes concerning the individual. Hence, to capture the sustainability construct and the intent-orientation more comprehensively, the framework needs to allow for inclusion of considerations on the three sustainability aspects. Keeping in mind that the aspects deal with recognition and evaluation of specific behavioral consequences, it makes sense to include them within the ATT construct, as this construct is already concerned with the perception and evaluation of behavioral outcomes. However, a person can only assume a behavior has a certain outcome if he/she is cognizant that the outcome is linked to the behavior. Supporting this assumption, Milfont and Gouveira [40] found that people who recognize a strong link between their behaviors and potential distant outcomes show stronger pro-environmental attitudes than those who do not. Furthermore, it may make or not make a referent a role model concerning a behavioral domain depending on the perceived consequences that a referent's behavior has on one or more sustainability aspects. Additionally, a person can consider the recognition that a behavior has a positive or negative impact on a sustainability aspect a PBC factor. Someone may, for example, assume that knowledge about the relation between a particular behavior, the increase in emission of climate active gases, global warming, and the future loss of agricultural areas and natural resources can make it easier to decide to perform an alternative behavior. It becomes clear that, to capture each belief construct, it is necessary to explicitly include knowledge about the impact of specific consumption behaviors on the sustainability aspects as one precondition for behavioral intention. By integrating a knowledge component, the model would also capture the impact focus of the sustainable-consumption concept. The TPB framework itself acknowledges a causal link between knowledge and beliefs, but as yet it fails to specify that knowledge.

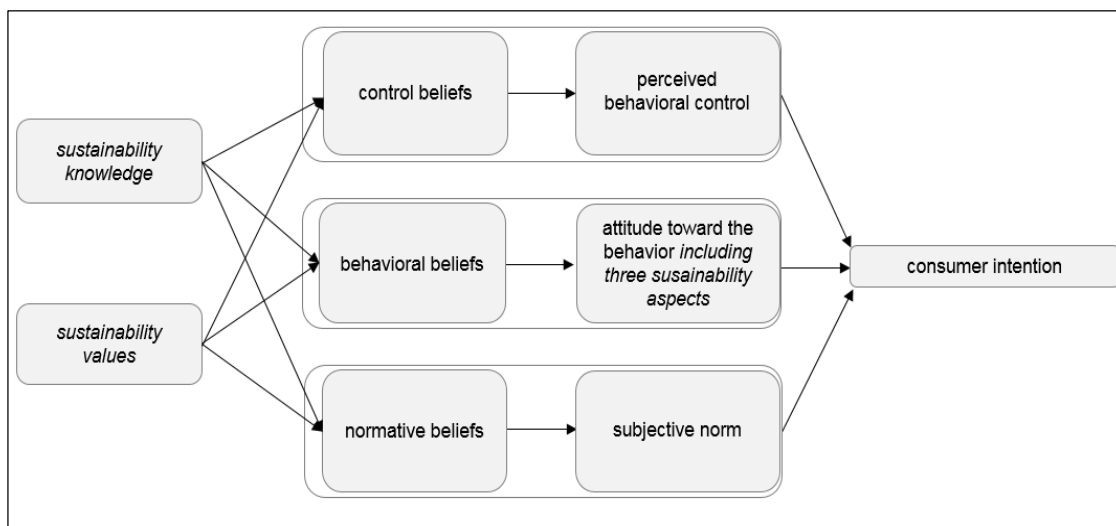
Besides knowledge, values are another substantial factor that needs to be explicitly taken into account in a TPB adapted to sustainable consumption-intention formation. Not only are values considered an important part of ESD [9], they are also a causal factor in social decision-making processes [41]. Vermeir and Verbeke [8] found that individual value orientations also indirectly influence the intention to purchase sustainable dairy products. More specifically, the individual importance we attribute to sustainability values may affect the beliefs we form concerning a given consumer behavior. Schwartz [42,43] argues that, in general, values underlie the evaluation of behaviors and events. A person will thus use the values he/she considers important to evaluate the outcomes of his/her consumer behavior. The relation between outcome evaluation and values can be described by the theory of cognitive dissonance. This theory proposes that, when a person has contradictory cognitions, he/she will change either one or the other cognition [44]. Someone who experiences cognitive dissonance between his/her attitudes and a given behavior is assumed to change the attitudes as changing attitudes is easier than changing behavior [45]. In the same way, a person will rather re-evaluate the behavioral outcomes that conflict with a particular value than decide the value to be of little importance as values can only change over time [46,47]. We argue that, through the mechanism of cognitive dissonance, sustainability values also affect both the specific character of injunctive and descriptive normative beliefs. If an individual experiences cognitive dissonance between values he/she considers important and a perceived norm, that individual will evaluate that norm pursuant

to her/his values. For example, a referent may become a role model sooner due to a certain behavior if this behavior is compatible with the values (e.g., protecting the biosphere) that the subject considers important. Respectively, to be motivated to comply with perceived normative prescriptions, those prescriptions may not conflict with the values the subject considers important. Last, the importance a person assigns to specific values can affect the PBC construct. Someone may, for example, consider having certain sustainability values an important factor to help facilitate performing a given behavior. It, therefore, seems reasonable to include the component of values as a further ultimate determinant to obtain a more thorough idea of the critical motivational factors that underlie sustainable consumption-intention formation. Fishbein and Ajzen [13] assume that values determine salient beliefs that underlie each global construct in the TPB framework. However, to adapt the TPB to the requirements of sustainability, which values are important to form sustainable consumption intention must be specified.

The next section will illustrate the TPB adaptation by elaborating on the newly integrated factors sustainability knowledge and sustainability values. We will then illustrate the adapted model by visualizing each construct over the example on living on a vegetarian diet.

#### 4. An Adapted TPB for Sustainable Consumption-Intention Formation

In accordance with the basic framework, we propose that sustainable consumption-intention formation depends on three global constructs: perceived behavioral control, attitude toward the behavior, and subjective norms. We argue that the attitude construct should include considerations concerning three sustainability aspects. The global constructs themselves are each the result of certain beliefs concerning the behavior in question and exert direct influence on the intention formation. Additionally, we propose that the individual importance of sustainability values and two dimensions of sustainability knowledge (i.e., problem-based knowledge and solution-based knowledge) determine consumption intention by influencing both control as well as behavioral and descriptive normative beliefs (Figure 1).



**Figure 1.** Adapted TPB for Sustainable Consumption-Intention Formation (italic letters mark adapted constructs; arrows show possible causal relations).

##### 4.1. The Role of Knowledge in Describing Sustainable Consumption-Intention Formation

Knowledge is considered an essential prerequisite for pro-environmental and sustainable behavior or intention formation [20,32,36,48]. It can influence action by promoting awareness and providing reasons for specific conservational actions [49]. In their seminal meta-analysis of studies on determinants of responsible environmental behavior, Hines and colleagues [19] show that pro-environmental behavioral intention is based on different declarative aspects of knowledge.



Those aspects can roughly be categorized in two types. First, to develop pro-environmental intentions, one needs knowledge of environmental issues. This type includes knowledge about processes within ecosystems and the effects human actions have on those systems [50,51]. Knowledge about a given system is also a common factor in the field of sustainability science [52]. Here, we refer to this knowledge type as problem-based knowledge. By rousing our attention, problem-based knowledge might be an important starting point for the willingness to act [53]. Second, an individual must be cognizant of possible action strategies to tackle an identified problem (solution-based knowledge) [19,50]. This knowledge type implicitly includes knowledge about a desired behavioral outcome. In the sustainability-science literature, knowledge about a desired outcome is referred to as target knowledge [52]. In their review of transdisciplinary research in the field of sustainability science, Brandt and colleagues [52] also present knowledge that is needed for promoting transformation processes as a further knowledge type. We assume that, in a broader context, exceeding the specific consumer action, solution-based knowledge can be understood as part of this transformation knowledge.

However, although problem-based and solution-based knowledge are identified as relevant for the formation of behavioral intention, in their meta-analysis, Hines and colleagues [19] show that the influence knowledge exerts over behavior is weak. This finding is confirmed by a study conducted by Tanner and Wölfling Kast [54]. Up to now, there are no definite explanations for this so-called knowledge-behavior gap [55]. One reason why knowledge seems to fail promoting pro-environmental/sustainable behavior may lie in the knowledge construct itself. Frick, Kaiser, and Wilson [50] found empirical evidence that different knowledge dimensions must work together in a coherent way to have a considerable impact on behavior. Like Hines and colleagues, Frick and colleagues distinguish between problem-based and solution-based knowledge aspects. The authors, however, propose a twofold approach to the solution-based knowledge aspect. They note that, besides knowledge of possible actions, to address an issue, the individual has to know about the relative impact different behavioral options have on an ecological problem. However, due to the systematic complexity and intertwining of ecological, social, and economic systems on both the local and the global level, it is not entirely possible to ascertain the relative effectiveness of each behavior in question. Thus, for our work, we propose a twofold knowledge approach that differentiates between problem-based and solution-based knowledge with the second dimension only referring to knowledge of different behavioral options.

As a further explanation for the weak knowledge-behavior relationship, researchers propose that knowledge alone is not a sufficient condition for the formation of behavior or behavioral intention [48]. Correspondingly, Frick and colleagues state that knowledge does not influence behavior directly but via mediating factors. Rather, those factors should be included “in a causal chain from knowledge to behavior” [50] (p. 1610), to better understand the role of knowledge. This assumption corresponds to Fishbein’s and Ajzen’s [13] proposition that the knowledge aspect indirectly exerts influence on behavioral intention by influencing the belief aspects of each of the three global constructs that determine sustainable consumption-intention formation (see previous section). In conclusion, for our adapted model, we propose the addition of two knowledge dimensions, problem-based knowledge and solution-based knowledge, as one essential prerequisite for behavioral, normative, or control beliefs with respect to the particular behavior. Those two dimensions are the sub-constructs that make up the factor sustainability knowledge (see Figure 1). Up to this point, however, the knowledge component lacks specific reference to sustainability. To link the two knowledge dimensions to sustainable consumer behavior, they must be adapted to sustainability so as to refer to the three sustainability aspects. Taking up the definition of problem-based environmental knowledge as knowledge about environmental consequences of a specific behavior (see above), sustainability-related problem-based knowledge with respect to consumer behavior must include knowledge about economic, ecological, and social consequences of a given behavior. Moreover, it must cover the recognition of consequences for both present and future generations as well as local and global impacts of that behavior. As most consumer behaviors can only have an indirect impact on any of the aspects, problem-based knowledge must include both the immediate and more distant consequences of a given behavior (Table 1). For the same reason, solution-based knowledge is

concerned with recognition of possible ways to tackle direct and indirect consequences of a specific consumer behavior (Table 1).

**Table 1.** Sustainable meat consumption: factors and exemplary statements.

Factors in the Basic TPB	Factors in the Adapted TPB	Exemplary Statements
Unspecific Knowledge	Problem-Based Knowledge <sup>1</sup>	<ul style="list-style-type: none"> <li>• A meat-based diet contributes to the emission of climate-active gases.</li> <li>• The emission of climate-active gases contributes to global warming.</li> <li>• Global warming contributes to extreme weather conditions like droughts and rise of the sea level.</li> </ul>
	Solution-Based Knowledge	Meat-based diet-related options to help mitigate global warming are <ul style="list-style-type: none"> <li>• cutting down on meat</li> <li>• living on a vegetarian diet</li> <li>• cutting down on red meat</li> <li>• buying organic meat products</li> </ul>
Unspecific Values	Importance of Sustainability Values	Protection of the global environment is important to me.
Consumption Intention		I intend to live on a vegetarian diet.
Descriptive Norm		Most people that are important to me are consuming meat. E: My best friends are consuming meat. V: When it comes to matters of diet, I want to be like my best friends.
Injunctive Norm		Most people that are important to me would approve of me living on a vegetarian diet. E: My best friends would approve of me living on a vegetarian diet. V: When it comes to matters of diet, I want to do what my best friends approve of.
Attitude Toward the Behavior	Attitude Toward the Behavior: Individual Reference	My living on a vegetarian diet is good for my health. E: My living on a vegetarian diet will probably help me maintain physical strength. V: My maintaining physical strength is good.
	Attitude Toward the Behavior: Local Present Environmental Reference	My living on a vegetarian diet is good for the local environment. E: My living on a vegetarian diet will probably help mitigate fresh-water pollution. V: My helping mitigate fresh-water pollution is good.
	Attitude Toward the Behavior: Global Present Environmental Reference	My living on a vegetarian diet is good for the global environment. E: My living on a vegetarian diet will probably help mitigate global warming. V: My helping mitigate global warming is good.
Perceived Behavioral Control		I would find it difficult to live on a vegetarian diet. E: I do not know of any tasty alternatives for meat products. V: Not knowing of tasty alternatives for meat products will make it difficult for me to live on a vegetarian diet.

<sup>1</sup> E: statement on the expectancy aspect; V: statement on the value aspect.

#### 4.2. The Role of Values in Describing of Sustainable Consumption-Intention Formation

Values refer to relatively stable beliefs about desirable end states or behaviors [47,56]. Those beliefs transcend specific situations [56,57]. Values serve as standards by which a behavior, a person or an event, is judged as desirable [58]. Several empirical works link specific sustainability-related personal values to sustainable or ethical behavior. In their study on distinct determinants of recycling behavior, McCarty and Shrum [59] found empirical evidence that specific value orientations influence recycling behavior via mediating factors. In a more recent study, Milfont and Gouveira [40] found that environmental preservation is positively correlated with individual biosphere, altruistic, and future orientations. Supporting those results, Bolderdijk and colleagues [48] found that pro-environmental behavioral intentions are linked to biosphere values. Those findings indicate that sustainable intention formation is closely linked to altruistic values and long-term perspectives. However, although this

may point in the right direction, such values do not fully capture the sustainability concept. Within the concept of sustainability, the overall desirable goal of any action must be intra- and intergenerational justice concerning economic, ecological, and social aspects on the local and the global level (see Section 1). Thus, when referring to sustainable values we must enclose the actual sustainability aspects (generational aspect, spatial aspect, coherence aspect) with their underlying dimensions. Here, it is not the question if someone possesses those values. Rather, like Bolderdijk and colleagues' results show, the importance an individual attributes to each value might be crucial for their respective ability to affect behavioral, outcome, and social beliefs. By comprising sustainability values as another proximal factor, the adapted model proposes that the relative personal importance those values have stand in a possible causal relation to each belief construct (Figure 1).

## 5. Model in Action

In the following, we will illustrate the model by visualizing the factors over the example on living on a vegetarian diet.

Livestock and meat production contribute to a wide range of sustainability-related problems. For example, the sector accounts for 18 percent of global greenhouse gas emissions and eight percent of worldwide water use and is considered a main cause of deforestation [60]. A promising way to reduce such problems related to livestock production would be to forego consuming meat. In their work on environmental consequences of different dietary choices in Sweden, Martin and Brandão [61] show that a vegetarian diet could lead to a considerable decrease in eutrophication, greenhouse gas emissions, and the impact of acidification. Additionally, the shift to a vegetarian diet would, over the long run, result in a substantial decrease in global cropland use [62]. Besides their large range of sustainability-related impacts, dietary choices are also linked to individual health. Findings concerning the beneficial effects of a vegetarian diet on health are, however, heterogeneous. While there is evidence of health benefits of a vegetarian diet compared to a general omnivore diet, especially in the field of non-communicable disease like cancer and type II diabetes [63,64], the health of vegetarians is found to be similar to health-conscious non-vegetarians [65,66]. Despite the inconsistent findings concerning its specific health impact the overall notion is that, if properly planned, a vegetarian diet “can be nutritionally adequate for adults and children” [64] (p. 613).

In this paper, we limit the presentation to exemplary statements per factor and to only some possible answers in the solution-based knowledge category (Table 1). In a questionnaire, the recipient would give his/her subjective degree of agreement on a seven-point unipolar adjective scale (global constructs, values, and beliefs) or choose an answer in a multiple-choice format (problem-based knowledge and solution-based knowledge).

As a direct condition for intending to live on a vegetarian diet in a sustainability-oriented fashion, a person must evaluate the perceived difficulty to perform the action (perceived behavioral control) against his/her evaluation of the behavior (attitude toward the behavior) and his/her perception that his/her performing the behavior is approved of or shown by relevant referents (injunctive or descriptive subjective norm). For example, one can have an overall favorable attitude toward living on a vegetarian diet and receive social support for cutting off meat consumption but at the same time find it difficult to perform the behavior and lack the respective role models (Table 1).

A person who views knowledge of tasty alternatives for meat products an important condition for living on a vegetarian diet (belief power) but thinks he/she lacks this knowledge (belief strength) will form a relatively negative control belief. Furthermore, to develop a more positive attitude toward living as a vegetarian, a person's behavioral beliefs must be overall positive. For example, someone could form a rather positive belief because he/she expects that living on a vegetarian diet will help mitigate global warming (outcome expectancy), while considering mitigating global warming a good thing (outcome evaluation, Table 1).

For the purpose of clarity, here, we limited the examples to the environmental dimension. To thoroughly capture the sustainability concept, behavioral beliefs must be operationalized concerning



each sustainability aspect. Thus, in a respective questionnaire, items capturing the spatial and the generational aspects of both the economic and social dimension should be added. Finally, the concept of perceived subjective norm is dependent on different salient descriptive and injunctive normative beliefs. A person who thinks his/her friends do not live a vegetarian lifestyle (belief strength) and wants to be like those friends when it comes to diet (belief power) will form a somewhat negative descriptive normative belief regarding living on a vegetarian diet. That same person, however, may form a rather positive injunctive belief regarding that particular behavior if he/she thinks that his/her friends would approve of him/her foregoing consuming meat (belief strength) while wanting to comply with this perceived normative prescript (belief power). Note that one belief alone does not constitute the shape of the respective global construct. Rather, a person can form a number of different beliefs for each category that are weighed against each other in the model [13]. Underlying those control, behavioral and normative beliefs are specific behavior-related sustainability knowledge types. Additionally, belief formation is influenced by the importance that specific sustainability values have for the individual. Before a person can decide to behave in a sustainable way, he/she must first understand the processes within natural systems and the effect a meat-based diet has on those systems. For example, he/she must know that the global climate depends on the relative amount of climate-active gases in the atmosphere and that a rise in temperature has negative effects on the biosphere and ultimately on the well-being of future generations. That same person must also know that consuming meat contributes to the emission of climate-active gases and thus that the individual meat intake eventually contributes to global warming (problem-based knowledge, Table 1). Furthermore, he/she must be cognizant that foregoing consuming meat is one possible way for an individual to meet the challenge of climate change (solution-based knowledge). As a second ultimate condition for deciding to cut off individual meat intake out of sustainability-related considerations, that a person will rather approve of those behavioral outcomes that correspond to his/her values. To give an example, someone to whom protection of ecological systems and natural resources is an important value, may find it good if the his/her living on a vegetarian diet helped mitigate global warming. Whereas for someone who does not rank this value highly this outcome may seem rather irrelevant. For the given example, corresponding values may be intra- and intergenerational justice and protection of the environment on the local or global level.

## 6. Conclusions and Outlook

The proximate aim of this paper is to frame a theoretical model so we can explain the internal pre-conditions of sustainability-relevant consumer intention formation. Finding the TPB a suitable basis for this purpose, we adapted that framework to the demands of the sustainability concept. As a special characteristic, the formation of such intentions requires knowledge and evaluation of generational, spatial, and coherence outcome aspects. We covered these aspects by integrating the factors sustainability values and sustainability knowledge and by extending the attitude construct.

The model illustrates which internal factors sustainability-related consumption-intention formation may be dependent on. As a next step, empirical testing will show how strongly any factor or sub-factor is related to a specific consumption intention. The findings, resulting from this testing, can then, in a third step, serve as a basis for planning and designing learning opportunities that help promote sustainable consumption-intention formation. To give an example, the framework can help define characteristic categories within a factor that are particularly related to a specific behavioral intention and thus help characterize specific types of intention. To give a simplified example, two people may form an equally weak intention to live on a vegetarian diet whereby the factor contributing most to this intention in Person 1 may be that he/she does not recognize the relevance of the behavior (low ATT), whereas Person 2 may well see the benefits but does not feel able to convert this knowledge into action (low PBC). The respective intentions then could be categorized according to that most influencing determinant. Defining types of intention can serve as a basis for planning learning opportunities that specifically help learners confront the particular hindering facets. For

learners of Type 1 (low ATT), it might be of help to increase their problem-based knowledge, whereas educational opportunities for the second type (low PBC) should rather focus on equipping learners with knowledge about possible behavioral solutions concerning an identified problem (solution-based knowledge) and other ways to increase their perceived control over the behavior.

The employed frameworks of TPB and declarative knowledge types have also been applied for contexts other than consumer behavior. Thus, provided that the target behavior covers each construct of the current model and is feasible for adolescents, we assume that our model can be used to well explain intention formation in further sustainability-relevant behavioral domains (e.g., waste and recycling behavior, travel-mode choice, and sustainability-related health behavior).

It must be clear, however, that any such model has some unavoidable limitations. In this specific case, the model is limited to the boundaries of State of the Art Science concerning a behavior's actual consequences. The economic, ecological, and social outcomes of any sustainability relevant consumer behavior are far too complex and intertwined to capture thoroughly. Thus, any operationalization of the adapted framework can only be an approximation to the multidimensionality of the sustainability concept. This is especially true for operationalizing the knowledge construct in a scholar context as it is restricted to behavior–outcome relations comprehensible to adolescents. Additionally, to cover as great a range of direct and indirect behavior-outcome relations as possible, the knowledge construct is restricted to very specific phenomena (e.g., causes and effects of global climate change (Table 1), degradation of ecosystems and species, or desertification and drought). Thus, educational interventions based on the framework are limited to one or two challenges.

Empirical testing of the adapted framework, therefore, relies on sensible item modeling. Model testing can illuminate the exact nature of the relationship between (1) sustainability values (and sustainability knowledge respectively) and beliefs and (2) the role those values have in shaping attitudes, subjective norms, perceived behavioral control, and intentions. The validated model may provide a focused means to help adolescents form sustainable (consumption) intentions and thus give support to ESD's main goal of empowering “(every human being) to contribute to sustainable development and take informed decisions and responsible actions for ( ... ) present and future generations” [9] (p. 33).

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## References

1. World Commission on Environment and Development. *Our Common Future (The Brundtland Report)*; Oxford University Press: Oxford, UK, 1987.
2. Ewing, B.; Moore, D.; Goldfinger, S.; Oursler, A.; Reed, A.; Wackernagel, M. Ecological Footprint Atlas 2010. Available online: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.660.8339&rep=rep1&type=pdf> (accessed on 1 August 2018).
3. Moran, D.D.; Wackernagel, M.; Kitzes, J.A.; Goldfinger, S.H.; Boutaud, A. Measuring sustainable development-Nation by nation. *Ecol. Econ.* **2008**, *64*, 470–474. [[CrossRef](#)]
4. Rockström, J.; Steffen, W.; Noone, K.; Persson, A.; Chapin, F.S., 3rd; Lambin, E.F.; Lenton, T.M.; Scheffer, M.; Folke, C.; Schellnhuber, H.J.; et al. A safe operating space for humanity. *Nature* **2009**, *461*, 472–475. [[CrossRef](#)] [[PubMed](#)]
5. United Nations. 17 Goals to Transform Our World. Available online: [www.un.org/sustainabledevelopment/](http://www.un.org/sustainabledevelopment/) (accessed on 4 January 2018).

6. United Nations Educational, Scientific and Cultural Organization. Education for Sustainable Development Goals. Learning Objectives. Available online: <http://unesdoc.unesco.org/images/0024/002474/247444e.pdf> (accessed on 1 August 2018).
7. Schreiber, J.R.; Siege, H. *Orientierungsrahmen für den Lernbereich globale Entwicklung im Rahmen einer Bildung für Nachhaltige Entwicklung: Ein Beitrag zum Weltaktionsprogramm "Bildung für Nachhaltige Entwicklung": Ergebnis des Gemeinsamen Projekts der Kultusministerkonferenz (KMK) und des Bundesministeriums für Wirtschaftliche Zusammenarbeit und Entwicklung (BMZ)*, 2nd ed.; Cornelsen: Berlin, Germany, 2016; ISBN 9783060656875.
8. Vermeir, I.; Verbeke, W. Sustainable food consumption among young adults in Belgium: Theory of planned behaviour and the role of confidence and values. *Ecol. Econ.* **2008**, *64*, 542–553. [[CrossRef](#)]
9. United Nations Educational, Scientific and Cultural Organization. UNESCO Roadmap for Implementing the Global Action Programme on Education for Sustainable Development. Available online: <http://unesdoc.unesco.org/images/0023/002305/230514e.pdf> (accessed on 1 August 2018).
10. Benn, J. Consumer education between 'consumership' and citizenship: Experiences from studies of young people. *Int. J. Consum. Stud.* **2004**, *28*, 108–116. [[CrossRef](#)]
11. United Nations Commission on Environment and Development. *Agenda 21. The United Nations Programme of Action from Rio*; United Nations: New York, NY, USA, 1992.
12. Bandura, A. Self-efficacy: Toward a unifying theory of behavioral change. *Psychol. Rev.* **1977**, *84*, 191–215. [[CrossRef](#)] [[PubMed](#)]
13. Fishbein, M.; Ajzen, I. *Predicting and Changing Behavior. The Reasoned Action Approach*; Psychology Press: New York, NY, USA, 2010; ISBN 9780805859249.
14. Heimlich, J.E.; Mony, P.; Yocco, V. Belief to Behavior: A Vital Link. In *International Handbook of Research on Environmental Education*; Stevenson, R.B., Brody, M., Dillon, J., Wals, A.E.J., Eds.; Routledge: New York, NY, USA, 2013; pp. 262–274. ISBN 0415892392.
15. Rieß, W. *Education for Sustainable Development. Theoretical Analyses and Empirical Studies*; Waxmann: Münster, Germany, 2010; ISBN 978383092311.
16. Ajzen, I. The Theory of Planned Behavior. *Organ. Behav. Hum. Decis. Process.* **1991**, *50*, 179–211. [[CrossRef](#)]
17. Pomery, E.A.; Gibbons, F.X.; Reis-Bergan, M.; Gerrard, M. From willingness to intention: Experience moderates the shift from reactive to reasoned behavior. *Pers. Soc. Psychol. Bull.* **2009**, *35*, 894–908. [[CrossRef](#)] [[PubMed](#)]
18. Armitage, C.J.; Conner, M. Efficacy of the Theory of Planned Behaviour: A meta-analytic review. *Br. J. Soc. Psychol.* **2001**, *40*, 471–499. [[CrossRef](#)] [[PubMed](#)]
19. Hines, J.M.; Hungerford, H.R.; Tomera, A.N. Analysis and Synthesis of Research on Responsible Environmental Behavior: A Meta-Analysis. *J. Environ. Educ.* **1987**, *18*, 1–8. [[CrossRef](#)]
20. Bamberg, S.; Möser, G. Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *J. Environ. Psychol.* **2007**, *27*, 14–25. [[CrossRef](#)]
21. Ravis, A.; Sheeran, P. Descriptive Norms as an Additional Predictor in the Theory of Planned Behaviour: A Meta-Analysis. *Curr. Psychol.* **2003**, *22*, 218–233. [[CrossRef](#)]
22. Ajzen, I. *Attitudes, Personality and Behavior*, 2nd ed.; Open University Press: Maidenhead, UK, 2005; ISBN 0335217036.
23. Cialdini, R.B.; Kallgren, C.A.; Reno, R.R. A Focus Theory of Normative Conduct: Recycling the Concept of Norms to Reduce Littering in Public Places. *J. Personal. Soc. Psychol.* **1990**, *58*, 1015–1026. [[CrossRef](#)]
24. Ajzen, I.; Fishbein, M. *Understanding Attitudes and Predicting Social Behavior*; Prentice-Hall: Englewood Cliffs, NJ, USA, 1980; ISBN 0139364439.
25. Rimal, R.N.; Real, K. How Behaviors are Influenced by Perceived Norms: A Test of the Theory of Normative Social Behavior. *Commun. Res.* **2005**, *32*, 389–414. [[CrossRef](#)]
26. De Leeuw, A.; Valois, P.; Ajzen, I.; Schmidt, P. Using the theory of planned behavior to identify key beliefs underlying pro-environmental behavior in high-school students: Implications for educational interventions. *J. Environ. Psychol.* **2015**, *42*, 128–138. [[CrossRef](#)]
27. Heuckmann, B.; Hammann, M.; Asshoff, R. Using the theory of planned behaviour to develop a questionnaire on teachers' beliefs about teaching cancer education. *Teach. Teach. Educ.* **2018**, *75*, 128–140. [[CrossRef](#)]
28. Patterson, R.R. Using the theory of planned behavior as a framework for the evaluation of a professional development workshop. *J. Microbiol. Biol. Educ.* **2001**, *2*, 34–41. [[CrossRef](#)]
29. Jackson, T. *Motivating Sustainable Consumption: A Review of Evidence on Consumer Behaviour and Behavioural Change*; Center for Environmental Strategy, University of Surrey: Guildford, UK, 2005.

30. Bamberg, S.; Ajzen, I.; Schmidt, P. Choice of Travel Mode in the Theory of Planned Behavior: The Roles of Past Behavior, Habit, and Reasoned Action. *Basic Appl. Soc. Psychol.* **2003**, *25*, 175–185. [\[CrossRef\]](#)
31. De Leeuw, A.; Valois, P.; Seixas, R. Understanding High School Students' Attitude, Social Norm, Perceived Control and Beliefs to Develop Educational Interventions on Sustainable Development. *Procedia-Soc. Behav. Sci.* **2014**, *143*, 1200–1209. [\[CrossRef\]](#)
32. McEachern, M.G.; Warnaby, G. Exploring the relationship between consumer knowledge and purchase behaviour of value-based labels. *Int. J. Consum. Stud.* **2008**, *32*, 414–426. [\[CrossRef\]](#)
33. Zhang, L.; Chen, L.; Wu, Z.; Zhang, S.; Song, H. Investigating Young Consumers' Purchasing Intention of Green Housing in China. *Sustainability* **2018**, *10*, 1044. [\[CrossRef\]](#)
34. Cheung, S.F.; Chan, D.K.-S.; Wong, Z.S.-Y. Reexamining the Theory of Planned Behavior in Understanding Wastepaper Recycling. *Environ. Behav.* **1999**, *31*, 587–612. [\[CrossRef\]](#)
35. United Nations Environment Programme. *Planning for Change: Guidelines for National Programmes on Sustainable Consumption and Production*; United Nations Environment Programme: Nairobi, Kenya, 2008; ISBN 9789280728996.
36. Austgulen, M.H. Environmentally Sustainable Meat Consumption: An Analysis of the Norwegian Public Debate. *J. Consum. Policy* **2014**, *37*, 45–66. [\[CrossRef\]](#)
37. Sheth, J.N.; Sethia, N.K.; Srinivas, S. Mindful consumption: A customer-centric approach to sustainability. *J. Acad. Mark. Sci.* **2011**, *39*, 21–39. [\[CrossRef\]](#)
38. Geiger, S.M.; Fischer, D.; Schrader, U. Measuring What Matters in Sustainable Consumption: An Integrative Framework for the Selection of Relevant Behaviors. *Sustain. Dev.* **2018**, *26*, 18–33. [\[CrossRef\]](#)
39. Dale, A.; Newman, L. Sustainable development, education and literacy. *Int. J. Sustain. High. Educ.* **2005**, *6*, 351–362. [\[CrossRef\]](#)
40. Milfont, T.L.; Gouveia, V.V. Time perspective and values: An exploratory study of their relations to environmental attitudes. *J. Environ. Psychol.* **2006**, *26*, 72–82. [\[CrossRef\]](#)
41. McClintock, C.G.; Liebrand, W.B.G. Role of interdependence structures, individual value orientation, and another's strategy in social decision making: A transformational analysis. *J. Personal. Soc. Psychol.* **1988**, *55*, 396–409. [\[CrossRef\]](#)
42. Schwartz, S.H. Value orientations: Measurement, antecedents and consequences across nations. In *Measuring Attitudes Cross-Nationally*; Jowell, R., Roberts, C., Fitzgerald, R., Gillian, E., Eds.; SAGE Publications: Los Angeles, CA, USA, 2007; pp. 169–203. ISBN 9781421919821.
43. Schwartz, S.H. An Overview of the Schwartz Theory of Basic Values. *Online Read. Psychol. Cult.* **2012**, *2*, 1–20. [\[CrossRef\]](#)
44. Gifford, R.; Sussman, R. Environmental Attitudes. In *The Oxford Handbook of Environmental and Conservation Psychology*; Clayton, S.D., Ed.; Oxford University Press: New York, NY, USA, 2012; pp. 65–80. ISBN 9780199733026.
45. Morris, C.G.; Maisto, A.A. *Understanding Psychology*, 9th ed.; Prentice Hall: Upper Saddle River, NJ, USA, 2010; ISBN 9780205786220.
46. Hartsell, B. Teaching Toward Compassion: Environmental Values Education for Secondary Students. *J. Adv. Acad.* **2006**, *17*, 265–271. [\[CrossRef\]](#)
47. Vermeir, I.; Verbeke, W. Sustainable Food Consumption: Exploring the Consumer "Attitude–Behavior Intention" Gap. *J. Agric. Environ. Ethics* **2006**, *19*, 169–194. [\[CrossRef\]](#)
48. Bolderdijk, J.W.; Gorsira, M.; Keizer, K.; Steg, L. Values Determine the (In)Effectiveness of Informational Interventions in Promoting Pro-Environmental Behavior. *PLoS ONE* **2013**, *8*, 1–7. [\[CrossRef\]](#) [\[PubMed\]](#)
49. Kaiser, F.G.; Roczen, N.; Bogner, F.X. Competence Formation in Environmental Education: Advancing Ecology-Specific Rather Than General Abilities. *Umweltpsychologie* **2008**, *12*, 56–70.
50. Frick, J.; Kaiser, F.G.; Wilson, M. Environmental knowledge and conservation behavior: Exploring prevalence and structure in a representative sample. *Personal. Individ. Differ.* **2004**, *37*, 1597–1613. [\[CrossRef\]](#)
51. Liefänder, A.K.; Bogner, F.X.; Kibbe, A.; Kaiser, F.G. Evaluating Environmental Knowledge Dimension Convergence to Assess Educational Programme Effectiveness. *Int. J. Sci. Educ.* **2015**, *37*, 684–702. [\[CrossRef\]](#)
52. Brandt, P.; Ernst, A.; Gralla, F.; Luederitz, C.; Lang, D.J.; Newig, J.; Reinert, F.; Abson, D.J.; von Wehrden, H. A review of transdisciplinary research in sustainability science. *Ecol. Econ.* **2013**, *92*, 1–15. [\[CrossRef\]](#)
53. Jensen, B.B. Knowledge, Action and Pro-environmental Behaviour. *Environ. Educ. Res.* **2002**, *8*, 325–334. [\[CrossRef\]](#)

54. Tanner, C.; Wölfling Kast, S. Promoting Sustainable Consumption: Determinants of Green Purchases by Swiss Consumers. *Psychol. Mark.* **2003**, *20*, 883–902. [[CrossRef](#)]
55. Kollmus, A.; Agyeman, J. Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environ. Educ. Res.* **2002**, *8*, 239–260. [[CrossRef](#)]
56. Rokeach, M. *The Nature of Human Values*; Free Press: New York, NY, USA, 1973.
57. Schwartz, S.H. Are There Universal Aspects in the Structure and Contents of Human Values? *J. Soc. Issues* **1994**, *50*, 19–46. [[CrossRef](#)]
58. Halstead, J.M.; Taylor, M.J. Learning and Teaching about Values: A review of recent research. *Camb. J. Educ.* **2000**, *30*, 169–202. [[CrossRef](#)]
59. McCarty, J.A.; Shrum, L.J. The Recycling of Solid Wastes: Personal Values, Value Orientations, and Attitudes about Recycling as Antecedents of Recycling Behavior. *J. Bus. Res.* **1994**, *30*, 53–62. [[CrossRef](#)]
60. Steinfeld, H. *Livestock's Long Shadow: Environmental Issues and Options*; Food and Agriculture Organization: Rome, Italy, 2006; ISBN 978-92-5-105571-7.
61. Martin, M.; Brandão, M. Evaluating the Environmental Consequences of Swedish Food Consumption and Dietary Choices. *Sustainability* **2017**, *9*, 2227. [[CrossRef](#)]
62. Tilman, D.; Clark, M. Global diets link environmental sustainability and human health. *Nature* **2014**, *515*, 518–522. [[CrossRef](#)] [[PubMed](#)]
63. Dinu, M.; Abbate, R.; Gensini, G.F.; Casini, A.; Sofi, F. Vegetarian, vegan diets and multiple health outcomes: A systematic review with meta-analysis of observational studies. *Crit. Rev. Food Sci. Nutr.* **2017**, *57*, 3640–3649. [[CrossRef](#)] [[PubMed](#)]
64. Craig, W.J. Nutrition concerns and health effects of vegetarian diets. *Nutr. Clin. Prac.* **2010**, *25*, 613–620. [[CrossRef](#)] [[PubMed](#)]
65. Key, T.J.; Appleby, P.N.; Rosell, M.S. Health effects of vegetarian and vegan diets. *Proc. Nutr. Soc.* **2006**, *65*, 35–41. [[CrossRef](#)] [[PubMed](#)]
66. McEvoy, C.T.; Temple, N.; Woodside, J.V. Vegetarian diets, low-meat diets and health: A review. *Public Health Nutr.* **2012**, *15*, 2287–2294. [[CrossRef](#)] [[PubMed](#)]



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