sustainability

MDPI

Article

How Inquiry-Based Service-Learning May Support Sustainability-Related Meaning-Making

Andreas Schobert [1,2,*], Claus-Christian Carbon [3,4], Gerald Enzner [1] and Matthias Forell [5]

[1] Faculty VI–School of Medicine and Health Sciences, Department of Medical Physics and Acoustics, Speech Technology and Hearing Devices, Carl von Ossietzky Universität Oldenburg, 26111 Oldenburg, Germany; gerald.enzner@uol.de
[2] Caspar-Vischer-Gymnasium Kulmbach, 95326 Kulmbach, Germany
[3] Department of General Psychology and Methodology, Universität Bamberg, 96047 Bamberg, Germany; ccc@uni-bamberg.de
[4] Research Group EPAEG (Ergonomics, Psychological Aesthetics, Gestalt), 96047 Bamberg, Germany
[5] Research Group School Research, Faculty of Philosophy and Education, Ruhr-Universität Bochum, 44801 Bochum, Germany; matthias.forell@rub.de
* Correspondence: andreas.schobert@uni-oldenburg.de

Abstract

Education for Sustainable Development faces the challenge of enabling learners not only to engage with complex sustainability issues but also to develop independent judgment and engage in societal action. This study examines Inquiry-Based Service-Learning (IBSL) as a combination of Inquiry-Based Learning and Service-Learning and investigates the extent to which this teaching and learning setting provides conditions for sustainability-related meaning-making. Theoretically, the concept of the Communicative Umwelt is adopted and specified for school-based learning processes through four dimensions: Participation, Social Feedback, Real-World Contexts, and Epistemic Practices. Empirically, the study examines a one-year IBSL project involving two 11th-grade classes, in which 50 students developed a sustainably produced and fairly traded chocolate bar. The qualitative exploratory case study is based on group interviews with students, parents, and teachers, which were analyzed using structuring qualitative content analysis. The findings show that all four dimensions can be empirically identified in the project and are closely intertwined in the learning processes. They also provide indications of participant-reported changes in perceptions and more differentiated evaluations of sustainability-related interrelationships, as well as more tentative indications concerning action orientations. IBSL thus emerges as a promising approach for connecting epistemic processes with real-world societal responsibility in education for sustainable development (ESD).

Keywords: education for sustainable development (ESD); service-learning; inquiry-based learning; inquiry-based service-learning; social feedback; real-world learning; epistemic practices; Communicative Umwelt

Check for updates

Academic Editors: Juan Carlos Mosquera Feijoo, Marcos García Alberti and Fernando Suárez Guerra

Received: 15 October 2026
Revised: 4 November 2026
Accepted: 5 November 2026
Published: 8 November 2026

Copyright: © 2026 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license.

1. Introduction

International studies show that young people attach considerable personal and societal importance to sustainability-related challenges, yet feel insufficiently prepared to address them through school education. In a global UNESCO survey of 17,471 young people from 166 countries, 70% reported that they could not explain climate change or could explain only its basic principles. They also called for more interdisciplinary, action-oriented and

contextualized education that makes complex relationships understandable and enables independent action [1].

Youth studies in Germany likewise highlight the importance of sustainability-related questions. The 2024 Shell Youth Study identifies climate and environmental protection as major issues for young people, many of whom wish to shape societal developments while facing growing uncertainty about the future [2].

The complexity of sustainability issues is evident in food systems, where health, environmental, economic and social factors interact. Von Philipsborn [3] emphasizes that examining food systems requires diverse methodological approaches and forms of evidence. Education for Sustainable Development (ESD) must therefore enable learners not only to participate responsibly in societal transformation but also to understand how scientific knowledge is generated and to critically assess knowledge claims.

This raises the question of the conditions under which sustainability-related perceptions, evaluations and action orientations emerge and change. The concept of the Communicative Umwelt describes how subjective meanings develop through information, social interactions and feedback processes [4]. It thus offers a perceptual and communication-psychological perspective on sustainability-related learning [4,5] that complements design-oriented educational approaches and the normative goals of ESD by focusing on how learners attribute meaning to their experiences. Against this background, the present study examines Inquiry-Based Service-Learning (IBSL) as a possible educational approach that connects independent inquiry with societally relevant action. It investigates how such conditions become apparent in a school-based project and what indications can be identified of reported changes in learners' sustainability-related perceptions, evaluations and action orientations.

2. Theoretical Framework

2.1. Conditions for Sustainability-Related Meaning-Making: The Concept of the Communicative Umwelt and Its Extension to Education for Sustainable Development

The present study assumes that sustainability-related meaning-making does not arise simply from the transmission of predetermined content but develops through communicative processes in which perceptions, evaluations and action orientations are formed and changed. The concept of the Communicative Umwelt provides a theoretical reference framework by describing how meanings emerge from the interplay of signals, social interactions and feedback processes and thereby structure perception and evaluation [4].

In this study, sustainability-related meaning-making refers to the process through which learners interpret sustainability-related information and experiences in light of their prior knowledge and conceptions, relate them to one another and attribute subjective meaning to them. This understanding draws on Zittoun and Brinkmann [6], who describe meaning-making as an active interpretation of situations and experiences based on prior knowledge, and on Odii et al. [7], who emphasize the interplay of cognitive and communicative processes in sustainability-related meaning-making. Within the perspective of the Communicative Umwelt, meanings may be confirmed, differentiated or changed through new experiences and social feedback [4]. Empirically, meaning-making is explored through reported perceptions, evaluations and action orientations. Perceptions concern which sustainability-related relationships learners recognize and describe as significant; evaluations concern how they judge them; and action orientations concern ideas or intentions for responsible action arising from such judgments. The interview statements are interpreted as indications of possible changes in sustainability-related attributions of meaning, not as evidence of lasting attitudinal or behavioral change.

The frameworks involved in this study operate at different levels. Inquiry-Based Learning and Service-Learning are primarily design frameworks: they specify structural features of learning arrangements, such as phases of inquiry, a real societal need, reflection, and collaboration with community partners [8–10]. ESD is primarily a normative and curricular framework that defines sustainability-related goals, key competencies, and recommended pedagogical approaches [11,12]. Together, these frameworks describe how learning should be organized and what it should achieve, but none of them models in detail how learners attribute meaning to the experiences such arrangements provide. The specific contribution of the Communicative Umwelt lies in addressing this link between design features and learning outcomes from a perceptual and communication-psychological perspective that focuses on how subjective attributions of meaning emerge and may be modified [4]. It is therefore understood here not as a competing didactic model but clearly as a complementary analytical lens. Relative to the frameworks outlined above, this perspective contributes in three respects. First, Inquiry-Based Learning and Service-Learning treat feedback, reflection, and recognition primarily as design features or quality criteria [8–10]. The Communicative Umwelt shifts attention from the presence of feedback to the meaning it acquires for learners. Analytically, this requires distinguishing the receipt of feedback from its evaluative or modifying function. Second, Service-Learning conceptualizes real-world contexts primarily in terms of authentic needs and community partnership [8,10], whereas the Communicative Umwelt conceives of material objects, actors, and institutional conditions as carriers of signals [4]. In design-oriented projects, learners may thus act not only as interpreters of sustainability-related signals, such as labels or product claims, but also as designers of signals for others, for example, when creating a product and communicating its sustainability claim. Third, ESD frameworks specify target competencies and recommended pedagogical approaches [11,12] but do not model the process through which sustainability-related orientations emerge and change in individual learners. The Communicative Umwelt describes perception, evaluation, and action as reciprocally linked through feedback. Changed perceptions and evaluations therefore need not translate directly into action when competing signals, such as price or availability, shape everyday decisions [4].

Information and experiences are perceived and interpreted against the background of existing conceptions, experiences, and expectations. Social feedback, such as professional assessments, acceptance, rejection, or irritation, can itself become a new signal that confirms, differentiates, or calls existing conceptions into question. Perception, interpretation, and action are linked through reciprocal feedback: learners act on the basis of their existing conceptions, encounter responses from their social and material environment, and may incorporate these experiences into subsequent evaluations and decisions. The Communicative Umwelt thus offers a perspective for interpreting the interplay of these processes in relation to possible changes in subjective attributions of meaning.

The particular combination of Inquiry-Based Learning and Service-Learning is also central to this investigation. Inquiry-Based Learning enables learners to formulate questions, investigate information, critically examine knowledge claims and develop reasoned judgments. Service-Learning links school learning with real societal needs, responsible action and collaboration with actors outside school. Both approaches offer opportunities for active participation, reflection on experience and engagement with different perspectives and feedback. Inquiry-Based Service-Learning combines these processes by linking independent knowledge generation with societally relevant action.

From the interaction of these perspectives, four interrelated analytical dimensions are distinguished for school-based IBSL: (1) Participation, (2) Social Feedback, (3) Real-World Contexts and (4) Epistemic Practices. They capture different but interrelated conditions for sustainability-related meaning-making: Participation enables learners to formulate their

own questions, interpretations and decisions; Social Feedback can confirm, challenge or change these interpretations; Real-World Contexts embed experience in concrete societal, material and institutional conditions; and Epistemic Practices enable critical examination of information and knowledge claims and the development of reasoned judgments. The dimensions thus describe different functions within interconnected processes of meaning-making rather than independent characteristics.

The four dimensions are not categories taken directly from Carbon's concept. Their selection is grounded in combining its perceptual and communication-psychological perspective with the theoretical foundations of ESD and the characteristic learning and action processes of IBSL. They constitute a theory-informed, subject-specific analytical framework without claiming completeness. Its particular explanatory value lies in examining how active participation, social feedback, authentic societal experience and epistemic inquiry interact as conditions of sustainability-related meaning-making.

(1) Participation

According to the concept of the Communicative Umwelt, signals do not possess fixed meanings but become meaningful through their interpretation within a specific Umwelt, understood as a subjectively perceived and meaning-structured context [4]. For school-based learning processes, this suggests that sustainability-related orientations cannot emerge through the transmission of knowledge alone. Learners need opportunities to actively explore sustainability-related issues, develop their own questions and perspectives, make decisions, and participate in shaping the learning process. Participation thus creates conditions for learners to generate their own meanings rather than merely adopting predetermined interpretations.

A comparable assumption can be found in Education for Sustainable Development. Rieckmann [11] describes learner-centered pedagogy as regarding learners as autonomous actors and emphasizing the active development of knowledge based on prior knowledge and experience. Action-oriented learning likewise connects abstract content with concrete experience. A scoping review identifies participatory, problem-oriented, project-oriented, interdisciplinary, and inquiry-based approaches among the most frequently recommended pedagogical approaches for fostering sustainability competencies in secondary education, consistently emphasizing learners' active participation in learning and knowledge-building processes [13].

Participation thus creates conditions for learners to develop their own sustainability-related meanings, based on which evaluations and action orientations can emerge.

(2) Social Feedback

Drawing on Carbon's concept of feedback loops and social interchange, Social Feedback is conceptualized as a distinct dimension of sustainability-related meaning-making in educational settings. The Communicative Umwelt is a dynamic system in which perceived and interpreted signals trigger actions that, in turn, feed back into this Umwelt. The concept of the Umwelt goes back to Jakob von Uexküll and refers to the subject-specific world structured by perception and meaning within which an organism perceives and acts [14]. Actions, responses, and changes can themselves become signals that are subsequently perceived and interpreted, thereby connecting individual processes of perception and action with collective and systemic developments [4].

In school-based learning processes, interpretations, evaluations, or action proposals function as signals that may encounter different forms of Social Resonance, including Acceptance, Rejection, Irritation, and Questioning (Figure 1). These responses can themselves become social signals whose meaning learners interpret anew and may thereby contribute to the further development of their interpretations, evaluations, or action proposals. Their

significance depends not merely on the presence of feedback but on the meaning attributed to it within the respective Communicative Umwelt. Social norms, reputational cues, and the observed behavior of others can likewise influence perception and interpretation [4]. Meanings can thereby be confirmed, differentiated, or changed.

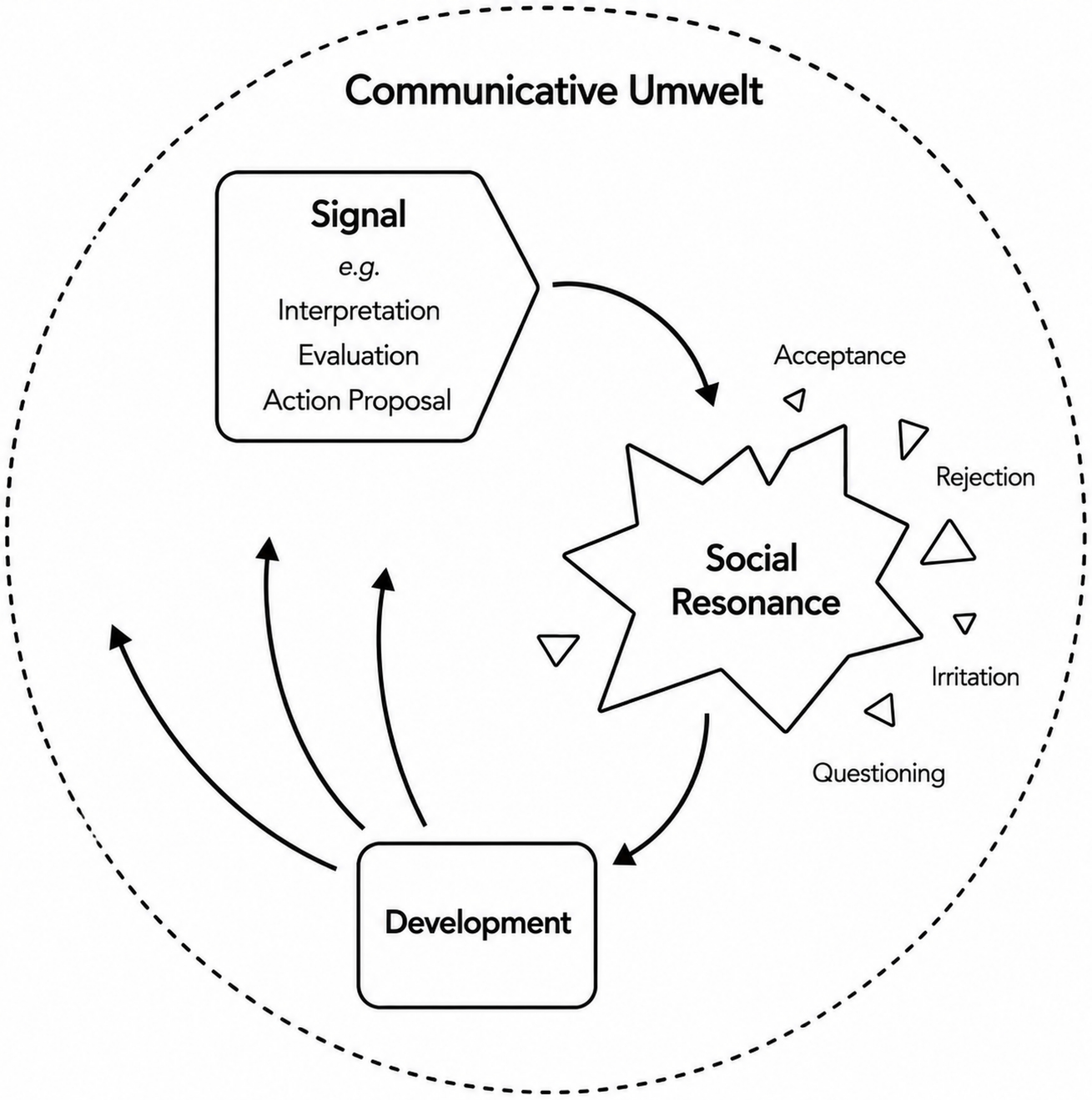


Figure 1. Process of Social Feedback within the Communicative Umwelt in School-Based Learning Settings.

This perspective is consistent with the emphasis on dialogic and reflective forms of learning in Education for Sustainable Development. Sustainability issues require the exchange of different perspectives and critical reflection, while dialogic forms of learning enable different experiences and bodies of knowledge to be related to one another [12]. Social Feedback thus creates conditions under which sustainability-related meanings can be examined and changed through interaction with others and social resonance, influencing perceptions, evaluations, and action orientations.

(3) Real-World Contexts

Real-World Contexts represent another dimension of sustainability-related meaning-making. Communicative Umwelten encompass not only information and its exchange but also human actors, material and symbolic objects, and institutional structures. Perception and interpretation, therefore, take place within specific social, material, and institutional conditions [4]. For school-based learning processes, sustainability-related issues can take on a different quality when connected to real objects, actors, decision-making conditions, and societal practices, rather than being treated exclusively as school content.

Within Real-World Contexts, sustainability appears not merely as an abstract objective but as a practice shaped by concrete resources, interests, responsibilities, and institutional frameworks. Signals acquire meaning in relation to the actors, material conditions, and social and institutional channels through which they are communicated, including interpersonal communication, media, and economic or institutional conditions such as availability, pricing, or legal regulations [4]. Engagement with a real product, production process, or societal problem can therefore open up different meaning structures than those offered by exclusively verbal or mediated representations.

Carbon illustrates, using sustainability-oriented consumer environments, that regional embeddedness, traceable material origins, and identifiable participants can foster trust and strengthen the alignment between products, personal values, and local contexts [4]. Real-World Contexts thereby make sustainability-related issues tangible as practices tied to actual resources, interests, decisions, and institutional conditions.

This perspective also corresponds to the importance of reality-based and societally embedded learning arrangements in Education for Sustainable Development. Community-based research projects, Service-Learning, and other experiential forms of learning connect learners with current environmental, social, and economic challenges beyond school [13]. Collaborative real-world projects and partnerships with companies, non-governmental organizations, public institutions, or political actors likewise enable learners to explore sustainability problems through the experience and expertise of societal partners [11]. Embedding learning in Real-World Contexts thus connects sustainability-related meanings to concrete societal realities and actual demands for action.

(4) Epistemic Practices

Epistemic Practices represent another dimension of sustainability-related learning processes. The Communicative Umwelt highlights how perceptions, evaluations and meanings arise in communicative processes and can be changed through new information and experiences [4]. Carbon also emphasizes questioning established conceptions in developing new solutions, distinguishing an initially open generation of creative ideas from their subsequent knowledge-based assessment, which may also consider ecological consequences and wider systemic relationships [4].

Inquiry-Based Learning builds on these considerations by making independent questioning, investigation and reasoned assessment of knowledge claims central to learning. This epistemic engagement is especially relevant to ESD because sustainability issues frequently involve complex systemic relationships, different forms of evidence and contested claims. Epistemic Practices extend beyond understanding scientific findings to socially organized processes in which claims are formulated, communicated, evaluated and legitimized [15]. ESD accordingly aims to enable learners to understand scientific knowledge, critically assess different forms of evidence and evaluate complex sustainability issues on a sound knowledge basis [11,12].

International research on ESD identifies systems thinking, critical thinking and integrated problem-solving as key sustainability competencies. These include recognizing

complex interrelationships, dealing with uncertainty, assessing knowledge claims and integrating different perspectives and forms of knowledge when addressing complex sustainability problems [11,12].

For school-based learning, sustainability-related statements should therefore not be accepted merely on grounds of subjective plausibility. Learners need opportunities to investigate questions systematically, collect observations and data, analyze relationships, justify conclusions, critically evaluate claims and reflect on uncertainty, limitations of evidence and competing explanations [15].

A complementary perspective is provided by research on Socio-Scientific Issues (SSI), which examines engagement with socially relevant, science-related problems. This research highlights that judgments about such issues depend not solely on scientific knowledge, but also on evaluating evidence, informal reasoning and considering ethical and societal concerns [16,17]. SSI thus connects epistemic inquiry with normative judgment and socially relevant decision-making. In sustainability issues, scientifically grounded findings and different value positions may need to be weighed together without necessarily yielding one unambiguous course of action.

The following section examines Inquiry-Based Service-Learning (IBSL) as a teaching and learning arrangement in which Inquiry-Based Learning and Service-Learning are systematically connected and the conditions of sustainability-related meaning-making described above may interact.

2.2. Inquiry-Based Service-Learning (IBSL)

Inquiry-Based Learning (IBL) refers to a self-directed yet structured process in which learners, driven particularly by curiosity, gain insights that are new to them. Reitinger [18] describes this as a process ranging from discovery grounded in sensory experience through systematic exploration to approaches characteristic of scientific inquiry. Key inquiry-related action domains are Experience-based Hypothesizing, Authentic Exploration, Critical Discourse, and Conclusion-based Transfer.

In Service-Learning, engagement for other people or the common good is combined with subject-specific learning [8,19]. Learners apply school-based knowledge in practice, develop subject-specific and transversal competencies, and experience the effectiveness of their own actions through the purposeful application of learning content [20,21].

Despite partial overlaps, Inquiry-Based Learning and Service-Learning are not equivalent. Inquiry-Based Learning is primarily oriented toward generating new knowledge and theoretical insights; solving practical problems is not a necessary objective [22]. Pedaste et al. [9] conceptualize Inquiry-Based Learning in terms of orientation, conceptualization, investigation, conclusion, and discussion, while Healey and Jenkins [23] emphasize learners' active participation in disciplinary research and knowledge-building processes. Societal action or an orientation toward the common good is not a necessary defining characteristic of these approaches, and Inquiry-Based Learning may also address problems outside municipal, civil-society, or nonprofit contexts [24].

Service-Learning, by contrast, is constitutively oriented toward a real societal need and a contribution to others or the common good [8,19]. Its established quality standards include a real need, curricular integration, reflection, participation, engagement outside school, and recognition, but do not define a systematic inquiry process as a necessary structural characteristic [8,10]. Research and analysis processes primarily serve to identify and specify the societal need [8,10,24]. Whereas Inquiry-Based Learning structures learning and problem-solving according to the logic of scientific inquiry, Service-Learning follows more closely the logic of project management [24].

These different emphases appear complementary with regard to the conditions for sustainability-related meaning-making developed in Section 2.1. Service-Learning provides authentic societal contexts for action, collaboration with external actors, and embeddedness in real social contexts, whereas Inquiry-Based Learning supports systematic engagement with complex issues through exploration, reflection, and knowledge building. Both approaches also provide opportunities for Participation and dialogic engagement.

Against this background, Inquiry-Based Service-Learning is understood in the present study as an extended form of Service-Learning in which elements of Inquiry-Based Learning are systematically integrated. The real societal need and the engagement addressing that need remain the starting point of the learning arrangement, while the underlying questions are deliberately deepened through epistemically oriented processes of exploration, reflection, and knowledge building. IBSL thus combines the societal embeddedness of Service-Learning with the potential of Inquiry-Based Learning for systematic knowledge generation.

The following section reviews the state of research on Inquiry-Based Learning, Service-Learning, and Inquiry-Based Service-Learning in relation to the conditions for sustainability-related meaning-making developed in Section 2.1.

2.3. State of Research and Potential

Inquiry-Based Service-Learning has been addressed in both international and German-language discourse but has so far received only limited systematic attention [25–27]. Internationally, combinations of Inquiry-Based Learning and Service-Learning can be found under different conceptualizations. Bernot et al. [28] combine Service-Learning with scientific inquiry to address real-world problems in an undergraduate science course, while Reardon [29] combines inquiry and Service-Learning in university-based Educational Leadership programs. Eutsler et al. [30] examine an Inquiry-Based Service-Learning setting in teacher education and report positive associations with subject-specific learning processes and academic performance. Cronin et al. [31] combine Service-Learning in sustainable design with students' active engagement as researchers and emphasize reflection and real-world societal problems. These studies demonstrate the relevance of combining the two approaches but do not yet constitute a uniformly conceptualized or broadly investigated field.

Empirical evidence on IBSL in school contexts remains particularly limited. One school-based impact study reports better science achievement and positive effects on topic-specific attitudes and behaviors, but no additional effect on broader civic engagement; its transferability to the German school system is limited [32]. In higher education, evidence also remains limited [25,26]. In the German-language context, Schlicht and Slepcevic-Zach [24] analyze similarities and differences between Research-Based Learning and Service-Learning. Müller-Naevecke and Naevecke [33] report positive effects on cognitive and methodological competencies and self-organization, although the two approaches are treated largely independently and the findings are descriptive-reflective. Evaluations in a Social Work degree program indicate high student satisfaction but also considerable workload [27]. In a sustainability-related higher education Service-Learning setting on Planetary Health, Mahmud et al. [34] report positive knowledge and attitude scores alongside more variable self-reported behaviors.

Because IBSL, as a distinct teaching and learning setting, has received only limited empirical investigation, the following synthesis also draws on findings concerning Inquiry-Based Learning and Service-Learning in relation to the four dimensions developed in Section 2.1. With regard to Participation, both approaches provide opportunities for learner participation in decision-making and responsibility [8,35,36]. Content and learning processes may emerge through negotiation among students, teachers, and community partners

or in relation to curricular requirements [18,37–39], while experiences of participation can support self-efficacy [8,40]. However, available findings predominantly concern Inquiry-Based Learning and Service-Learning separately; how participatory processes interact within IBSL remains insufficiently investigated.

Research concerning Social Feedback points to the importance of negotiation, teamwork, reflection, recognition, and feedback. Negotiation processes can foster engagement with different perspectives and the joint development of solutions [8,41], while teamwork and cooperative work provide opportunities for dialogic competence, self-organization, and shared responsibility [35,42]. Reflection enables experiences, outcomes, and interpretations to be examined and further developed through feedback [38,43,44], and recognition and feedback on learning progress can contribute to perceived efficacy and the meaningfulness of learners' contributions [8,37,43]. At the same time, Social Feedback is not guaranteed by cooperative work alone but depends on the pedagogical design of communication and reflection processes [45]. How such feedback processes operate within IBSL remains empirically underexplored.

Regarding Real-World Contexts, societal embeddedness is constitutive for Service-Learning. Its quality standards require engagement with a real challenge and the identification and specification of an actual societal need [19,20]. Engagement outside school and collaboration with community partners provide access to new learning environments, perspectives, and situations for action [20,43,46]. Inquiry-Based Learning may likewise address societally relevant questions and practical contexts, but municipal, civil-society, or nonprofit embeddedness is not a necessary structural characteristic [24]. In Service-Learning, the quality of such learning opportunities also depends on deliberate collaboration, including communication, coordination of expectations and goals, and shared reflection [20,47]. IBSL therefore offers the potential to combine Service-Learning's societal embeddedness with inquiry-oriented processes, but the conditions under which this combination is realized in school-based projects remain insufficiently investigated.

With regard to Epistemic Practices, Inquiry-Based Learning supports the generation, examination, and justification of knowledge through developing hypotheses, conducting investigations, and reflecting on findings [9,38]. It can also foster understanding of the significance of engaging in inquiry [18,48], while inquiry processes provide opportunities to document observations systematically, examine findings, and justify knowledge claims [9]. In a sustainability-related school context, Baptista et al. [49] likewise show how inquiry into a real local environmental problem can involve investigating problem contexts, engaging with different sources of information, and developing reasoned approaches to action. Systematic inquiry, however, is not a constitutive characteristic of Service-Learning [19,24,50]. Service-Learning can nevertheless relate generated knowledge to real societal issues, external actors, and concrete demands for action. IBSL may therefore embed epistemic processes within societally relevant contexts for action, but the limited evidence available does not permit robust conclusions about whether this combination produces a distinct additional effect compared with Inquiry-Based Learning or Service-Learning alone.

In summary, Inquiry-Based Learning and Service-Learning offer complementary contributions to the four dimensions developed in Section 2.1. A research gap remains regarding how Participation, Social Feedback, Real-World Contexts, and Epistemic Practices interact within IBSL and the extent to which this interplay supports sustainability-related meaning-making. The present empirical study addresses this gap through a concrete school-based IBSL project.

2.4. Research Questions

Based on the theoretical framework and state of research outlined above, the present study examines Inquiry-Based Service-Learning (IBSL) as a learning setting for sustainability-related meaning-making through Participation, Social Feedback, Real-World Contexts, and Epistemic Practices. Against this background, the following research questions are addressed:

RQ1. To what extent can the theoretically derived dimensions of Participation, Social Feedback, Real-World Contexts, and Epistemic Practices be identified and described over the course of a school-based IBSL project?

RQ2. To what extent does the course of the project provide evidence of reported changes in learners' sustainability-related perceptions, evaluations, and action orientations?

3. Materials and Methods

This section presents the empirical study of Inquiry-Based Service-Learning in the context of Education for Sustainable Development, including the project context, study design, data collection, analytical procedure, and methodological quality criteria.

3.1. Study Context: The Inquiry-Based Service-Learning Project "Sustainable Chocolate Bar"

The "Sustainable Chocolate Bar" project involved two regular Grade 11 classes at a German secondary school (Gymnasium), comprising 50 students aged 16–17. Conducted over one school year within regular Art instruction, it linked product and packaging design to sustainability-related questions across Geography, Politics and Society, Biology and Chemistry, Ethics and Spanish. Its starting point was a societal need identified by the school's Fairtrade group: to provide a fairly traded, sustainably produced alternative to the conventional chocolate previously offered at school and, in doing so, to raise awareness of problematic global production conditions, particularly exploitative child labor, while potentially contributing to improved living and working conditions in cocoa-producing countries. The students worked toward a fairly traded, sustainably produced chocolate bar intended for educational use in schools and undertook public information and outreach activities, thereby contributing beyond their own learning group.

The project involved external partners including a chocolate producer, chocolatier, packaging designer, sustainable printing company, academic partners and civil-society networks. Their expertise connected students' decisions to actual production requirements and wider societal needs. The service component encompassed not only the development of the chocolate bar but also the independent design and implementation of educational and informational activities. The students communicated their findings on global supply chains, exploitative child labor, and fair trade through visits to primary schools and activities at an Education for Sustainable Development event at another school. They also began developing a film and board games to communicate these issues in an age-appropriate manner and prepared an international exchange with France. These activities established the chocolate bar as a concrete educational and communication medium and demonstrated the project's societal engagement beyond product development itself.

The project comprised several overlapping and interacting phases (Figure 2). Knowledge Building addressed sustainable chocolate production, global supply chains, and design principles, while Inquiry Activities focused on ingredients, production processes, and the requirements for sustainable packaging. Working in groups, students developed product concepts and made decisions concerning material and aesthetic qualities, including colors, surfaces, graphic design, information density, recognizability, and their relationship to the sustainability claim. Their ideas were discussed and revised with experts with regard to feasibility, costs, and scalability. An important aspect was that the students discussed their

considerations not only within the school setting but also in dialogue with actors involved in actual production, design, and marketing processes. Their concepts were ultimately implemented as a real product in collaboration with the project partners.

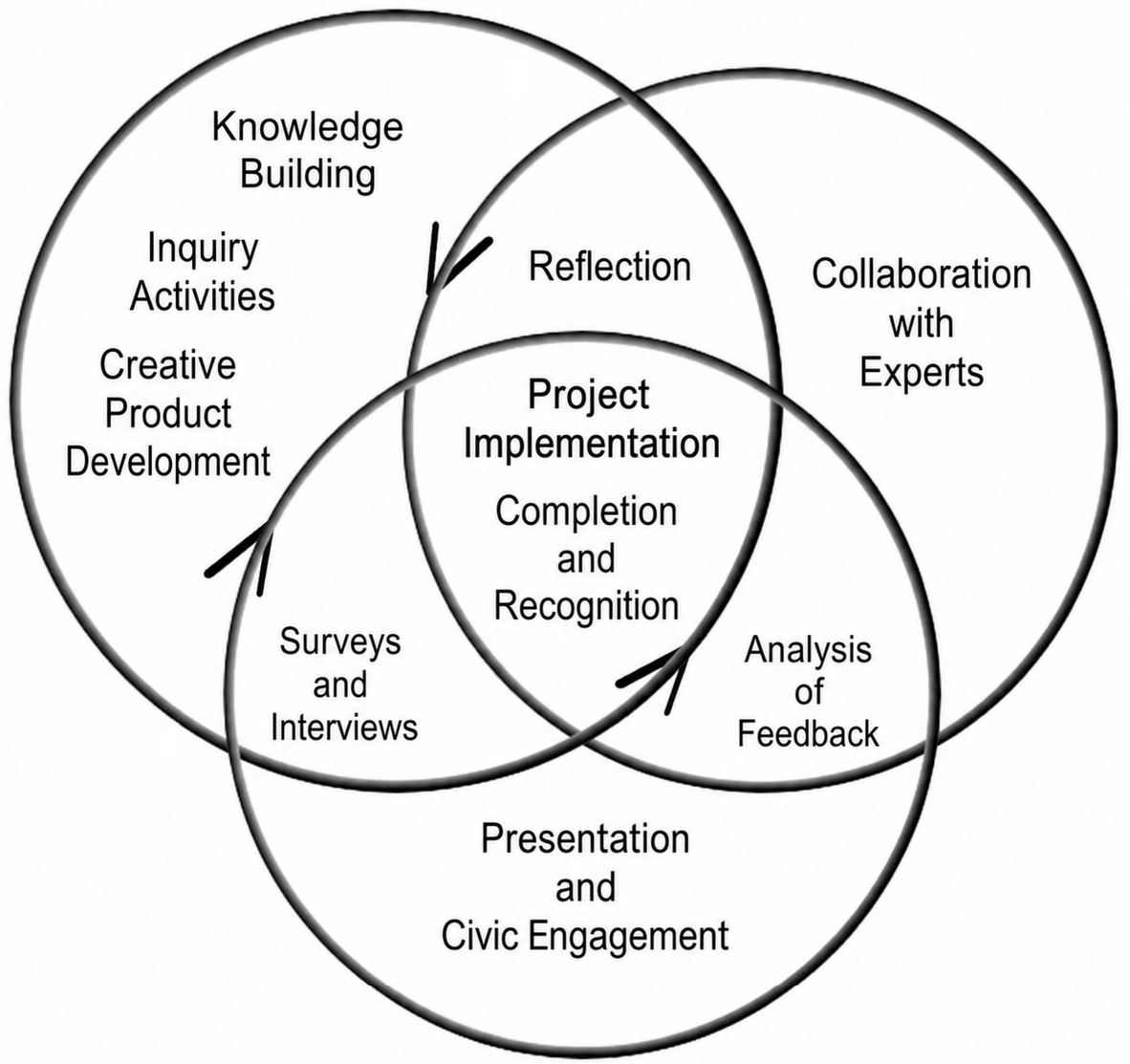


Figure 2. Dynamic Project Process in Inquiry-Based Service-Learning.

Reflection took place throughout the project and addressed subject-specific, social, and normative dimensions, particularly sustainable consumption and societal responsibility. Students considered tensions between sustainability, taste, professional feasibility, economic viability, and communication of the sustainability concept. They also developed and tested interview guides and questionnaires to collect consumer feedback on the product, packaging, and sustainability concept and used this feedback for further development.

The students also presented their chocolate bar and its background to the Federal Minister of Food and Agriculture and discussed possibilities for wider dissemination. A public presentation at a food festival enabled the students to communicate issues of child labor, fair production and sustainability to visitors and receive feedback on their work. One final chocolate-bar prototype was developed from the groups' ideas, and 500 bars were produced. These activities combined engagement for a defined societal concern with inquiry-oriented learning and reflection.

3.2. Study Design, Data Collection, and Analysis

The study adopted a qualitative exploratory case study design within school-based practitioner research. The one-year project involved two regular mixed-gender Grade 11 classes, comprising 50 students aged 16–17, at a school in a small-town setting. Students came from different family backgrounds and entered the project with different experiences and interests in sustainability. Some belonged to an existing school Fairtrade group; others had no corresponding prior experience.

Data were collected one week after project completion through four group interviews: two groups of five female students (one group from each class), four mothers and six teachers (three women and three men). Student and parent participation was voluntary; the two student groups reflected both classes and different project tasks. Some parents had provided organizational or advisory assistance during the food-festival presentation. Three interviewed teachers had participated directly through Geography lessons, a survey conducted in Politics and Society, and contact with a project in the chocolate's country of origin in Spanish; these teachers also supported the food-festival presentation. Three other teachers were familiar with the project without being directly involved. Teachers were purposively invited to include both perspectives; participation was voluntary.

All four interviews were conducted face-to-face at school outside regular class time by the teacher who had initiated the project and taught the participating classes. They lasted between 40 and 60 min. Separate semi-structured interview guides for students, parents and teachers addressed the research questions and theoretical dimensions while allowing open exploration of participants' experiences. To reduce the potential influence of the teacher–student relationship, grades for work performed in the project had already been determined before the interviews. Participants had also received written assurance that their interview statements would not affect assessment, as required for approval by the responsible authority. At the start of the interviews, students were explicitly encouraged to give truthful, open and critical accounts; the same was explained in detail to teachers, who also raised critical points. Interviews were conducted in German, digitally recorded, transcribed verbatim, anonymized during transcription and analyzed in German. Selected quotations were subsequently translated into English as meaning-preserving renderings, not authorized English-language originals. All participants consented to participation and recording, with additional parental or guardian consent for minors; the requisite official approvals were obtained.

Data were analyzed using structuring qualitative content analysis according to Mayring [51]. The deductively developed main categories—Participation, Social Feedback, Real-World Contexts, and Epistemic Practices—were derived from the dimensions developed in Section 2.1 and served as the theory-guided analytical framework. During analysis, these main categories were differentiated through subcategories developed abductively from the interview material to capture recurring patterns and specify the function of each dimension within the IBSL learning setting. A coding guide containing definitions and anchor examples was developed, and the category system was pilot-tested on a subset of the interview material to assess applicability and discriminability. All coding was conducted using MAXQDA 26 (VERBI Software, Berlin, Germany).

Methodological quality was addressed through a rule-guided procedure, transparency and critical discussion within the four-person research team. One researcher initially coded the entire interview material. Several selected passages were then discussed with the three co-authors, including uncertain category assignments, illustrative anchor examples and passages relevant to developing or distinguishing categories. Differing interpretations were discussed until a shared decision was reached. The teacher-researcher consciously distinguished personal project experiences and expectations from statements supported by

interview material, considered critical or contradictory accounts, and discussed alternative readings with the co-authors. Student, parent and teacher perspectives were considered separately, without prematurely resolving contradictions. Reported experiences were not interpreted as proof of causal effects or lasting attitudinal or behavioral change.

4. Results

The results are presented according to the four theoretically derived dimensions: Participation, Social Feedback, Real-World Contexts, and Epistemic Practices. Tables 1–4 summarize the corresponding subcategories, definitions, and illustrative anchor quotations, which are subsequently examined in the same order using the interview data. To facilitate orientation, each table provides an overview of the analytical structure of the respective main category before the corresponding findings are discussed in detail.

Table 1. Subcategories of the main category "Participation".

Subcategory	Brief Description/Definition	Anchor Example
Independent Decision-Making and Design (P1)	Learners develop their own ideas, make content-related or design-related decisions, and thereby influence the course or outcome of the project. Coding focuses on actual scope for decision-making; mere participation or the execution of predetermined tasks is not sufficient.	"From the flavor and the chocolate to the filling, the packaging, and the implementation, we could basically have a say in everything." (Student)
Shared Responsibility (P2)	Learners take responsibility for ensuring that their own and jointly made decisions are implemented in a viable manner and that their individual contribution meets the qualitative and practical requirements of the real-world project. The focus is on the commitment to one's own contribution to the project's success.	"They really did take on some responsibility because they were partly responsible for making the project work and for actually producing a real product in the end." (Teacher)
Perceived Impact of One's Own Actions (P3)	Learners experience that their own ideas and actions have discernible consequences and do not remain without effect within the confines of the school setting. Coding focuses on the subjectively perceived impact of one's own contribution.	"In the end, you could see that you actually have quite a lot of influence over what you eat and where it comes from." (Student)

Table 2. Subcategories of the main category "Social Feedback".

Subcategory	Brief Description/Definition	Anchor Example
Feedback (SF1)	Learners receive responses to ideas, decisions, products, or actions. Social feedback is coded initially regardless of whether it leads to a change in the respective idea or attribution of meaning.	"Otherwise, everything always stays within this little school bubble. Having someone from outside assess what was actually achieved and give feedback on it is something we normally don't really have." (Teacher)
Negotiation (SF2)	Different perspectives, interests, or proposed solutions are brought into dialogue with one another. Decisions or meanings emerge through discussion, consideration of alternatives, compromise, or joint further development.	"When we had different ideas, everyone gave their opinion. Sometimes parts of different suggestions were taken and put together, and then we agreed on something." (Student)
Validation (SF3)	Learners' own ideas, decisions, or attributions of meaning are confirmed, corrected, differentiated, or called into question through the responses of others in relation to social, professional, or societal standards. In contrast to mere feedback, social feedback here serves an evaluative or modifying function.	"At the food festival, one visitor was disappointed that the bar wasn't vegan. That showed us that there really are people for whom exactly that would be important." (Student)

Table 3. Subcategories of the main category "Real-World Contexts".

Subcategory	Brief Description/Definition	Anchor Example
Authentic Requirements (RWC1)	Learners are required to make decisions under actual technical, design-related, economic, or organizational conditions. The task has real consequences and cannot be addressed solely according to school-based assessment criteria.	"In the end, we had to think realistically and put the facts on the table. If an idea wasn't feasible, you also realized that it just couldn't work that way." (Student)
Societal and Professional Embeddedness (RWC2)	Learning processes take place in connection with real actors, institutions, production sites, and societal practices. Coding captures learners' involvement in actual social, professional, economic, or political contexts of action—not the feedback received within these contexts as such.	"It really takes you out of this little school bubble: the real world of work, the chocolatier, the minister, different appointments—really from the very beginning all the way to the finished product." (Teacher)
Public Impact (RWC3)	The project or its product extends beyond the confines of the school, reaches real audiences, and is publicly presented, used, discussed, or marketed. Coding captures the societal reach of the project outcome and its potential to connect with audiences beyond the school context.	"We gave the name more thought because we knew it was going to be around for longer and reach more people." (Student)

Table 4. Subcategories of the main category "Epistemic Practices".

Subcategory	Brief Description/Definition	Anchor Example
Generating Knowledge (EP1)	Learners systematically generate or obtain information through observation, experimentation, surveys, research, or other forms of their own inquiry. The decisive criterion is that information is not merely transmitted but is generated or systematically obtained through learners' own inquiry activities.	"I definitely think that was an inquiry. Through the feedback from lots of people, we kept getting new information and, almost like a kind of statistic, got a better picture of what a lot of people liked." (Student)
Examining Ideas and Assumptions (EP2)	Assumptions, ideas, or possible solutions are not simply accepted but are compared and examined for their viability based on observations, trials, data, criteria, or reasoned expert knowledge.	"You couldn't just be sure: 'My suggestion is the best one.' You had to look at things, try them out, and find the best option from the different possibilities." (Student)
Justifying Knowledge Claims and Decisions (EP3)	Knowledge claims and decisions are related to comprehensible reasons, criteria, or evidence. This also includes critically examining the reasoning of others and assessing its validity for one's own decisions.	"The reasons made sense: the milk chocolate had a longer shelf life, so it made more sense for production and sales. When you asked questions and thought about it again yourself, it made sense." (Student)

RQ1 concerns the empirical identification and description of these dimensions within the IBSL learning setting. Evidence concerning learners' sustainability-related perceptions, evaluations, and action orientations is considered within the individual categories. These three areas do not constitute additional categories but serve as heuristic points of reference and are not assumed to be mutually exclusive. Section 4.5 subsequently examines these findings across categories with regard to RQ2.

4.1. Participation

Within the main category Participation, three analytically distinct subcategories were identified (Table 1). Independent Decision-Making and Design (P1) refers to the scope for decision-making and design, Shared Responsibility (P2) to the resulting responsibility for the success of the project, and Perceived Impact of One's Own Actions (P3) to the experience of the consequences of one's own actions. P3 should be distinguished in particular from Public Impact (RWC3): P3 captures learners' subjective experience of the impact of their own actions, whereas RWC3 captures the project's actual societal reach.

Independent Decision-Making and Design (P1)

The material provides clear evidence of extensive student scope for decision-making and design across different phases of product development, including the composition of the chocolate bar, ingredients and filling, and packaging design. Students describe determining key elements themselves rather than merely choosing between predetermined options and contributing their own ideas to initial packaging and visual concepts.

Compared with regular subject lessons, which they perceived as more predetermined, students report greater freedom and feeling their opinions were heard: "In this project, you really did feel like you had a bit more freedom." Teachers likewise confirm opportunities for students to make decisions concerning design, flavor, and the overall direction of the product.

At the same time, decision-making was embedded in a professional implementation process that imposed organizational, design-related, and production-related constraints. Some students would have preferred greater involvement in particular areas, but predominantly described these limitations as understandable. As one student summarized, they had "done most of it ourselves" and had been able to "decide most of it," while the division of work with the professionals had "worked out fine."

Shared Responsibility (P2)

Working on a product that was actually going to be produced was associated with higher expectations regarding students' own contributions. Parents describe quality expectations as "very high," particularly because the product had to appeal to others and students' packaging designs would subsequently be further developed professionally.

According to the parents, students largely embraced this responsibility as a challenge. One parent characterized their attitude as: "It wasn't a case of 'we have to'; it was 'we want to.'" The project also remained a topic of private conversations over an extended period, with students continuing to engage with stages of product development outside class.

Perceived Impact of One's Own Actions (P3)

The perceived impact of students' actions became particularly evident when their decisions produced a tangible product. Students describe the transition from planning to production and tasting the finished chocolate bar as memorable moments. One parent similarly recalls initial skepticism about "whether a school could actually pull something like this off" and, after holding the finished bar, states, "I'm impressed."

Students also related this perceived impact to consumption decisions. One student states that the project showed "that you actually have quite a lot of influence over what you eat and where it comes from." The material thus indicates perceived impact both in relation to the jointly developed product and to students' own consumption.

4.2. Social Feedback

Within the main category Social Feedback, three distinct communicative functions were differentiated (Table 2). Feedback (SF1) initially captures the receipt of social feedback, Negotiation (SF2) refers to the negotiation of different positions in relation to one another, and Validation (SF3) requires feedback to lead learners to confirm, correct, or question their own understanding in relation to external standards. Mere collaboration with external partners is not sufficient for any of these categories; in each case, the communicative function is decisive.

Feedback (SF1)

The material shows that students received feedback from a range of social and professional contexts throughout the project. Feedback concerned both product development and

how the product was perceived by people outside the participating learning groups. During product development, students deliberately sought others' views, for example, when selecting flavor and filling by asking what people liked or disliked. Parents likewise report feedback outside the classroom, including tastings with family members and acquaintances.

Feedback was not limited to taste but also concerned design and the overall effect of the product. Students thus encountered responses to different aspects of their work at several stages of development.

Negotiation (SF2)

The interviews show that different ideas repeatedly had to be coordinated, both within working groups and between the two participating classes. Students report differing positions concerning the chocolate bar and its packaging but describe generally being able to reach an agreement.

Within groups, different proposals were not simply replaced by individual decisions; instead, elements from several ideas were combined. Students consequently described the outcome as a shared product in which "there really was something from everyone" and as "a product made by all of us together."

Parents likewise describe negotiation as recurring throughout the project. Different ideas and requirements had to be considered and compromises found. One parent summarizes this recurring task as: "We have to agree on this; we have to find a solution." The resulting outcome could therefore differ from what individual participants had originally envisaged.

Validation (SF3)

The material also contains situations in which students' ideas were examined against external assessments and subsequently confirmed, modified, or rejected. This is particularly evident in exchanges with professionals. One student reports that the chocolatier assessed the different proposals in terms of "what could actually be done and what couldn't," meaning that students' ideas were evaluated under professional conditions rather than merely acknowledged.

Students also describe expert judgments as relevant when several options were available. At certain points, they had to "trust the experts" when professional experience indicated "what makes the most sense." Such interventions were not predominantly described as arbitrary restrictions on students' decision-making; rather, students emphasized that professionally required changes were understandable.

4.3. Real-World Contexts

Within the main category Real-World Contexts, three subcategories were differentiated (Table 3). Authentic Requirements (RWC1) captures the reality of the requirements, Societal and Professional Embeddedness (RWC2) the institutional and societal embeddedness of the learning process, and Public Impact (RWC3) the reach of the resulting product or action beyond the school context. The mere presence of an external partner is not automatically coded as Social Feedback; only a communicative response from that partner would additionally relate to SF1–SF3.

Authentic Requirements (RWC1)

The material shows that students had to align their decisions with conditions arising from the actual production and marketing of the chocolate bar. These included flavor and recipe, shelf life, packaging, design feasibility, and appeal to potential consumers. Their ideas could therefore not be selected solely according to personal preferences but had to be reconciled with the requirements of a product that could actually be produced.

Students particularly describe how initially preferred ideas sometimes had to be modified under real production conditions. Technical and production-related requirements increasingly made the development process "more realistic." At the beginning, however, it was not always clear how individual ideas and initial "building blocks" could be combined into a feasible product; the concrete conditions of implementation became progressively apparent over the course of the project.

Societal and Professional Embeddedness (RWC2)

The interviews show that students were involved in a range of professional and societal contexts. They interacted with external professionals, visited production sites, and incorporated professional expertise into product development. During the visit to the chocolatier, students saw "where the chocolate bar would actually be produced in the end" and presented their own prototypes or product concepts.

Collaboration was not limited to receiving information or specialist knowledge. Students contributed their own designs and product ideas, discussed them with professionals, and further developed them in dialogue under conditions of professional implementation. Parents likewise emphasize the combination of theoretical information with concrete encounters and excursions, describing insights into working and production contexts as particularly memorable.

Societal embeddedness also extended to the political context. Students presented the chocolate bar to the Federal Minister of Food and Agriculture and discussed possibilities for its wider dissemination. The meeting was described as an exceptional component of the project, although participants did not attribute to it an impact that clearly exceeded that of other project phases.

Public Impact (RWC3)

Over the course of the project, both the project and the resulting product increasingly extended beyond the school context. The chocolate bar was produced, publicly presented, and sold, thereby reaching audiences not involved in its school-based development.

This became particularly visible at the food festival, where students approached visitors, presented the chocolate bar, and sold it directly to an external audience. The decisive point here is not the feedback received—which is assigned to Social Feedback—but the project's actual reach beyond school through a real product.

Students were already aware of this public reach during the design process. They described individual decisions as more significant because the outcome was not merely a school assignment but would remain visible and reach a larger audience.

4.4. Epistemic Practices

Within the main category Epistemic Practices, three knowledge-related functions were distinguished (Table 4). Generating Knowledge (EP1) concerns the generation or systematic acquisition of knowledge, Examining Ideas and Assumptions (EP2) the examination of assumptions, ideas, and possible solutions based on available information, professional feedback, and concrete requirements, and Justifying Knowledge Claims and Decisions (EP3) the reasoned or evidence-based justification of knowledge claims and decisions. Mere exposure to expert knowledge is not sufficient for EP1–EP3; an active process of knowledge generation, examination, or justification on the part of the learners must be evident.

Generating Knowledge (EP1)

The material indicates that students did not obtain information exclusively through instruction by teachers or external professionals but also generated information themselves and used it in further product development. This is particularly evident in the

development, implementation, and analysis of surveys. One teacher explicitly identifies "developing surveys" and "analyzing surveys" as components of subject-specific learning within the project.

The surveys therefore functioned not merely as a means of collecting individual responses but as a methodological procedure through which information was systematically generated and analyzed in connection with the concrete project.

The students' independent development of survey questions also addressed sustainability-related decision-making processes. One teacher reported that the students developed questions concerning fair trade, production without exploitative child labor, and sustainability, relating these aspects to other factors influencing purchasing decisions, particularly price, taste, and packaging design. In doing so, they also addressed the methodological question of how such relationships could be investigated using an appropriate questionnaire designed to avoid leading questions as far as possible. The students conducted the surveys and subsequently analyzed the results to gain insights for further product development.

The students also described the forthcoming public presentation of the chocolate bar as an incentive to seek more detailed information about its background. One student explained that they needed to engage more intensively with the topic in order to explain the development process and its ethical foundations to other people.

Examining Ideas and Assumptions (EP2)

The interviews show that students' ideas and possible solutions were not simply accepted but had to be tested and compared. Students describe phases of uncertainty in which it was unclear "whether you were doing it right or wrong" or whether the process would produce a viable result.

They report having to "try out lots of things" and compare different suggestions rather than assuming that "my suggestion is the best one." Some initially preferred ideas were consequently abandoned. One teacher likewise characterizes parts of the process as "trial and error," with solutions being tested and further developed rather than predetermined.

A critical engagement with knowledge claims also became apparent in relation to the credibility of sustainability-related claims. One student pointed out that companies sometimes present their products as sustainable even when this is not actually the case. The statement also indicated that evaluating such claims requires relevant background knowledge and may involve uncertainty for consumers. It thus suggests a critical awareness of the reliability of sustainability-related information.

Justifying Knowledge Claims and Decisions (EP3)

The material also shows that decisions were related to comprehensible reasons and criteria. Students distinguish between merely accepting statements made by professionals and understanding the reasoning themselves. For example, the decision to use milk chocolate with a longer shelf life became comprehensible in relation to production and sales requirements. Other professional objections likewise became understandable when students asked questions, received explanations, or reconsidered the reasoning themselves.

Such reasoning extended beyond individual technical decisions. Students had to consider several requirements simultaneously, and the viability of solutions was not determined solely by personal preferences. Sustainability-related criteria were also weighed against one another. One student, for example, notes that consistently choosing organic and Fairtrade products in everyday life is not always possible, but describes bringing such information to mind when making decisions.

The parent interviews similarly suggest a shift in how price differences were understood. One parent reports that, following the project, higher prices for sustainable chocolate were

associated more strongly with production conditions and the avoidance of child labor rather than being perceived merely as price differences.

4.5. Cross-Category Indications of Sustainability-Related Change

Across the four main categories, the interviews offer indications of participant-reported changes in sustainability-related perceptions, evaluations, and action orientations. These aspects are interconnected, but changed perceptions and evaluations do not necessarily translate into corresponding behavior.

4.5.1. Sustainability-Related Perceptions

The most pronounced indications concern how students perceived production conditions and global interdependencies. Several students described the examination of cocoa cultivation, child labor, and working conditions as particularly memorable. One student recalled that a talk on chocolate production had opened her eyes to the circumstances in which cocoa can be produced without fair labor conditions. She linked this new awareness to considering what she was purchasing and whose production practices her purchases might support. Another student explained that learning about the industry changed which aspects she noticed when encountering chocolate products in shops.

These perceptions extended beyond chocolate. A student described paying more attention to regional origins, organic products, and the conditions under which fruit and vegetables were grown and transported. She also related this awareness to empathy for people working under difficult conditions in cocoa production. The parent interviews provide an additional perspective: one mother recalled her daughter returning from a presentation on sustainable cocoa cultivation and talking extensively about what she had learned, including the implications of child labor. Such accounts suggest that the significance attributed to production conditions sometimes extended beyond classroom activities into family conversations.

4.5.2. Sustainability-Related Evaluations

The material also suggests more differentiated evaluations of sustainability-related products. In the parent interviews, price differences were discussed not simply as differences in cost but in relation to production conditions, fair treatment, and the possible avoidance of child labor. Students likewise described weighing sustainability against taste, affordability, and their own practical options. One student observed, in an account that also acknowledged continued consumption of conventional products: "I would not say that I always eat Fairtrade or sustainable chocolate... but you definitely pay much more attention to it" (Student; translated and lightly edited). She also noted that purchasing Fairtrade products regularly could be difficult for students who did not yet earn their own money.

A further differentiation concerned the credibility of sustainability claims. One student observed that some brands present themselves as sustainable even though they are not, and identified the difficulty of acquiring enough background knowledge to judge such claims. Her account suggests both greater critical awareness of sustainability-related product information and recognition of the limits of her own ability to verify it. These evaluations therefore concerned not only what participants considered desirable but also what they regarded as affordable, credible, and feasible.

4.5.3. Sustainability-Related Action Orientations

Some accounts also pointed to changes in intended actions and self-reported purchasing practices. Students described wanting to consider Fairtrade certification, product origins, and production conditions more carefully when shopping. One student stated that,

since the project, she had personally purchased only chocolate from a sustainably oriented producer, while others described more selective purchasing without consistently avoiding conventional chocolate. These accounts indicate different degrees of reported change rather than a uniform behavioral shift.

Parents likewise reported occasional changes in family consumption. One mother recalled visiting an organic food store and trying Fairtrade chocolate in response to the project. Another stated, "We no longer buy conventional chocolate from the usual manufacturers," while acknowledging that alternatives were not available for every cocoa-based product (Parent; translated and lightly edited). These are self-reported examples of possible changes outside the school setting, not independently verified consumption data.

At the same time, the interviews also highlighted constraints. Students pointed to the higher prices of Fairtrade products and the limitations of their own financial resources; teachers likewise raised doubts about whether heightened awareness would consistently prevail over price, availability, and everyday preferences. Taken together, the material offers the clearest indications of reported changes in sustainability-related perceptions and increasingly differentiated evaluations. Evidence concerning action orientations and purchasing behavior is more selective and varies between participants. Because the interviews were retrospective and no independent pre–post assessment was carried out, the findings do not establish the magnitude or persistence of behavioral change.

5. Discussion

The interpretation proceeds in three steps. First, with reference to the first research question, we examine how the four empirically identified dimensions interact within the project and how this interplay can be interpreted in light of the concept of the Communicative Umwelt (Section 5.1). Second, we examine the significance of combining Inquiry-Based Learning and Service-Learning for this constellation and the implications that can be derived for ESD (Section 5.2). Finally, the indications of participant-reported changes in sustainability-related perceptions, evaluations, and action orientations identified across the Results section are interpreted with reference to the second research question (Section 5.3).

5.1. Interplay of the Four Dimensions of Sustainability-Related Meaning-Making

With regard to RQ1, the findings show that all four theoretically derived dimensions—Participation, Social Feedback, Real-World Contexts, and Epistemic Practices—can be empirically identified within the IBSL learning setting and intersect in concrete situations. Students develop their own ideas and make decisions while coordinating them with others, aligning them with real-world requirements, and further developing them through feedback and professional reasoning. Feedback can simultaneously provide new information and initiate further examination or decision-making, while Real-World Contexts connect decisions to concrete requirements and Epistemic Practices support the reasoned comparison and examination of alternatives.

From the perspective of the Communicative Umwelt, the empirically described interplay of the four dimensions can be interpreted in relation to subjective attributions of meaning. Information, experiences, and social feedback are perceived and interpreted against the background of existing conceptions. The interviews show that students developed their own ideas and proposed solutions, compared them with professional assessments and actual production requirements, and revised some of them. Such feedback can be understood as new signals that may inform subsequent evaluations and decisions. The Communicative Umwelt thus provides an analytical perspective on the possible confirmation, differentiation, or modification of existing attributions of meaning through the interplay of perception, interpretation, and action.

This interpretation is consistent with previous findings on the two constituent approaches. Research on Service-Learning identifies participation, societal embeddedness, collaboration, and reflection as important characteristics or learning conditions [10,21], while Inquiry-Based Learning has been associated with student decision-making and processes of investigation, communication, and reflection [9,36]. Previous research has thus described individual effects and functions associated with Inquiry-Based Learning and Service-Learning. The specific contribution of the present study lies in empirically showing how Participation, Social Feedback, Real-World Contexts, and Epistemic Practices intersect within a shared IBSL learning arrangement.

Beyond describing this interplay, the Communicative Umwelt perspective made visible aspects that the constituent frameworks do not explicitly address. First, focusing on the meaning attributed to feedback rather than its mere presence made it possible to distinguish Feedback (SF1) from Validation (SF3). On the same basis, collaboration with external partners was coded as Social Feedback only where a communicative function was evident. The chocolatier's assessment of "what could actually be done and what couldn't," or a food-festival visitor's disappointment that the bar was not vegan, thus became relevant not as feedback per se but as signals through which students confirmed, revised, or differentiated their assumptions. Second, treating Real-World Contexts as "Communicative Umwelten" shows that students acted not only as interpreters of sustainability-related signals but also as designers of signals for others, through the packaging, the product name, and their outreach activities. Students' statement that they "gave the name more thought" because it would "reach more people" indicates that the anticipated responses of a real audience already shaped design decisions. Having to formulate and communicate a sustainability claim themselves may also have contributed to the critical awareness of the credibility of sustainability-related claims that some students expressed. This interpretation remains tentative, as the material does not allow such a connection to be traced directly. Lastly, the Communicative Umwelt also reveals the recursive relationship between perception, evaluation, and action, which we will discuss in more detail in Section 5.3.

5.2. IBSL as an Integration of Inquiry and Engagement

The findings can be related to the specific combination of Inquiry-Based Learning and Service-Learning. In the project investigated, surveys, trials, and reasoned decision-making contributed to developing a product intended for real implementation, while the practical task repeatedly required information to be generated and examined. This illustrates the complementarity of the two approaches assumed for IBSL [50].

The engagement component extends beyond providing a real-world context for application. Learners participated in a project whose outcome was intended for real audiences and to have a life beyond the classroom. Their scope for decision-making and design was therefore linked to responsibility for a shared outcome. Service-Learning thus adds a societal dimension of action: students contribute to a project whose development and outcome are meaningful to others.

At the same time, inquiry and engagement do not merely exist alongside one another. Engagement connects knowledge generation to a real societal context of action: the information required, the viability of solutions, and the criteria relevant to decisions are shaped by the shared project and the actors involved. Inquiry, in turn, enables learners to investigate these requirements and perspectives, examine their own assumptions and proposed solutions in light of them, and justify their decisions rather than merely accepting external assessments. Inquiry and societal action are thus brought into a reciprocal relationship.

This reciprocal relationship is particularly evident in collaboration with engagement partners. The chocolatier, designer, and other professionals represented requirements

arising from actual production and design, confronting students' ideas with conditions that would not have existed in the same way within school alone. At the same time, external assessments were in some cases questioned, explained, and critically considered. External expertise could therefore become part of learners' own processes of judgment rather than simply being accepted as given.

For ESD, the findings indicate that not only the sustainability topic itself but also the way in which it is addressed is important. Sustainability-related issues were not presented exclusively as predetermined knowledge or as instructions to adopt a particular "correct" behavior. Instead, information, interests, and requirements had to be weighed in concrete decisions. This corresponds to an understanding of ESD that enables learners to engage in reasoned ways with complex problems, different perspectives, and trade-offs [11–13].

IBSL can therefore be understood as a didactic structure in which sustainability-related knowledge is connected with societal action without reducing such action to the implementation of predetermined sustainability norms. Learners are given opportunities to make decisions, investigate their underlying conditions, and weigh alternative solutions against reasoned criteria. From the perspective of the Communicative Umwelt, the integration of engagement and inquiry makes societal requirements and external expertise part of sustainability-related meaning-making while rendering them accessible to learners' own examination.

The findings show that students engaged with sustainability-related questions, independently sought information, and developed a critical awareness of the credibility of sustainability-related claims. The development of their own survey questions concerning fair trade, sustainability, and consumption decisions also illustrates the integration of epistemic practices into their engagement with societally relevant issues. However, the interview material provides only limited insight into the extent to which specific sustainability-related claims, for example regarding Fairtrade certification, global supply chains, or environmental impacts, were independently and systematically examined using different sources. The retrospective group interviews focused on overarching project experiences and learning processes and did not consistently capture individual subject-specific research and verification activities in detail. The findings therefore indicate sustainability-related information seeking, critical reflection, and initial forms of independent inquiry, without providing sufficient evidence of a comprehensive systematic examination of sustainability-related knowledge claims.

These findings connect with international studies combining Inquiry-Based Learning and Service-Learning. Bernot et al. [28] relate scientific inquiry to real-world problems identified by community partners; Reardon [29] and Eutsler et al. [30] likewise examine combinations of inquiry and Service-Learning; and Cronin et al. [31] show how Service-Learning in sustainable design can involve students as active researchers. The present findings extend this still limited body of research by showing, in a school-based IBSL setting, how inquiry and engagement can be reciprocally related over the course of a project. Given the exploratory case study design, however, no distinct additional effect beyond those of the individual teaching and learning approaches can be inferred.

5.3. Indications of Reported Changes in Sustainability-Related Orientations

RQ2 yields a differentiated picture. The clearest indications concern shifts described by participants in sustainability-related perceptions and evaluations, whereas indications concerning action orientations remain more tentative. Importantly, the findings do not suggest a linear progression from knowledge to behavior.

Participants described sustainability-related interrelationships as being considered more strongly in relation to concrete products, production conditions, and consumption

decisions. They also described more differentiated evaluations as sustainability-related criteria were weighed against factors such as price, taste, and financial means. Sustainability thus emerged not as an isolated criterion but as one of several considerations requiring reasoned trade-offs rather than the adoption of a predetermined position.

Epistemic Practices are relevant in this context because generating, examining, and justifying knowledge supports engagement with different information and criteria in sustainability-related decision-making. In conjunction with Social Feedback and Real-World Contexts, evaluations can thereby be related to other perspectives and actual conditions. From this perspective, these reported developments in sustainability-related orientations can be understood as emerging through the interplay of information, learners' own decisions, social responses, and real-world contexts.

Findings concerning action orientations require greater caution. Although students reported intending to pay greater attention to sustainability-related criteria in purchasing decisions and parents described isolated changes in family consumption, these orientations continued to compete with personal preferences, financial means, and everyday constraints. The findings therefore do not support a direct or consistent transition from reported shifts in perceptions and evaluations to lasting behavioral change.

From the perspective of the Communicative Umwelt, this pattern can be explained theoretically rather than read as an indication that learning was ineffective. Within the project, sustainability-related signals were salient and socially reinforced through the shared product, the public presentations, and the feedback students received. In learners' everyday Umwelt, by contrast, these signals compete with others, such as price, availability, familiar products, taste preferences, and the purchasing practices of family and peers [4]. Whether a changed evaluation guides action therefore depends on the meaning these competing signals acquire in a specific decision situation. The interviews reflect these constraints: students referred to higher prices and their limited financial resources, parents to the lack of alternatives for some products, and teachers to doubts about whether heightened awareness would prevail over price, availability, and everyday preferences (Section 4.5). Whereas ESD frameworks define which competencies learners should develop, the Communicative Umwelt offers a process-based explanation of why changes in perceptions and evaluations do not necessarily translate into consistent action.

This differentiated pattern is consistent with previous research. Rimm-Kaufman et al. [32] report positive effects on topic-related attitudes and behaviors but no additional effect on broader civic engagement, while Mahmud et al. [34] report positive sustainability-related knowledge and attitude scores alongside more variable self-reported behaviors. Baptista et al. [49] likewise describe differences in the extent to which learners justified the need for action and developed concrete approaches to action in an inquiry-based examination of a local environmental problem.

For ESD, this underscores that educational processes should not be assessed solely by whether acquired knowledge is immediately translated into sustainable behavior, but also by whether learners perceive sustainability-related interrelationships more differentially, integrate multiple criteria into their evaluations, and justify their decisions. From the perspective of the Communicative Umwelt, these developments can be understood as meaning-making processes emerging through engagement with information, other perspectives, and real-world contexts. The findings therefore suggest that the Communicative Umwelt is relevant not only for describing the structure of the learning setting but also as a theoretical lens for understanding such reported developments in sustainability-related orientations.

6. Conclusions

6.1. Limitations and Directions for Future Research

As the retrospective group interviews focused on overarching project experiences, the collected material allows only limited examination of individual subject-specific research and verification processes. The qualitative exploratory approach allowed an in-depth consideration of different actor perspectives within a specific school-based setting. The researcher's multiple roles as project initiator, teacher, interviewer and analyst provided detailed contextual knowledge but may also have influenced interview responses and their interpretation. Grades were already determined, independence of assessment was assured in writing, and open and critical responses were encouraged. Nevertheless, socially desirable responses cannot be ruled out, including effects of collegial proximity in the teacher interviews. Critical discussion of selected codings and interpretations with the co-authors supported reflexive distance and analytical transparency.

The findings should be interpreted within the scope of the present case. The study was designed to provide an in-depth analysis of a specific IBSL setting rather than to establish generalizable causal relationships or the relative effectiveness of IBSL compared with other teaching and learning approaches. With regard to RQ2, perceptions, evaluations, and action orientations were not assessed longitudinally; the findings therefore do not establish whether reported changes persist over time or translate into lasting behavioral change.

Future research could compare Inquiry-Based Learning, Service-Learning, and IBSL under comparable conditions and examine whether their integration generates specific contributions beyond those of the two approaches implemented separately. Longitudinal studies could further investigate the stability of changes in sustainability-related perceptions, evaluations, and action orientations.

6.2. Concluding Remarks

The present study identifies IBSL as a promising approach to Education for Sustainable Development in which societal action and Epistemic Practices are systematically connected. Its central contribution lies in conceptualizing sustainability-related meaning-making as neither the transmission of knowledge nor the adoption of predetermined norms for action. Instead, the findings show that Participation, Social Feedback, Real-World Contexts, and Epistemic Practices intersect within the IBSL project, creating conditions in which learners can explore sustainability issues, engage with diverse perspectives and real-world requirements, and develop reasoned judgments.

The findings provide the clearest indications of participant-reported changes in perceptions of sustainability-related interrelationships and more differentiated evaluations, while indications concerning sustainability-related action orientations remain more tentative.

IBSL thus connects societal action with processes of inquiry, examination, and justification. Complementing Inquiry-Based Learning and Service-Learning as design frameworks and ESD as a normative framework, the concept of the Communicative Umwelt provides a process-oriented lens for understanding sustainability-related meaning-making as socially embedded and feedback-based. It directs attention to the meaning learners attribute to feedback, to real-world contexts as communicative environments in which learners also design signals for others, and to the recursive rather than linear relationship between perception, evaluation, and action. The present case study thereby contributes to the empirical specification of IBSL as a still under-researched approach to ESD and identifies starting points for its further theoretical and empirical development.

https://doi.org/10.3390/su182111391

Author Contributions: Conceptualization, A.S., C.-C.C., G.E. and M.F.; methodology, A.S., C.-C.C., G.E. and M.F.; investigation, A.S.; formal analysis, A.S.; writing—original draft preparation, A.S.; writing—review and editing, A.S., C.-C.C., G.E. and M.F. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted as part of the research project on Inquiry-Based Service-Learning. The research and data collection procedures were reviewed and approved by the Bavarian State Ministry of Education and Cultural Affairs (reference no. III.5-BO5106/263/23, 10 April 2025). The interviews were conducted on 30 June 2026. The approval covered the planned data collection procedures as well as requirements concerning voluntary participation, participant information and consent, data protection, confidentiality, and anonymization.

Informed Consent Statement: Informed consent was obtained from all participants involved in the study. Prior to participation, the students and, in the case of minors, their legal guardians were informed about the purpose and procedures of the study and the processing of their data. Participation in the group interviews was voluntary. Participants were informed about the confidential handling of their data and their right to withdraw their consent.

Data Availability Statement: The qualitative data generated and analyzed during this study are not publicly available due to privacy and confidentiality requirements concerning the study participants.

Acknowledgments: The authors thank freaksforfuture e.V. for supporting the project and facilitating its integration into the freakstotable network. During the preparation of this manuscript, the authors used ChatGPT (OpenAI, GPT-5.6 Sol) to assist with selected passages in improving language, clarity, and readability; with the translation of the manuscript; and with the development of graphical representations. The authors reviewed and edited all AI-assisted output and take full responsibility for the content of this publication.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. UNESCO. *Youth Demands for Quality Climate Change Education*; UNESCO: Paris, France, 2022. Available online: https://unesdoc.unesco.org/ark:/48223/pf0000383615 (accessed on 20 August 2026).
2. Schneekloth, U.; Albert, M. Jugend und Politik. In *Jugend 2024: 19. Shell Jugendstudie—Pragmatisch Zwischen Verdrossenheit und Gelebter Vielfalt*; Shell Deutschland GmbH, Ed.; Beltz: Weinheim, Germany; Basel, Switzerland, 2024; pp. 43–100. (In German)
3. von Philipsborn, P. Ernährungspolitische Maßnahmen als komplexe Interventionen. *Haushalt Bild. Forsch.* **2024**, *13*, 18–27. (In German) [CrossRef]
4. Carbon, C.-C. The Communicative Umwelt for Creative Design, Addressing the Psychology of Sustainability, to Solve Future Global Challenges. *Front. Psychol.* **2026**, *17*, 1746896. [CrossRef] [PubMed]
5. Carbon, C.-C. Psychology of Design. *Des. Sci.* **2019**, *5*, e26. [CrossRef]
6. Zittoun, T.; Brinkmann, S. Learning as Meaning Making. In *Encyclopedia of the Sciences of Learning*; Seel, N.M., Ed.; Springer: Boston, MA, USA, 2012; pp. 1809–1811. [CrossRef]
7. Odii, B.C.; Huang, Y.; Harder, M.K. Understanding the Mechanisms of Meaning-Making for Transformations toward Sustainability: Contributions from Personal Knowledge Theory. *Sustain. Sci.* **2024**, *19*, 865–881. [CrossRef]
8. Seifert, A.; Zentner, S.; Nagy, F. *Praxisbuch Service-Learning: "Lernen durch Engagement" an Schulen*, 2nd ed.; Beltz: Weinheim, Germany, 2019. (In German)
9. Pedaste, M.; Mäeots, M.; Siiman, L.A.; de Jong, T.; van Riesen, S.A.N.; Kamp, E.T.; Manoli, C.C.; Zacharia, Z.C.; Tsourlidaki, E. Phases of Inquiry-Based Learning: Definitions and the Inquiry Cycle. *Educ. Res. Rev.* **2015**, *14*, 47–61. [CrossRef]
10. Billig, S.H.; Weah, W. K-12 Service-Learning Standards for Quality Practice. In *Growing to Greatness 2008: The State of Service-Learning Project*; Kielsmeier, J.C., Neal, M., Schultz, N., Leeper, T.J., Eds.; National Youth Leadership Council: St. Paul, MN, USA, 2008; pp. 8–15.
11. Rieckmann, M. Learning to Transform the World: Key Competencies in Education for Sustainable Development. In *Issues and Trends in Education for Sustainable Development*; Leicht, A., Heiss, J., Byun, W.J., Eds.; UNESCO: Paris, France, 2018; pp. 39–59.
12. UNESCO. *Education for Sustainable Development Goals: Learning Objectives*; UNESCO: Paris, France, 2017. [CrossRef]
13. Sposab, K.; Rieckmann, M. Development of Sustainability Competencies in Secondary School Education: A Scoping Literature Review. *Sustainability* **2024**, *16*, 10228. [CrossRef]

14. von Uexküll, J. *Umwelt und Innenwelt der Tiere*; Verlag von Julius Springer: Berlin, Germany, 1909. (In German)
15. Kelly, G.J.; Licona, P. Epistemic Practices and Science Education. In *Science: Philosophy, History and Education*; Matthews, M.R., Ed.; Springer: Cham, Switzerland, 2018; pp. 139–165. [CrossRef]
16. Sadler, T.D. Informal Reasoning Regarding Socioscientific Issues: A Critical Review of Research. *J. Res. Sci. Teach.* **2004**, *41*, 513–536. [CrossRef]
17. Zeidler, D.L.; Sadler, T.D.; Simmons, M.L.; Howes, E.V. Beyond STS: A Research-Based Framework for Socioscientific Issues Education. *Sci. Educ.* **2005**, *89*, 357–377. [CrossRef]
18. Reitinger, J. *Forschendes Lernen: Theorie, Evaluation und Praxis in Naturwissenschaftlichen Lernarrangements*; Prolog-Verlag: Immenhausen bei Kassel, Germany, 2013. (In German)
19. Bringle, R.G.; Hatcher, J.A. A Service-Learning Curriculum for Faculty. *Mich. J. Community Serv. Learn.* **1995**, *2*, 112–122.
20. Zentner, S. "Wir müssen ihnen zutrauen, dass sie etwas verändern können." Demokratiekompetenz stärken mit Service-Learning—Lernen durch Engagement. *DDS—Die Dtsch. Sch.* **2020**, *112*, 192–203. (In German) [CrossRef]
21. Celio, C.I.; Durlak, J.; Dymnicki, A. A Meta-Analysis of the Impact of Service-Learning on Students. *J. Exp. Educ.* **2011**, *34*, 164–181. [CrossRef]
22. Huber, L. Forschendes Lernen: 10 Thesen zum Verhältnis von Forschung und Lehre aus der Perspektive des Studiums. *Die Hochsch.* **2004**, *13*, 29–49. (In German)
23. Healey, M.; Jenkins, A. *Developing Undergraduate Research and Inquiry*; Higher Education Academy: York, UK, 2009.
24. Schlicht, J.; Slepcevic-Zach, P. Research-Based Learning und Service Learning als Varianten problembasierten Lernens. *Z. Für Hochschulentwicklung* **2016**, *11*, 85–105. (In German) [CrossRef]
25. Ali, H.O.; Abdul Rahman, A.; Wan Abidin, W.Z. Service Learning: An Investigation into Its Viability as a Strategy to Achieve Institutional Goals. *Procedia Soc. Behav. Sci.* **2012**, *56*, 388–395. [CrossRef]
26. Lim, Y.; Maccio, E.M.; Bickham, T.; Dabney, W.F. Research-Based Service-Learning: Outcomes of a Social Policy Course. *Soc. Work Educ.* **2017**, *36*, 809–822. [CrossRef]
27. Sowa, F.; Zitzmann, C. (Eds.) *Anders Lehren und Lernen: Forschendes Service Learning über Lebenswelten von Menschen in Wohnungsnot*; Wochenschau Verlag: Frankfurt am Main, Germany, 2020. (In German)
28. Bernot, K.M.; Kulesza, A.E.; Ridgway, J.S. Service Learning as Inquiry in an Undergraduate Science Course. *Am. Biol. Teach.* **2017**, *79*, 393–400. [CrossRef]
29. Reardon, R.M. Inquiry-Based Service Learning in a University-Based Educational Leadership Program: Service Leadership and Internship in a Principal Fellows Program. In *Inquiry-Based Learning for Faculty and Institutional Development: A Conceptual and Practical Resource for Educators*; Blessinger, P., Carfora, J.M., Eds.; Emerald Group Publishing Limited: Bingley, UK, 2014; Volume 1, pp. 339–356. [CrossRef]
30. Eutsler, L.; Naik, M.; Peecksen, S.; Branton, R. Impact of Inquiry Portfolios within a Service-Learning Literacy Field Experience on Preservice Teachers' Knowledge Growth and GPA. *Teach. Teach. Educ.* **2023**, *124*, 104032. [CrossRef]
31. Cronin, M.; Malone, D.; Abrey, K.; Osgood, L. Engaging Students as Researchers: Impacts of International Service Learning on Sustainable Design Students. *Sustainability* **2026**, *18*, 1034. [CrossRef]
32. Rimm-Kaufman, S.E.; Merritt, E.G.; Lapan, C.; DeCoster, J.; Hunt, A.; Bowers, N. Can Service-Learning Boost Science Achievement, Civic Engagement, and Social Skills? A Randomized Controlled Trial of Connect Science. *J. Appl. Dev. Psychol.* **2021**, *74*, 101236. [CrossRef]
33. Müller-Naevecke, C.; Naevecke, S. Forschendes Lernen und Service Learning: Das humboldtsche Bildungsideal in modularisierten Studiengängen. In *Hochschulen im Spannungsfeld der Bologna-Reform: Erfolge und Ungewollte Nebenfolgen aus Interdisziplinärer Perspektive*; Hericks, N., Ed.; Springer VS: Wiesbaden, Germany, 2018; pp. 119–143, (In German). [CrossRef]
34. Mahmud, M.M.; Ahamad, F.; Ariff, S.H.Z.M.; Teh, J.K.L.; Azizan, S.N.; Che Hasan, A.L. Service Learning and Sustainability: Understanding Student Knowledge and Attitudes in Planetary Health Education. *Sustainability* **2026**, *18*, 4515. [CrossRef]
35. Zavertanik, S. Green Lab: Entdecken und Forschen im Freiluftlabor. In *Entdecken. Forschen. Fördern: Forschendes Lernen in Theorie und Praxis*; Luttenberger, S., Pustak, S., Eds.; Leykam: Graz, Austria, 2020; pp. 119–134. (In German)
36. Rogat, T.K.; Witham, S.A.; Chinn, C.A. Teachers' Autonomy-Relevant Practices within an Inquiry-Based Science Curricular Context: Extending the Range of Academically Significant Autonomy-Supportive Practices. *Teach. Coll. Rec.* **2014**, *116*, 1–46. [CrossRef]
37. Mauz, A.; Zentner, S. Lernen durch Engagement—Service-Learning. In *Handbuch Demokratiepädagogik*; Beutel, W., Gloe, M., Himmelmann, G., Lange, D., Reinhardt, V., Seifert, A., Eds.; Debus Pädagogik: Frankfurt am Main, Germany, 2022; pp. 696–712. (In German)
38. Reitinger, J.; Oyrer, S. CrEEd for Schools: Ein partizipationsorientiertes Konzept für Unterrichts- und Schulentwicklung im Sinne des Forschenden Lernens. In *Entdecken. Forschen. Fördern: Forschendes Lernen in Theorie und Praxis*; Luttenberger, S., Pustak, S., Eds.; Leykam: Graz, Austria, 2020; pp. 15–28. (In German)
39. Bruce, J.A.; Webster, N.S.; Hoover, T.S. Developing Youth Voice in Service Learning Projects. *J. Ext.* **2006**, *44*, 4TOT1. [CrossRef]

40. Furco, A. "Zufriedener, sozialer, sensibler und motivierter": Hoffnungsvolle Ergebnisse in den USA. In *Durch Verantwortung lernen: Service Learning—Etwas für Andere tun. 6. Weinheimer Gespräch*; Sliwka, A., Petry, C., Kalb, P.E., Eds.; Beltz: Weinheim, Germany; Basel, Switzerland, 2004; pp. 12–31. (In German)
41. Bringle, R.G.; Clayton, P.H. Civic Learning: A Sine Qua Non of Service Learning. *Front. Educ.* **2021**, *6*, 606443. [CrossRef]
42. Sliwka, A.; Frank, S. *Service Learning: Verantwortung Lernen in Schule und Gemeinde*; Beltz: Weinheim, Germany; Basel, Switzerland, 2004. (In German)
43. Frank, S.; Seifert, A.; Sliwka, A.; Zentner, S. Service Learning—Lernen durch Engagement. In *Praxisbuch Demokratiepädagogik: Sechs Bausteine für die Unterrichtsgestaltung und den Schulalltag*; Edelstein, W., Frank, S., Sliwka, A., Eds.; Beltz: Weinheim, Germany, 2009; pp. 151–192. (In German)
44. Bringle, R.G.; Ruiz, A.I.; Brown, M.A.; Reeb, R.N. Enhancing the Psychology Curriculum Through Service Learning. *Psychol. Learn. Teach.* **2016**, *15*, 294–309. [CrossRef]
45. Lorenzo Moledo, M.d.M.; Sáez-Gambín, D.; Ferraces Otero, M.J.; Varela Portela, C. Reflection and Quality Assessment in Service-Learning Projects. When, With Whom, and Why. *Front. Educ.* **2021**, *5*, 605099. [CrossRef]
46. Pawlowski, D.R. From the Classroom to the Community: Best Practices in Service-Learning. *J. Commun. Pedagog.* **2018**, *1*, 85–92. [CrossRef]
47. Dumlao, R.J. Collaborating Successfully with Community Partners and Clients in Online Service-Learning Classes. *J. Tech. Writ. Commun.* **2023**, *53*, 218–239. [CrossRef]
48. Cairns, D.; Areepattamannil, S. Exploring the Relations of Inquiry-Based Teaching to Science Achievement and Dispositions in 54 Countries. *Res. Sci. Educ.* **2019**, *49*, 1–23. [CrossRef]
49. Baptista, M.; Pinho, A.S.; Alves, A.R. Students' Learning for Action Through Inquiry-Based Science Education on a Local Environmental Problem. *Sustainability* **2025**, *17*, 3907. [CrossRef]
50. Schobert, A.; Enzner, G.; Forell, M. Demokratiebildung strukturell im Unterricht verankern: Forschendes Lernen durch Engagement als Ansatz zur Förderung von Partizipation, Dialogfähigkeit und epistemischer Reflexion. *Z. Für Bild.* **2026**. *submitted* (In German)
51. Mayring, P. *Qualitative Inhaltsanalyse: Grundlagen und Techniken*, 13th ed.; Beltz: Weinheim, Germany, 2022. (In German)

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.