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Empathy, prosociality and sustainable consumer behavior as statistical predictors of attitudes toward sustainable development in teacher education

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ABSTRACT

Education for Sustainable Development (ESD) in teacher education is widely recognized as a key context for advancing sustainability, yet empirical research has often examined sustainability-related attitudes and dispositions in isolation. This study adopts an integrative approach to examine how empathy, prosocial behavior, sustainable consumer behavior, and responsibility are associated with attitudes toward sustainable development (ASD). Using validated self-report instruments, data were collected from 330 student teachers and analyzed through reliability testing, correlational analyses, and domain-specific multiple regression models. The findings confirm that ASD is a multidimensional construct characterized by distinct yet overlapping patterns of psychological and behavioral correlates across environmental, economic, social, and educational domains. Empathy (both affective and cognitive), prosocial behavioral tendencies, environmentally conscious consumption, and feelings of moral responsibility were consistently associated with stronger ASD, although their relative contributions varied by domain. Prosocial behavior emerged as a salient correlate of the social and educational dimensions of ASD, while responsibility and sustainable consumption were more strongly linked to environmental and economic orientations. Gender showed a small but significant association with the educational domain, underscoring heterogeneity within student teacher populations. By modeling multiple correlates simultaneously, this study extends existing ESD research beyond fragmented analyses. The results highlight the value of operationalizing prosociality as a multidimensional construct and offer original empirical insights to inform the design of responsive and inclusive ESD curricula in teacher education.

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Introduction

The growing urgency of the climate crisis and widening social inequities have intensified the need to understand the psychological foundations of Attitudes toward Sustainable Development (ASD), particularly in teacher education. ASD integrates environmental awareness, economic equity, social justice, and educational responsibility (Makrakis et al. 2024) and reflects the knowledge, values and dispositions that shape sustainable decision-making (Biasutti 2015). Fostering ASD in teacher education is a crucial step in preparing teachers to embed Education for Sustainable Development (ESD) in both curriculum design and classroom practice, in ways that support the transformative and action-oriented goals of ESD (Fischer et al. 2022).

In the present study, ASD are conceptualized as the attitudinal dimension of sustainability, referring specifically to individuals' evaluative orientations toward environmental, social, economic, and educational aspects of sustainable development. This distinguishes ASD from broader constructs such as sustainability consciousness, which integrates knowledge, attitudes, and behaviors, and from ESD-related beliefs, which focus more narrowly on perceptions of teaching and implementing sustainability in educational contexts. We retain the term ASD to emphasize a focused analytical lens on attitudinal dispositions as a distinct component of sustainability engagement. This framing allows for a more precise examination of how psychological and behavioral factors—such as empathy, prosociality, and responsibility—relate to evaluative orientations, rather than to broader cognitive or behavioral dimensions. ASD is operationalized using a validated four-domain scale (environment, economy, society, and education), which captures the multidimensional nature of sustainability attitudes while maintaining conceptual specificity (Gallardo-Vázquez et al. 2024).

ASD are grounded in socio-emotional capacities – most notably empathy, moral reasoning, and prosocial motivation (Keto 2026). Empathy – the ability to understand and share others' feelings – facilitates moral concern, while prosocial tendencies channel that concern into cooperative, helping actions that recognize interdependence and shared welfare (Keto 2026). These constructs serve as psychological antecedents of sustainable attitudes by sensitizing individuals to the relational and systemic nature of sustainability challenges (Olsen et al. 2024).

Complementing these antecedents, sustainable consumer behavior provides a concrete behavioral pathway through which individuals enact environmentally and socially responsible consumption (Sudbury-Riley and Kohlbacher 2016). Over time, these behaviors may contribute to the internalization of sustainable norms that reinforce positive attitudes. Finally, responsibility, conceptualized as a sense of moral obligation rather than reactive guilt, further anchors these attitudes by fostering agency and long-term commitment (Kaiser and Shimoda 1999).

Despite the conceptual convergence among these constructs, most studies have examined them in isolation, limiting opportunities for theoretical integration (Neaman et al. 2022). Few studies have investigated empathy, prosociality, consumer behavior, and responsibility together in relation to ASD, particularly in teacher education contexts, where such attitudes carry broader implications beyond the social domain. Compounding this issue, the limited availability of studies that include participants from multiple national contexts leaves current insights largely contextual, constraining

theoretical integration and practical application across diverse educational settings (Fischer et al. 2022).

The present study addresses these gaps by investigating how empathy (affective and cognitive), prosocial behavior, sustainable consumer behavior, and responsibility are jointly associated with ASD across its four domains: environment, economy, society, and education. By focusing on teacher education students, the study contributes to identifying socio-emotional and behavioral dimensions that can be cultivated through curriculum design and pedagogical innovation. The background analysis focuses on ESD and teacher education, with particular attention to ASD, empathy and prosociality as key correlates of sustainable behavior, and the role of responsibility in sustainable and ethical consumer behavior.

Education for Sustainable Development, teacher education and attitudes toward sustainable development

Education for Sustainable Development is promoted as a key strategy for advancing the Sustainable Development Goals (SDGs) by equipping learners with the knowledge, skills and values needed to support environmental integrity, social justice and economic viability (UNESCO 2020). Core ESD competencies like critical thinking, systems thinking, collaboration and a sense of responsibility are highly relevant for future teachers who will mediate how sustainability is interpreted and enacted in schools (Fischer et al. 2022). Teacher education is therefore a strategic arena for ESD because teachers act as multipliers: By embedding sustainability principles in their curriculum and teaching practice they can influence generations of learners and help facilitate the transition to a more sustainable future (Biasutti et al. 2018; Fischer et al. 2022).

Attitudes toward sustainable development are a central outcome of ESD because they reflect learners' readiness to engage with sustainability across environmental, social, and economic dimensions (Biasutti and Frate 2017). Empirical evidence indicates that ESD interventions can strengthen ASD among student teachers. For example, a master's level ESD course significantly improved student teachers' ASD across multiple domains (Nousheen et al. 2020), and a course on ESD and the SDGs increased both knowledge and action-oriented, critical perspectives of sustainability (García-González, Jiménez-Fontana, and Azcárate 2020).

Similarly, service-learning projects in environmental education have been shown to enhance ASD among primary student teachers (Diez-Ojeda, Queiruga-Dios, and Queiruga-Dios 2025). However, ASD vary with sociodemographic and contextual factors, hence, outcomes are not uniform. Studies report differences linked to program type, regional context, and family background, with mixed findings regarding gender (Soysal and Ok 2021). This variability suggests that student teachers are not a homogeneous group and highlights the importance of modeling the interrelated psychological and behavioral correlates of ASD in order to design responsive ESD curricula that can engage diverse profiles of attitudes and practices.

Beyond sociodemographic and contextual variability, recent research highlights that sustainability-related attitudes in teacher education are shaped by broader psychosocial dimensions. In a mixed-methods study with Italian pre-service teachers, Sulla et al. (2024) found a mutually reinforcing relationship among environmental

identity, attitudes toward sustainability education, and a sense of community responsibility, suggesting that sustainability orientations are connected not only to knowledge acquisition but also to self-positioning in relation to nature and collective wellbeing. In higher education more broadly, empathy and solidarity have been linked to students' perceptions of social responsibility in relation to the SDGs (Gallardo-Vázquez et al. 2024). This suggests that sustainability-related attitudes are partly grounded in relational and civic dispositions, rather than solely in the cognitive endorsement of sustainability principles.

Recent quasi-experimental work with pre-service primary school teachers (Muñoz-Losa et al. 2025) has shown that sustainability courses can improve knowledge, willingness, and self-reported sustainability behavior. However, changes in concrete behavior may be less pronounced than changes in awareness and intention, highlighting the importance of examining the psychological and behavioral mechanisms that support the translation of sustainability endorsement into practice.

Empathy, prosociality and sustainable behavior

Recent work emphasizes that sustainability behavior is embedded within broader prosocial tendencies. Sustainability-oriented actions can be viewed as a subtype of prosocial behavior because they benefit others – present and future generations of human and nonhuman entities – by protecting shared resources (Paço 2019). From this perspective, empathy, compassion and moral concern are central to explaining why individuals engage in sustainability responsible practices. Empirical studies support this link. Tam (2013) introduced the concept of “dispositional empathy with nature” showing that individuals who readily take nature's perspective report stronger environmental concern and behavioral intentions. Experimental studies further indicate that compassion for others' suffering can generalize concern for environmental degradation and support for climate-mitigation policies (Pfattheicher, Sassenrath, and Schindler 2016). Similarly, inducing higher levels of empathy for non-human entities has been found to strengthen proenvironmental attitudes and behaviors (Berenguer 2007).

These findings highlight the importance of distinguishing affective and cognitive facets of empathy. Recent literature suggests that empathy should be situated within a broader affective account of sustainability education. A systematic review by Olsen et al. (2024) conceptualized environmental education through the interconnected dimensions of “heads, hearts, and hands,” showing that knowledge, emotional processing, and action are tightly linked in how learners engage with ecological crises. In a related qualitative line of work, Hayes et al. (2023) argue that dialogue, empathy, emotion, action, and hope can create conditions for agency and collaborative response, particularly when sustainability challenges are framed as shared and intergenerational. At the same time, evidence on empathy is not entirely straightforward. Ienna et al. (2022) found that empathy was positively associated with proenvironmental attitudes and behavior, but that its contribution became more nuanced once objective environmental knowledge was modelled simultaneously, suggesting that affective and cognitive pathways may be complementary rather than interchangeable in sustainability-related engagement. In teacher education, both facets may enhance

ASD by enabling future teachers to recognize the human and nonhuman consequences of unsustainable practices and respond with concern and responsibility. Last, prosocial behavioral tendencies also appear relevant. For instance, Paço (2019) frames helping, volunteering and charitable actions as foundational for achieving the SDGs, while large-scale survey research shows that prosocial dispositions are associated with ecological behavior partly through increased connectedness to nature (Neaman et al. 2022).

Sustainable and ethical consumer behavior and responsibility

Sustainability is also expressed through consumption choices. Research on socially responsible and ecologically conscious consumer behavior links sustainability-oriented attitudes to behaviors such as buying eco-labelled products, recycling and supporting companies with strong social and environmental credentials (Sudbury-Riley and Kohlbacher 2016). These consumption patterns can be interpreted as everyday practical enactments of social responsibility, reinforcing sustainability-oriented attitudes through repeated behavior.

Perceived responsibility emerges as another key psychological construct. Kaiser and Shimoda (1999) demonstrated that self-ascribed responsibility for environmental problems is associated with ecological behavior over and above the influence of environmental attitudes. Subsequent studies confirm that feelings of responsibility toward future generations and adherence to moral norms to protect the environment are robust statistical predictors of proenvironmental intentions (Kaiser et al. 1999; Marchetti et al. 2025). These findings align with models linking proenvironmental behavior to moral identity and connectedness to nature.

Sociodemographic factors also shape sustainability-related attitudes and behaviors. Gender differences are observed. For example, a meta-analysis found that women report stronger environmental concern and engage in more proenvironmental behaviors than men across multiple countries (Zelezny, Chua, and Aldrich 2000). In consumer research, women also tend to exhibit higher levels of sustainable consumer behavior, partly explained by personality traits such as agreeableness and openness (Luchs and Mooradian 2012). Studies with student teachers similarly suggest sociodemographic influences on ASD, though gender effects are not entirely consistent (Soysal and Ok 2021).

Gaps and rationale for the present study

Previous research suggests that ESD in teacher education is associated with the development of multidimensional ASD. Studies have consistently reported meaningful associations between ASD and a range of psychological and behavioral constructs, including empathy, prosocial dispositions, sustainable and ethical consumer behavior, and a sense of moral responsibility. However, the empirical evidence supporting these relationships is predominantly correlational, and does not establish unidirectional pathways among attitudes and behaviors. Rather, existing findings point to potentially reciprocal and mutually reinforcing relationships, in which sustainability-oriented

actions and attitudes may co-develop over time (Kaiser and Shimoda 1999; Nousheen et al. 2020).

Despite this growing body of research, most studies have examined these constructs in isolation, focusing on single dimensions of sustainability-related attitudes or behaviors. Reviews of the field highlight substantial conceptual fragmentation, wide variation in measurement approaches, and a lack of integrative models that consider multiple psychological and behavioral dimensions simultaneously within teacher education contexts (Fischer et al. 2022; Neaman et al. 2022). As a result, there is limited empirical evidence on how empathy, prosocial intentions, sustainable consumer behavior, and responsibility co-occur as interrelated correlates of ASD among student teachers.

Furthermore, cross-national evidence remains scarce. Research on ESD in teacher education is geographically concentrated and often context-specific, limiting opportunities for comparative analysis and constraining the generalizability of findings across educational systems (Fischer et al. 2022; García-González, Jiménez-Fontana, and Azcárate 2020). Empirical studies also indicate considerable heterogeneity within student teacher populations, underscoring the need for approaches that can capture diverse profiles of sustainability-related attitudes rather than assuming homogeneity.

Taken together, the emerging literature points to a broader psychosocial ecology of sustainability-related attitudes, including environmental identity, sense of community responsibility, empathy, solidarity, emotional processing, and hope-oriented engagement. However, this evidence remains conceptually fragmented: some studies focus on identity and belonging, others on emotional engagement with climate issues, and still others on prosocial or ecological behavior, often using different outcome variables and educational contexts. This fragmentation echoes calls for an integrated approach to prosocial and environmental education, while leaving limited empirical evidence on how these adjacent psychosocial dimensions relate specifically to ASD within teacher education (Neaman et al. 2022; Olsen et al. 2024; Sulla et al. 2024). Overall, these findings suggest a broader psychosocial ecology of sustainability-related attitudes, however the evidence remains conceptually fragmented and only limited work has examined how these dimensions relate specifically to ASD within teacher education.

The present study addresses these gaps by investigating how multiple cores of prosociality—empathy (cognitive and affective), prosocial behavioral intentions, and feelings of responsibility—alongside sustainable and ethically minded consumer behaviors, are jointly associated with ASD across four domains: environment, economy, society, and education in a sample of student teachers from Italy, Scotland, Canada and Australia. By focusing on future teachers in a multi-country sample, the study seeks to identify psychological and behavioral correlates that may inform the design of ESD programs aimed at supporting coherent, multidimensional sustainability attitudes. The study is led by the following research question:

To what extent are empathy, prosocial behavior, sustainable consumer behavior, and responsibility statistically associated with ASD across its four domains—environment, economy, society, and education?

Based on prior evidence, we expect that students who demonstrate greater empathic capacity, environmentally and socially conscious consumption patterns, and a heightened sense of responsibility will report stronger attitudes toward sustainability.

Method

The study employed a quantitative, cross-sectional correlational design with multiple regression analysis to examine how empathy, prosocial behavior, sustainable consumer behavior and responsibility are associated with variation in ASD among student teachers. Specifically, this design was employed to (a) assess the internal consistency of the measures, (b) examine the distribution of variables, (c) explore bivariate associations, and (d) identify the statistical predictors of each ASD domain using multiple regression analyses.

Participants

The sample comprised 330 students enrolled in education programs at one university in each of Italy, Scotland, Canada, and Australia. Italian participants were enrolled in a primary teacher education program and were in the early stages of their training (e.g. first or second year), although this information was not systematically recorded across all participating institutions. Recruitment was conducted *via* an online questionnaire that student teachers at the various universities were invited to complete. Consistent with enrollment patterns in teacher education programs, participants were mainly women ($n=302$), with 27 men and one participant who preferred not to disclose their gender. This marked gender imbalance reflects typical enrollment patterns in teacher education, but it limits the robustness of gender-based comparisons. Accordingly, any findings related to gender should be interpreted with caution. The mean age was 20 years with $SD = 1.41$ (range 18–45). Participants' nationalities were Italian ($n=160$), Canadian ($n=85$), Australian ($n=14$), British ($n=7$) and other nationalities ($n=57$), with seven participants opting not to respond. We do not report country- or continent-level comparisons because the uneven subgroup sizes do not allow meaningful or robust interpretation.

Instruments

Data were collected using validated self-report questionnaires designed to assess ASD and related psychological and behavioral constructs. The selected constructs were chosen to operationalize prosociality in a multidimensional manner, capturing both internal dispositions (empathy, prosocial intentions, and responsibility) and externally oriented behavioral expressions linked to sustainability. While ASD and responsibility have been widely examined in ESD research, empathy, prosocial intentions, and sustainable consumer behavior have been less frequently integrated within teacher education studies, and are rarely modeled together as part of a coherent operational framework for prosocial sustainability orientations.

All instruments were administered in their validated versions, and items employed Likert-type scales appropriate to each measure. In addition, demographic information (gender, age, level of education, degree specialization, and teaching area) was collected at the beginning of the questionnaire to explore potential influences on ASD. The following section describes each instrument, its purpose, structure, response format, and reliability.

Attitudes toward sustainable development scale (ASD)

The ASD scale (Biasutti and Frate 2017) was designed to measure sustainability attitudes among university students. The scale was originally validated with Italian populations. It consists of 20 items subdivided into four domains: environment (items 1–5), economy (items 6–10), society (items 11–15), and education (items 16–20). Responses are rated on a five-point Likert scale (1=strongly disagree, 5=strongly agree). The scale demonstrates excellent reliability (Cronbach's alpha of 0.85).

Ethically minded consumer behavior scale (EMCB)

The EMCB (Sudbury-Riley and Kohlbacher 2016) examines sustainable consumption behaviors. The instrument includes 10 items organized into 5 subfactors with two overlying factors. Respondents are asked to rate how well each item reflects their usual behavior on a 5-point Likert scale (1=never true, 5=always true). The scale has been validated across four countries and demonstrates good psychometric properties, with Cronbach's alpha values above 0.85.

Basic empathy scale (BES)

The BES (Jolliffe and Farrington 2006) is a self-report questionnaire that measures empathy in adolescents and young adults. The questionnaire comprises 20 items across two subscales: affective empathy and cognitive empathy. The scale has very good reliability, with Cronbach's alpha values of 0.85 and 0.79 for the affective and the cognitive subscales. Responses are rated on a 5-point Likert scale (1=strongly disagree, 5=strongly agree).

Prosocial behavioral intentions scale (PBIS)

The PBIS (Baumsteiger and Siegel 2019) is a four-item mono-factorial instrument that assesses prosocial behavioral intentions. It includes four items rated on a 7-point Likert scale (1=definitely would not do this, 7=definitely would do this). The scale demonstrates very good psychometric properties with Cronbach's alpha of 0.83.

Responsibility scale (RS)

The RS (Kaiser and Shimoda 1999) is a closed-ended questionnaire that measures personal responsibility toward the environment and sustainable development. The scale consists of 20 items across three factors: responsibility feeling, guilt feeling, and responsibility judgment. Responses are rated on a 5-point Likert scale (1=confirm totally, 5=reject totally). The scale has good psychometric properties: responsibility feeling alpha = 0.83, responsibility judgment alpha = 0.74, and guilt feeling alpha = 0.81.

These tools were useful for supporting an integrative approach to understanding ASD in teacher education. By operationalizing prosociality across affective, motivational, and behavioral dimensions, they provide empirical insights that extend existing ESD research and inform the design of more responsive ESD curricula.

Procedure

Data were collected during 2023 *via* online questionnaires available in Italian and English, hosted on qualtrics.com, and distributed through each university's online

system. Participation was voluntary, and respondents completed the instruments anonymously, with an average completion time of approximately 40 min. Given the length of the survey, the support of teacher education departments was instrumental in facilitating participation.

The study adhered to ethical standards for research involving human participants throughout the study. The research adhered to internationally recognized ethical principles, including those outlined in the Declaration of Helsinki, and complied with local regulations for research involving human participants (i.e. ethical approval was obtained from each participating university). All participants received detailed information about the purpose of the study and provided informed consent before taking part.

Data analysis

Quantitative analyses were conducted using IBM SPSS Statistics (version 25) to test the research hypotheses. First, Cronbach's alpha coefficients were calculated to assess the internal reliability of each subscale and descriptive statistics (means and standard deviations) were computed for all variables. Pearson's correlations were then computed to examine the associations among all instrument subscales.

Finally, multiple regression analyses were conducted with the four ASD domains (environment, economy, society, and education) as dependent variables and psychological, behavioral, and demographic factors as independent variables. A stepwise approach was used for exploratory purposes to identify the most salient variables associated with each domain while accounting for shared variance among predictors. Although stepwise regression has known limitations (e.g. model instability and data-driven selection), it was considered appropriate given the exploratory aim of the study; therefore, results should be interpreted with caution. While bivariate correlations indicate overall associations, regression analyses estimate the unique association of each variable after accounting for shared variance. Statistical significance was set at $p < 0.05$ for all analyses.

Results

Results are presented in three stages: (1) reliability and descriptive statistics for all measures, (2) bivariate associations among ASD domains and psychological variables, and (3) domain-specific regression models identifying variables most strongly associated with each ASD dimension.

Reliability coefficients (Cronbach's alphas) and descriptive statistics (mean scores and SDs)

Cronbach's alpha coefficients, mean scores, and standard deviations were computed for all questionnaire subscales and are reported in [Table 1](#). All instruments demonstrated acceptable to good internal consistency, with $\alpha \geq 0.71$ for most subscales. The only exception was the responsibility judgment subscale ($\alpha = 0.58$), which was

Table 1. Reliability coefficients (Cronbach's alpha), raw mean scores, and standard deviations for the questionnaire subscales.

Scales	Cronbach's alpha	Mean (SD) <i>n</i> = 330
ASD_Environment	0.71	3.95 (0.57)
ASD_Economy	0.71	4.15 (0.54)
ASD_Society	0.73	4.44 (0.47)
ASD_Education	0.84	4.53 (0.49)
EMCB_ECCB	0.83	3.44 (0.60)
EMCB_SCCB	0.71	3.54 (0.76)
BES_Cognitive	0.84	4.09 (0.45)
BES_Affective	0.75	3.77 (0.47)
PBIS	0.74	5.99 (0.85)
		4.34 on a 1–5 rescaled metric*
Resp_resp feelings	0.82	3.72 (0.79)
Resp_guil feelings	0.81	2.80 (0.78)
Resp_resp judg	0.58 (excluded)	3.28 (0.57)

*PBIS uses a 7-point response scale, whereas the other psychometric scales use 5-point Likert-type scales; therefore, PBIS mean was also rescaled to a 1–5 metric to facilitate descriptive comparison across measures.

excluded from further analyses due to inadequate reliability. This lower reliability may reflect heterogeneity in item content and potential differences in how participants interpreted evaluative responsibility judgments across contexts. Because the PBIS uses a 7-point response scale whereas the other instruments use 5-point Likert-type scales, raw PBIS mean scores are not directly comparable with the other scale means. Therefore, the PBIS mean was also rescaled to a 1–5 metric to facilitate descriptive comparison across measures.

Correlations (Pearson's *r*)

Bivariate correlations between variables were computed using Pearson's *r*. Findings showed that all ASD dimensions were positively associated with empathy (both affective and cognitive), prosocial behavior, sustainable consumer behavior, and responsibility feelings (see Table 2). Guilty feelings correlated positively with most ASD dimensions, though these associations were generally weaker. The strength of the correlations for responsibility feelings and guilt was comparable to those observed with empathy and consumer behavior.

Regression models

Stepwise multiple regression analyses were performed for each of the four subscales of the ASD questionnaire: environment, economy, society, and education. These analyses identified the most significant predictors among the psychological and behavioral variables measured by the other instruments (EMCB, BES, PBIS, and responsibility scales), as well as relevant demographic factors. In each table, the first row represents the model, including only the first variable entered; subsequent rows show the cumulative addition of variables. The reported R^2_{adj} values represent the proportion of variance explained at each step. The β coefficients correspond to the standardized beta values from the step in which the variable was entered. The final model in each table represents the most complete model for that ASD domain.

Table 2. Correlations (Pearson's r) between the subscales of the questionnaires.

	2	3	4	5	6	7	8	9	10	11
1. ASD_Environment	0.54**	0.44**	0.46**	0.34**	0.28**	0.27**	0.24**	0.20**	0.28**	0.26**
2. ASD_Economy	–	0.59**	0.55**	0.25**	0.21**	0.16**	0.34**	0.29**	0.35**	0.28**
3. ASD_Society	–	–	0.64**	0.24**	0.20**	0.31**	0.29**	0.36**	0.27**	0.16**
4. ASD_Education	–	–	–	0.22**	0.23**	0.36**	0.29**	0.30**	0.20**	0.10
5. EMCB_ECCB	–	–	–	–	0.63**	0.15**	0.05	0.25**	0.34**	0.33**
6. EMCB_SCCB	–	–	–	–	–	0.22**	0.09	0.19**	0.24**	0.29**
7. BES_Cognitive	–	–	–	–	–	–	0.42**	0.45**	0.12*	–0.02
8. BES_Affective	–	–	–	–	–	–	–	0.30**	0.21**	0.27**
9. PBIS	–	–	–	–	–	–	–	–	0.24**	0.11*
10. Resp_resp feelings	–	–	–	–	–	–	–	–	–	0.46**
11. Resp_guil feelings	–	–	–	–	–	–	–	–	–	–

* $p < 0.05$; ** $p < 0.01$.**Table 3.** Regression model for the environment factor of ASD.

Predictors	R^2_{adj}	β	t	F
1. EMCB_ECCB	0.12	0.26	4.9**	43.52**
2. BES_Affective	0.16	0.14	2.5*	33.19**
3. BES_Cognitive	0.18	0.15	2.8**	25.04**
4. Resp_resp feelings	0.20	0.14	2.7**	20.88**

* $p < 0.05$; ** $p < 0.01$.

ASD environment

The model for the environment dimension indicates that both socio-emotional factors (empathy) and behavioral practices (sustainable consumption) are jointly associated with higher environmental attitudes. As shown in Table 3, the model explained 20% of the variance ($R^2_{adj} = 0.20$). Significant predictors were the environmentally conscious consumer behavior subscale of the EMCB_ECCB, the affective and cognitive subscales of the BES, and the responsibility feelings subscale of the responsibility questionnaire. These results indicate that participants who reported higher empathy and sustainable consumption practices expressed stronger environmental attitudes.

ASD economy

The results (see Table 4) suggest that responsibility, affective empathy, and prosocial tendencies are jointly associated with stronger economic sustainability attitudes. The model accounted for 23% of the variance ($R^2_{adj} = 0.23$). Responsibility feelings was the first and strongest predictor, followed by affective empathy of BES, prosocial behavior (PBIS), and environmentally conscious consumer behavior (EMCB_ECCB). This pattern suggests that feeling personally responsible, being emotionally empathic, and engaging in prosocial and sustainable practices jointly underpin positive attitudes toward the economic aspects of sustainability.

ASD society

Overall, the model for the society dimension highlights that prosocial behavior, empathy, and responsibility are all associated with stronger orientations toward social sustainability. As reported in Table 5, 21% of the variance ($R^2_{adj} = 0.21$) was explained. The following five variables were retained in the final model: PBIS, BES affective

Table 4. Regression model for the economy factor of ASD.

Predictors	R^2_{adj}	β	t	F
1. Resp_resp feelings	0.12	0.22	4.05**	44.45**
2. BES_Affective	0.19	0.25	4.82**	39.80**
3. PBIS	0.21	0.14	2.60**	30.45**
4. EMCB_ECCB	0.23	0.13	2.50**	24.77**

* $p < 0.05$; ** $p < 0.01$.

Table 5. Regression model for the society factor of ASD.

Predictors	R^2_{adj}	β	t	F
1. PBIS	0.13	0.20	3.45**	49.79**
2. BES_Affective	0.17	0.15	2.66**	33.31**
3. EMCB_ECCB	0.19	0.12	2.33*	26.53**
4. Resp_resp feelings	0.20	0.13	2.39*	21.40**
5. BES_Cognitive	0.21	0.13	2.20*	18.29**

* $p < 0.05$; ** $p < 0.01$.

Table 6. Regression model for the education factor of ASD.

Predictors	R^2_{adj}	β	t	F
1. BES_Cognitive	0.13	0.22	3.64**	49.40**
2. EMCB_ECCB	0.15	0.16	3.09**	30.84**
3. BES_Affective	0.18	0.19	3.22**	24.21**
4. PBIS	0.19	0.13	2.24*	19.68**
5. Gender	0.20	-0.11	-2.05*	16.74**

* $p < 0.05$; ** $p < 0.01$.

empathy, EMCB_ECCB, responsibility feelings, and BES cognitive empathy. These variables were positively associated with social sustainability orientations, emphasizing cooperation, empathic concern, and ethical consumption.

ASD education

Finally, the educational dimension model (see Table 6) accounted for 20% of the variance ($R^2_{adj} = 0.20$) and indicates that both psychological factors (empathy and prosociality) and demographic characteristics (gender) are associated with attitudes toward sustainability in education. Female participants reported significantly higher scores on the education dimension of ASD. This model highlights the interplay between empathy, social engagement, and demographic variables in shaping sustainability-oriented educational attitudes.

Across the four regression models, adjusted R^2 values ranged from 0.20 to 0.23, indicating an adequate proportion of explained variance for exploratory research using psychosocial and self-report measures. Taken together, the results show that empathy, prosocial behavior, sustainable consumer behavior, and responsibility are consistently associated with ASD across domains, although their relative importance varies. Prosocial behavior appears particularly relevant for the social and educational domains, while responsibility and sustainable consumption are more strongly associated with the environmental and economic dimensions. These patterns highlight the multidimensional nature of ASD and the differentiated role of psychological and behavioral factors.

Discussion

The results provide an integrative and original overview of how empathy, prosocial behavior, sustainable consumer behavior, and responsibility are associated with different dimensions of ASD among student teachers. Rather than assuming causal precedence, the analyses highlight distinct yet overlapping patterns of association across the environmental, economic, social, and educational domains of ASD, highlighting the multidimensional and non-homogeneous nature of sustainability-related attitudes. Our results are consistent with previous research showing that prosocial dispositions, empathic capacity, and sustainable consumption habits are associated with sustainability-related attitudes (Neaman et al. 2022; Paço 2019). Unlike earlier studies, the present research examines these constructs simultaneously within a single analytical framework and does so across multiple institutional contexts in teacher education spanning different national settings, although without conducting country-level comparisons, thereby providing original evidence on how these dimensions co-occur among future teachers.

In terms of empathy, both affective and cognitive empathy were related to ASD, but with domain-specific nuances: affective empathy was especially associated with the environment, economy and society domains, whereas cognitive empathy was more strongly associated with the education domain. This pattern aligns with studies indicating that emotion-based concern for others' suffering fosters concern for environmental degradation and support for proenvironmental policies (Pfattheicher, Sassenrath, and Schindler 2016), while empathy based on perspective-taking has been shown to enhance proenvironmental attitudes and behaviors (Berenguer 2007; Tam 2013). The findings suggest that teacher education programs should nurture both empathic concern and perspective-taking as integral components of ESD. For example, ESD-oriented coursework could combine critical reflection on sustainability dilemmas with pedagogical activities that require student teachers to adopt multiple social and ecological perspectives, such as case-based discussions, role-play, or community-engaged learning tasks that foreground the experiences of affected human and non-human stakeholders.

In terms of prosocial behavior, PBIS scores emerged as strong correlates of ASD, particularly within the social and educational domains. This pattern suggests that everyday helping tendencies are associated with stronger orientations toward social equity, community wellbeing, and educational responsibility for sustainability. This finding aligns with research indicating that prosocial dispositions underpin ecological behavior and should be meaningfully integrated within environmental education (Neaman et al. 2022). For example, in teacher education programs, structured service-learning projects—such as collaborations with local schools, environmental NGOs, or community sustainability initiatives—can provide student teachers with opportunities to enact prosocial behaviors in real-world contexts, thereby reinforcing both prosociality and ASD (Diez-Ojeda, Queiruga-Dios, and Queiruga-Dios 2025; García-González, Jiménez-Fontana, and Azcárate 2020).

Environmentally conscious consumer behavior was consistently associated with ASD, suggesting that habitual, concrete proenvironmental practices are closely linked to how student teachers think about sustainability. This finding resonates with earlier

work indicating that socially responsible and ecologically conscious consumers report higher environmental concern and are more supportive of corporate social responsibility (Sudbury-Riley and Kohlbacher 2016). Our findings suggest that sustainable consumption habits may not only reflect but also reinforce positive ASD through repeated enactment of ethical values.

Responsibility feelings were positively associated with ASD in several domains, whereas guilt was weakly associated or nonsignificant. This pattern mirrors prior findings that self-ascribed environmental responsibility is a strong predictor of ecological behavior over and above attitudes (Kaiser et al. 1999; Kaiser and Shimoda 1999). The results are also consistent with models that link moral norms, moral identity and connection to nature with proenvironmental action (Marchetti et al. 2025). This suggests that in educational contexts, emphasizing professional and civic responsibility for sustainability may be more constructive than relying on guilt-based messages.

Several of the constructs examined—particularly empathy, prosocial behavior, responsibility, and sustainable consumer behavior—are conceptually related and may partially overlap. These constructs can be understood as interconnected dimensions within a broader prosocial and moral orientation toward sustainability, reflecting shared underlying dispositions such as concern for others and sensitivity to collective outcomes (Neaman et al. 2022; Olsen et al. 2024). Although regression analyses allow for the estimation of the unique association of each variable, some degree of conceptual and empirical overlap is expected. This should be considered when interpreting the findings, as the observed associations may reflect both distinct and shared variance among these constructs. Future research could further disentangle these relationships using approaches such as latent variable modeling or more differentiated measurement frameworks (Fischer et al. 2022).

Gender emerged as a small but significant correlate of the education-related dimension of ASD, with female student teachers reporting higher scores. However, this finding should be interpreted cautiously because the sample was highly unbalanced by gender, with women representing the large majority of participants. This finding is consistent with broader research evidencing that women tend to express stronger environmental concern and more sustainable consumer orientations (Luchs and Mooradian 2012; Zelezny, Chua, and Aldrich 2000). For teacher education, this result matters because it suggests that sustainability-oriented educational attitudes may not be evenly distributed across student teacher populations, underscoring the need for ESD approaches that engage all student teachers, rather than assuming uniform readiness or motivation. At the same time, evidence from studies focusing specifically on student teachers remains mixed, with some reporting weak or non-significant gender differences in ASD (Soysal and Ok 2021). Taken together, these findings suggest that gender may interact with contextual and psychological factors—such as empathy, prosociality, and educational experiences—rather than functioning as a simple or stable main effect.

Overall, this study advances ESD research in three ways. First, it provides domain-specific evidence that the psychological and behavioral correlates of ASD are not uniform: the relative salience of empathy, prosocial behavioral intentions, sustainable consumption, and responsibility differs across environmental, economic, social, and educational dimensions. Second, by operationalizing prosociality as a

multicomponent orientation (empathy as socio-emotional capacity, prosocial intentions as motivational readiness, and sustainable consumption as everyday enactment) and modeling these correlates simultaneously, the study moves beyond fragmented single-construct analyses and clarifies how distinct “prosocial sustainability” components co-occur in future teachers. Third, by drawing on participants from multiple national contexts, the study offers a broader basis for reflecting on possible areas of emphasis in teacher preparation, although the uneven country distribution means that transferability should be interpreted cautiously.

The study has limitations. Its cross-sectional, self-report design precludes causal inference and may be affected by common method bias. In addition, all measures relied on self-reported data, which may be susceptible to social desirability bias, particularly given the normative nature of sustainability-related attitudes and behaviors. The relatively low reliability of the responsibility judgment subscale restricted nuanced analysis of responsibility facets (Kaiser and Shimoda 1999). Although the sample included participants from institutions in multiple national contexts, its distribution across countries was uneven, with substantially larger groups from Italy and Canada than from Australia and Scotland limiting generalizability. This imbalance reduces the strength of any country-related inference and suggests that the findings should be interpreted with caution in relation to cross-national comparisons. Rather, the study should be understood as drawing on a multi-context sample that broadens the scope of the analysis and offers the opportunity to identify possible underlying commonalities across national contexts worldwide, while conclusions regarding transferability should remain cautious, and further studies are needed.

Moreover, because detailed information on program stage and prior ESD coursework was not systematically available across institutions, we were unable to examine how curricular exposure shaped ASD. Future studies should treat program stage and ESD exposure as key explanatory variables rather than background descriptors. Finally, research on teacher education for sustainable development indicates that institutional culture and national curricula have a strong influence on how sustainability is integrated into teacher education (Fischer et al. 2022). Consequently, convenience sampling may reflect the ESD orientation of participating institutions, as the authors’ interests in sustainability are often aligned with institutional cultures.

Implications for teacher education and further research

Despite these limitations, the results have practical implications for program design. There is evidence of the value in scaffolding prosocial engagement, cultivating empathy, and normalizing sustainable habits in teacher education programs. Our findings suggest that emphasizing responsibility rather than guilt may be associated with stronger actionable ASD. Programs may create regular opportunities for prosocial engagement. Service-learning, peer mentoring, and school–community projects may support the development of everyday helping norms and civic responsibility. These experiences appear to support positive attitudes toward the social and educational sides of sustainability.

Our evidence suggests that building empathy in ESD programs may be a valuable aim. Activities that help students feel for others—such as brief narratives, role-play,

and place-based stories—can make sustainability issues more concrete and human. Tasks that help with perspective-taking—such as guided discussions, Socratic seminars, and structured debates—help students reason cognitively and respond affectively through considering the views of different stakeholders. This aligns with recent work suggesting that sustainability and climate education should create dialogical spaces where difficult emotions can be acknowledged while learners are supported toward individual and collective forms of action, agency, and hope (Finnegan and d'Abreu 2024; Hayes et al. 2023). To this end, research in environmental education suggests that participatory, dialogical, and arts-based approaches are effective in engendering empathy. In climate change education, for example, young people can be supported to respond through creative and affect-driven approaches that extend beyond cognitive and scientific understandings of the problem (Rousell and Cutter-Mackenzie-Knowles 2020). In empathy-oriented pedagogies in environmental education, ethical reflection can be challenging, as learners are invited to see, hear and respect other people's life situations and experiences through themselves (Kallio, Vainikka, and Häkli 2026). Our findings on empathy add weight to these converging studies that argue for maintaining a focus on critically understanding others' experiences as an outcome of empathy development.

We argue that our evidence is relevant for signposting some practical approaches needed in teacher education programs and in in-service curriculum design. For example, pre-service educators should learn to make sustainable choices easy and routine. Simple changes—such as default recycling, clearly labeled sustainable options in canteens, selection of sustainable pedagogical resources, and subtle prompts within purchasing systems—can help students practice proenvironmental behaviors. Helping learners make repeated enactments of these small actions is likely to align with positive attitudes across sustainability domains.

Taking action for the environment emerges as a central element of ESD in our analysis, and the findings point to a potentially important pathway. Consistent with previous research, framing sustainability in terms of actionable and achievable solutions, and emphasizing what individuals and groups can actively contribute, appears to support more constructive forms of engagement (Fischer et al. 2022; Hayes et al. 2023). Our findings align with this perspective, suggesting that highlighting feasible actions may be associated with stronger sustainability-oriented attitudes. This approach may be more constructive than guilt-focused appeals. Programs may achieve more favorable outcomes when these elements are addressed in a coordinated and cumulative way—cultivating empathy, engaging students in prosocial action, and reinforcing daily sustainable habits—thereby supporting the development of more durable attitudes and practices. There are likely synergies across these features. For Kallio, Vainikka, and Häkli (2026), being empathetic does not necessarily lead to action, but it does mean an individual needs to be critically reflexive at various scales in their response making in order to come to a more fully informed ability to share the experience of another. Hence, educators may need to connect pedagogical approaches that foster empathy with meaningful, collaborative, and place-responsive action planning at various scales.

The findings identify key psychosocial and behavioral correlates that may inform the advancement of ESD while also highlighting areas for more robust and comparative research designs. Future studies should adopt longitudinal or quasi-experimental

approaches to examine whether empathy-building activities, prosocial engagement, and behavioral prompts are associated with improvements in ASD. In addition, incorporating behavioral indicators alongside self-report measures would strengthen the validity of findings and reduce potential biases associated with self-reported data. Moreover, future research could employ structural equation modeling – which was beyond the scope and analytical design of the present study – to further validate the observed associations and explore indirect pathways among the constructs. These directions contribute to the development of a robust and theoretically integrated evidence base on the psychological and behavioral foundations of sustainability mindsets, enabling the design of effective, contextually grounded, and culturally responsive approaches to ESD.

Author contributions

CRedit: **Michele Biasutti**: Conceptualization, Data curation, Formal analysis, Methodology, Supervision, Writing – original draft; **Greg Mannion**: Data curation, Investigation, Methodology; **Neus (Snowy) Evans**: Data curation, Investigation, Methodology; **Paul Elliott**: Data curation, Investigation, Methodology; **Eleonora Concina**: Formal analysis, Software; **Anthony M.A. Mangiacotti**: Formal analysis, Software.

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