

# Making Soil Visible: Social Marketing Design for Sustainability Literacy in Schools

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## ABSTRACT

Soil underpins food production, biodiversity, and climate mitigation, yet it remains weakly represented in public communication and consumer awareness. This paper examines how soil literacy can be operationalised through low-cost, age-adapted social marketing interventions in primary and secondary schools, treating learning environments as a pre-market arena where sustainability competencies are formed. Drawing on five pilot interventions in Serbian schools, the study assesses feasibility, acceptability, engagement, early learning signals, and behavioural intention. The interventions combined experiential learning, visual prompts, identity cues, scenario-based reasoning, and a peat-focused module connecting soil to horticultural markets. Results show a high level of acceptance among teachers, strong perceived clarity among students, and credible signals of learning and intention. The paper conceptualises posters, stickers, certificates, and quizzes not as supplementary teaching aids but as behavioural infrastructure that makes sustainability knowledge visible, memorable, and socially transmissible. Findings support a modular model of soil literacy that is scalable through age-differentiated design, experiential anchors, and competence-oriented assessment, with implications for sustainability communication, responsible marketing, and the European Union's (EU) Mission Soil policy delivery.

**Keywords:** Social marketing; Sustainability communication; Behavioural design; Soil literacy; Environmental education; Consumer socialisation.

**JEL Codes:** Q53, Q56, L83, Q58, C23, R11.

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## I. Introduction

Sustainability transitions depend not only on technological innovation, regulation, and market redesign, but also on citizens' capacity to recognise environmental problems, interpret their consequences, and act on them in everyday life (Katicas et al., 2024; Roca Vallejo et al., 2025). The European Union's (EU) Mission "A Soil Deal for Europe" explicitly identifies increasing soil literacy in society as one of its eight core objectives, recognising that the bottleneck to sustainable land use is not only scientific or regulatory but communicational and behavioural. Soil is a particularly important but often overlooked case. It underpins food production, biodiversity, water regulation, carbon storage, and climate resilience, yet it frequently remains invisible in public discourse and school-based environmental education (Brevik et al., 2022a; Hayhoe, 2013). While children and adolescents may express generally positive environmental attitudes, prior research suggests that they often lack a structured understanding of soil as a living system and of the links between soil health, climate, consumption, and land-use choices (Johnson et al., 2023; Ribič et al., 2024).

This invisibility creates a marketing and communication problem with direct relevance to business and management research. Soil is not paid sufficient attention and is easily overlooked in everyday life unless it is made visible through concrete practices, images, stories, artifacts, and decision situations. Unlike plastic pollution or air pollution, soil degradation is often slow, hidden, and difficult to dramatise (Brevik et al., 2022a). For this reason, soil literacy requires more than the transmission of scientific information. It requires the design of learning environments in which soil becomes tangible, consequential, and personally meaningful (Hayhoe, 2013; Moscatelli & Marinari, 2024; Tseng & Lai, 2025). From a marketing perspective, this is a fundamental problem of decision architecture, salience, and message persistence – domains in which social marketing research has accumulated substantial theoretical and empirical insight (Andreasen, 1995; Kotler & Lee, 2008).

This paper examines how soil literacy can be operationalised through school-based social marketing interventions. Rather than treating soil literacy as a narrow science-education problem, we conceptualise it as a sustainability communication challenge: how can low-cost communication tools and behavioural design elements make soil visible, memorable, and actionable among young citizens, who are themselves consumers, future market participants, and intermediaries of household sustainability practices? This framing is consistent with social marketing approaches that move beyond awareness-raising to behaviourally relevant communication, cues, and enabling environments (McKenzie-Mohr & Tabanico, 2025). It is also consistent with consumer socialisation research, which positions childhood and adolescence as critical formative periods for sustainability-relevant attitudes, habits, and decision heuristics (John, 1999; Moschis & Churchill, 1978).

The empirical basis of this paper is a coordinated set of pilot interventions implemented in Serbian primary and secondary schools on horticultural innovations in soil-friendly practices. The interventions were designed to test classroom feasibility,

teacher acceptability, student engagement, and early learning signals under realistic school conditions. They included composting workshops, art-based activities, scenario-based quizzes, print communication materials, certificates, and a secondary-school module on peat extraction and peat-free alternatives – the latter directly connecting soil literacy to a contested resource market in horticulture. The interventions were not designed as a randomised impact assessment; rather, they represent a formative, multi-site intervention study aimed at understanding whether and how soil literacy can be embedded into classroom practice as scalable behavioural design.

Serbia provides a particularly informative empirical setting for several reasons. First, the country combines a strong agricultural base with rapid urbanisation and growing exposure to global brand and retail environments (Filipovic et al., 2025), making it a useful site for studying how classroom-based sustainability communication interacts with consumer culture. Second, the Serbian school system serves both rural and urban populations under a single national curriculum, allowing the same intervention framework to be tested across diverse community contexts. Third, soil literacy in Serbia is currently underdeveloped at the policy level, which means that the intervention represents a real-world introduction rather than reinforcement of existing programmes – yielding more interpretable signals about acceptability and engagement. Cross-national comparability with other Central and Southeastern European countries adds external relevance to the findings.

The paper addresses the following research question: *How can age-adapted social marketing interventions make soil literacy visible, understandable, and actionable in primary and secondary school contexts?*

The contribution is threefold. First, the study extends research on soil literacy by shifting attention from knowledge transmission to intervention design, visibility, and behavioural salience (Brečić et al., 2021). Second, it contributes to sustainability communication and social marketing by showing how low-cost artifacts such as posters, stickers, certificates, and quizzes function as behavioural infrastructure rather than decorative materials. Third, it offers practical implications for scaling soil literacy interventions through modular, age-differentiated, competence-oriented design – with implications for responsible marketing, sustainability communication, and policy delivery in terms of the EU Soil Mission.

## II. Theoretical Background

### A. Soil Literacy as Sustainability Competence

Soil literacy has emerged as an important educational and policy priority, particularly within European sustainability agendas. Soil supports food systems, biodiversity, carbon storage, and ecosystem resilience, yet research consistently shows that soil is underrepresented in curricula and poorly understood by young people (Brevik et al., 2022a, 2022b; Hayhoe, 2013). This gap is not only informational. It reflects the fact that soil is often treated as background material rather than as a living, consequential system embedded in food chains, production systems, and consumer choices.

Earlier work on soil education shows that learners frequently hold fragmented mental models of soil. Students often recognise that soil is connected to plant growth, but they struggle to understand soil formation, vertical soil structure, biological activity, and long-term ecological processes (Hayhoe, 2013). These misconceptions are not easily corrected through passive instruction. They require explicit conceptual scaffolding, experiential learning, and reflective engagement (Hayhoe, 2013; Ribič et al., 2024).

Recent European work reframes soil literacy as a multidimensional competence involving attitudes, behaviours, and capabilities (Katicas et al., 2024; Roca Vallejo et al., 2025). This competence-oriented view is important because it moves soil education beyond factual awareness. A soil-literate student should not only know that soil matters but should also be able to interpret soil-related problems, recognise trade-offs, and connect soil health with everyday practices and policy choices. Johnson et al. (2023), in a survey of 3,661 school children aged 13–15 across Ghana, South Africa, and Zimbabwe, show that adolescents may report positive attitudes toward soil protection while demonstrating weaker competences, particularly in understanding soil as a living system and recognising soil–climate linkages. This divergence between attitudes (52% positive) and competences (23% knowledgeable) supports the need for interventions that target capability and reasoning, not only attitudes.

This competence framing is especially relevant for schools, which represent a strategic setting for sustainability communication because they reach pre-market consumers during formative socialisation phases (John, 1999). If soil is taught only as a scientific object, students may acquire isolated facts without developing the ability to use soil knowledge in practical reasoning. If, however, soil is presented as a living system embedded in food, climate, waste, construction, land use, and consumption, it becomes a gateway competence for a broader understanding of sustainability (Katicas et al., 2024; Roca Vallejo et al., 2025).

## ***B. Social Marketing and Behavioural Design in Sustainability Communication***

Social marketing applies marketing principles and techniques to influence behaviours that benefit individuals and society (Andreasen, 1995; Kotler & Lee, 2008). In environmental contexts, social marketing has been used to promote recycling, energy conservation, water saving, responsible food consumption, and other pro-environmental practices (McKenzie-Mohr & Tabanico, 2025; Peattie & Peattie, 2009). Its relevance for soil literacy lies in its focus on behaviour, salience, cues, and practical adoption rather than information alone.

Environmental education programmes often assume that knowledge will automatically lead to behavioural change. However, the knowledge–action gap is well documented in sustainability communication and behaviour-change research (Kollmuss & Agyeman, 2002; McKenzie-Mohr & Tabanico, 2025; Peattie & Peattie, 2009). Individuals may care about environmental issues yet fail to act because the issue is abstract, invisible, inconvenient, or weakly connected to everyday routines. Soil protection is especially vulnerable to this problem because soil degradation is often less visible than other environmental harms (Brevik et al., 2022a; Johnson et al., 2023).

Social marketing and behavioural design therefore suggest that soil literacy interventions should not rely only on classroom explanation. They should create visible cues, identity markers, repeated exposure, and simple action pathways. This insight has parallels in commercial marketing, where research on retail decision architecture, point-of-sale prompts, and packaging design demonstrates that consumer behaviour is shaped by the format of information, not only its content (Cadario et al., 2016; Parguel et al., 2015). Posters can function as memory anchors, stickers as identity cues, certificates as recognition devices, and quizzes as assessment-as-learning tools. Such artifacts are consistent with evidence that visual, narrative, and creative communication can strengthen environmental learning and emotional engagement, especially among younger learners (de Aguiar Junior & Falcão, 2023; Hayhoe, 2013; Moscatelli & Marinari, 2024).

Importantly, school-based interventions also activate child-to-family diffusion mechanisms. Children who acquire sustainability competences and visible identity cues (stickers, certificates, and project artifacts) function as conduits for sustainability communication into household decision-making (Damerell et al., 2013; Easterling et al., 1995). This intergenerational diffusion is a distinctive feature of school-based social marketing, with direct relevance to consumer socialisation theory (John, 1999; Moschis & Churchill, 1978) and to the broader marketing question of how sustainability norms travel across age cohorts.

### ***C. Age-differentiated Communication and Experiential Learning***

Developmental differentiation is essential in sustainability education. Younger pupils often benefit from visual, creative, and emotionally engaging activities, while older pupils can engage with scenarios, trade-offs, and governance reasoning (Filipović, 2011; Hayhoe, 2013; Ogelman, 2012; Ribič et al., 2024). Hirai et al. (2020) show that interest in soil tends to decline with age, suggesting that pedagogy must evolve from descriptive awareness toward applied reasoning if engagement is to be sustained.

Experiential learning is particularly important for soil education. Hayhoe (2013) demonstrates that hands-on activities and reflective discussion improve students' conceptual understanding of soil. Tseng and Lai (2025) similarly show that field-based and practical activities, together with question-driven learning, can increase engagement and conceptual coherence, especially when students work with tangible soil samples across multiple learning stages within a structured five-week programme. These findings support interventions that bring soil into the classroom through composting demonstrations, soil samples, or visible ecological processes.

Creative methods are also valuable. Drawings, stories, posters, and visual artifacts help younger learners construct meaning through symbolic representation (de Aguiar Junior & Falcão, 2023; Hayhoe, 2013). For older learners, scenario-based quizzes and problem-based prompts are more appropriate because they require students to interpret causes, consequences, and possible solutions (Ribič et al., 2024). Such formats move students from factual recall towards applied environmental reasoning, which corresponds to higher-order cognitive engagement appropriate for adolescent cognitive development.

#### ***D. Peat as an Applied Soil Literacy Case in Horticultural Markets***

Peat extraction offers a particularly useful applied case for secondary-school soil literacy because it directly connects soil with consumer markets – specifically the horticulture and growing-media industries. Peatlands store carbon and support biodiversity, yet peat extraction for horticultural use can damage peatland ecosystems and release stored carbon. Teaching about peat therefore connects soil with climate, production systems, consumption choices, and substitution pathways. This makes peat a strong case for transition literacy, because students can examine not only environmental harm but also alternatives such as compost, coconut coir, wood fibre, and peat-free growing media (Aran, 2024).

The peat case is consistent with competence-oriented soil literacy because it requires students to connect scientific knowledge with market choices, production practices, and policy trade-offs (Katicas et al., 2024; Roca Vallejo et al., 2025). It also addresses the soil–climate linkage that adolescents often fail to recognise (Johnson et al., 2023). By presenting peat as both a soil and climate issue, educators can make soil protection more relevant to contemporary sustainability debates and connect it to a real consumer-facing transition challenge in the horticulture sector – an industry in which voluntary commitments, regulatory pressure, and consumer demand are converging on peat-free alternatives.

#### ***E. Children, Adolescents, and Consumer Socialisation***

A further reason to focus on schools as a site for sustainability communication is that childhood and adolescence are formative periods during which consumer attitudes, brand sensitivities, and decision heuristics take shape. The consumer socialisation literature shows that children progress through identifiable stages of cognitive and social development that shape how they process marketplace information, attend to product cues, and form preferences (John, 1999; Moschis & Churchill, 1978; Filipović, 2011). Younger children rely heavily on perceptual and visual cues, while older children and adolescents develop the ability to engage with abstract concepts, multi-attribute trade-offs, and social-comparison processes.

This has direct implications for sustainability communication. Interventions targeted at younger children should leverage concrete, visual, and affective cues; interventions for adolescents should engage analytical reasoning and identity-relevant trade-offs. The peat module exemplifies the latter approach by inviting students to evaluate competing claims, environmental costs, and substitution options – cognitive operations that map onto adolescent consumer decision-making in real markets.

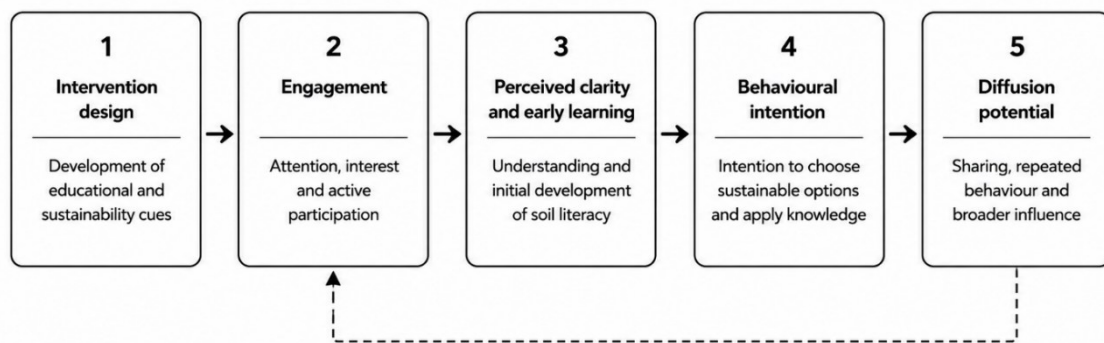
Childhood and adolescent sustainability socialisation also matter because of intergenerational diffusion. Children and adolescents are not only future consumers but also present-day intermediaries who carry information, attitudes, and norms into household and community contexts (Damerell et al., 2013; Easterling et al., 1995). School-based interventions therefore have a multiplier effect: each pupil reached is also a potential conduit to parents, siblings, and peers. This intergenerational dimension is a distinctive feature of school-based sustainability communication and should be

deliberately designed into intervention materials – for example, through portable identity cues (stickers), shareable artifacts (drawings, certificates), and social-media-native diffusion mechanisms appropriate for adolescents.

**F. Conceptual Framework**

The intervention logic developed in this paper is grounded in the idea that soil literacy emerges when environmental knowledge is made visible, tangible, and decision-relevant. Drawing on social marketing, experiential learning, and competence-based soil education, we propose a five-stage framework (Figure 1).

**Figure 1**  
**Conceptual Framework for Soil Education**



Source: Author’s own

The first stage, *intervention design*, includes age-adapted content, visual materials, identity cues, and applied learning mechanisms. The second stage, *engagement*, refers to students’ active participation through hands-on activity, creative expression, discussion, or scenario reasoning. The third stage captures *perceived clarity and early learning signals*, including students’ self-reported understanding and item-level performance on knowledge checks. The fourth stage concerns *behavioural intention* – students’ reported willingness to think differently or change habits. The fifth stage, *diffusion potential*, refers to the possibility that learning extends beyond the classroom through posters, stickers, peer communication, and child-to-family transmission (Damerell et al., 2013; Easterling et al., 1995).

This framework aligns with soil literacy research that emphasises attitudes, behaviours, and competences (Katikas et al., 2024; Roca Vallejo et al., 2025), with experiential learning evidence in soil education (Hayhoe, 2013; Tseng & Lai, 2025), and with social marketing approaches that use cues, salience, and enabling tools to support behaviour change (Andreasen, 1995; Kotler & Lee, 2008; McKenzie-Mohr & Tabanico, 2025). It is also consistent with the consumer socialisation literature, which highlights childhood and adolescence as formative periods during which sustainability-relevant attitudes, identities, and behavioural heuristics take shape (John, 1999).

The framework is deliberately designed to be developmentally differentiated rather than uniform. Different stages of the framework are activated through different

mechanisms depending on the learner's age. For younger pupils, engagement is primarily achieved through creative and visual expression; for older pupils, through applied reasoning and trade-off analysis. The diffusion stage operates differently as well: stickers and identity cues drive peer-to-peer and child-to-family communication for younger pupils, while social-media-native artifacts and student-generated communications drive diffusion among adolescents.

### **III. Methodology**

#### **A. Research Design and Formats**

The study uses a mixed-method and multi-site pilot design. Its purpose was not to estimate causal treatment effects through randomisation, but to assess whether the intervention materials and delivery formats were feasible, engaging, and capable of producing early learning signals in real school environments. This formative design is appropriate for exploratory study and early-stage intervention development, where the priority is to test classroom readiness, refine materials, and identify mechanisms before scaling to more rigorous pre/post or controlled evaluation (Craig et al., 2008).

The interventions were implemented across three primary and two secondary schools in Serbia, with a common objective – to make soil visible and meaningful – but differed in delivery format according to students' age and classroom contexts. This modular design reflects evidence that soil education should be developmentally differentiated (Hayhoe, 2013; Hirai et al., 2020; Ogelman, 2012).

The primary-school interventions included three formats. The first was a composting workshop with 14-year-old pupils in Brus, a rural municipality near the Kopaonik mountain range. The second was an art-based intervention with 10-year-old pupils in Smederevo (sub-urban municipality), using creative drawing to connect soil, nature, and environmental care. The third was a scenario-based quiz and discussion with 14-year-old pupils in Barajevo (urban municipality of Belgrade), focused on soil degradation and land-use decisions.

The secondary-school interventions were implemented with 17-year-old students in two Belgrade grammar schools. One module focused on peat extraction, peatlands, carbon storage, and peat-free alternatives – directly linking soil literacy to a contested horticultural market. A second module focused on responsibility, trade-offs, and student-generated communication about soil protection, including a peer-to-peer diffusion mechanism (“One post for soil”) translating learning into social-media-native dissemination.

#### **B. Study and Evaluation Instruments**

The intervention materials included posters, stickers, certificates, slide decks, quizzes, hands-on composting items, creative drawing tasks, and visual prompts. These materials were designed not as decorative supplements, but as communication and behavioural tools – a deliberate operationalisation of the social marketing principle that environmental behaviour is shaped by cues, reinforcement, identity, convenience, and

social context (Andreasen, 1995; Kotler & Lee, 2008; McKenzie-Mohr & Tabanico, 2025, Brečić et al., 2021).

Posters provided repeated classroom exposure, functioning as memory anchors that stabilise key messages beyond a single session. Stickers functioned as identity and diffusion cues, allowing pupils to signal commitment and carry messages into peer and household contexts. Certificates reinforced recognition and legitimised participation. Quizzes supported assessment-as-learning, simultaneously testing comprehension and reinforcing core messages through applied prompts. The peat module added a resource-chain narrative connecting soil to horticultural markets, while the secondary diffusion mechanism (“One post for soil”) translated learning into peer-to-peer social-media communication.

Evaluation relied on teacher appraisal, student questionnaires, and student quiz responses. Teacher instruments assessed perceived clarity, usefulness, applicability, willingness to participate again, and willingness to recommend the materials to colleagues. Student instruments assessed clarity, perceived learning, prior exposure to ecological topics, behavioural intention, and agreement with soil-related statements using both categorical and Likert (1–5) items. In the Brus intervention, a student quiz (15 items, mixed multiple-choice and true/false) provided item-level evidence of post-intervention knowledge uptake.

Across the five pilot sites, the evaluation generated structured feedback from 91 teachers (24 in Brus, 26 across Smederevo and Barajevo, 21 in Secondary Pilot 1, and 20 in Secondary Pilot 2). Quantitative student data were collected from 25 pupils in Brus (quiz responses), 32 students in Secondary Pilot 1, and 22 students in Secondary Pilot 2. Qualitative engagement signals were documented across all sites through teacher narrative feedback and observational notes. The evaluation framework follows established practice in formative intervention research, in which acceptability, feasibility, and early learning signals are assessed as preconditions for more rigorous subsequent evaluation (Craig et al., 2008).

The evidence should be interpreted as formative and exploratory. The study does not claim long-term behavioural change or causal impact. Instead, it evaluates whether the intervention package demonstrates sufficient feasibility, acceptability, and early learning potential to justify refinement and scale-up. Where possible, the analysis triangulates teacher and student responses, quantitative and qualitative data, and across-site comparisons to strengthen the interpretive validity of conclusions.

The interventions were conducted with school-level approval and in line with standard educational research ethics. Participation by teachers and students was voluntary, with the understanding that the activities were embedded into routine classroom practice rather than separate research procedures. No personally identifying data were collected, and quiz and survey responses were aggregated for analytical reporting. Where hands-on activities involved organic materials (e.g., composting demonstrations), basic safeguarding practices appropriate to school settings were applied, including allergy checks and the option to decline physical handling.

## IV. Results

### A. *Primary-school Interventions*

The primary-school results indicate high classroom acceptability and strong engagement across age-adapted formats. In Brus, teacher appraisal was highly favourable. All 24 teachers indicated that the workshop increased environmental awareness, and almost all (22/24) positively evaluated the organisation, posters, stickers, and participation potential. Teacher suggestions were mostly oriented toward adding more everyday examples (5/24), more experiments or demonstrations (5/24), and more time or repeated sessions (4/24). Importantly, 7 of 24 teachers explicitly stated that no changes were needed – a strong signal of acceptability and readiness for replication. This pattern indicates that teachers accepted the core design and primarily wanted deeper experiential exposure, rather than structural redesign.

Student quiz results from Brus provide early evidence of knowledge uptake. Across 25 student responses, total scores ranged from 5 to 19 points, with a mean of 12.56 ( $SD = 4.65$ ; median = 12) on a 19-item scale. Item-level analysis showed a stronger performance on operational composting concepts, including the role of microorganisms (>90% accuracy) and compost-supporting activities, than on more abstract conceptual definitions such as “What is soil?” (<20% accuracy). This suggests that hands-on composting successfully made practice-linked concepts salient, but that future iterations should strengthen the initial conceptual framing of soil as a living system before transitioning into composting as a practice.

The Smederevo and Barajevo interventions confirmed the value of developmental differentiation. In Smederevo, third-grade pupils engaged through creative drawing, which translated soil protection into personally meaningful visual expression – consistent with research showing that visual and creative methods are especially effective for younger learners (de Aguiar Junior & Falcão, 2023; Hayhoe, 2013; Moscatelli & Marinari, 2024). In Barajevo, eighth-grade pupils engaged through scenario-based reasoning, which required them to diagnose soil degradation scenarios (a degraded schoolyard after repeated trampling and rainfall; planning of a factory near fertile land) and propose rule-based responses. This format aligns with evidence that older pupils benefit from applied reasoning and problem-based tasks (Ribič et al., 2024).

Teacher feedback on the Soil Significance materials package ( $n = 26$  across both sites) was strongly positive (Table 1). Posters were perceived as clear and appropriate, stickers were described as attractive and motivating, and the quiz was considered suitable for stimulating thinking. The few recurring improvement suggestions concerned minor localisation and design issues, such as colour contrast and Cyrillic versus Latin script. These findings suggest that the materials, particularly Poster 2 and stickers, are classroom-ready but require low-cost adaptation for broader implementation.

Qualitative comments described stickers as “charming,” “original,” “fantastically created,” and noted that “pupils loved stickers” – affective descriptors confirming that the materials achieved their intended motivational function. Similarly, the quiz instrument was repeatedly praised as “thought-provoking,” with situational formats encouraging analytical thinking rather than rote memorisation. No teacher questioned

the substantive accuracy of the content, and multiple teachers explicitly called for expanding the campaign to additional schools – a strong signal of perceived value and willingness to diffuse within the educational community.

**Table 1– Sentiment-coded teacher responses by component, Soil Significance pilots (n = 26).**

Component	Negative	Neutral	Positive	Positive + suggestion	Suggestion only
Overall campaign	0	5	16	2	3
Poster 1	0	16	4	4	2
Poster 2	1	6	15	1	3
Quiz	1	16	5	0	4
Stickers	0	6	19	0	1

Source: Author’s own

**B. Secondary-school Interventions**

The secondary-school pilots also produced favourable feasibility and engagement signals. Teacher evaluations indicated strong acceptability, especially for perceived contribution to behavioural change and overall material quality. In the first secondary pilot (n = 21), the overall assessment of materials reached a 90.5% net-positive evaluation, with mean scores of 4.48 (SD = 0.98) on a 1–5 Likert scale (Table 2). In the second secondary pilot (n = 20), 85% of teachers evaluated the materials as clear and easy to understand, while 70% viewed them as applicable in regular teaching. Three quarters of teachers in the second pilot also indicated a willingness to recommend the materials to colleagues – a meaningful scale-readiness proxy because it expresses willingness to diffuse the intervention through professional networks.

**Table 2– Teacher evaluation summary, Secondary Pilot 1 (n = 21).**

Notes. M = Mean; SD = Standard deviation.

Indicator	M	SD	Negative	Neutral	Positive	Net positive (%)
Materials are easy to apply in classroom practice	3.43	0.98	2	10	9	42.9
Materials stimulate students to think about soil protection	3.90	1.00	1	5	15	71.4
Materials can contribute to behavioural change	3.95	1.07	2	3	16	76.2
Overall assessment of the materials	4.48	0.98	1	1	19	90.5

Source: Author’s own

Student outcomes indicate strong perceived clarity and relevance. In Secondary Pilot 1 (Table 3), 56.2% of students reported that the content was completely clear, with an

additional 34.4% reporting that it was mostly clear. More than half (53.1%) indicated an intention to change habits, while 43.8% answered “maybe” – suggesting openness to behavioural reflection. Concerning the Likert-scale evaluation items, 81.2% responded positively that the campaign helped them understand why soil protection matters (mean = 4.25, *SD* = 1.02), and 78.1% responded positively that the campaign made them think more about how their behaviour affects the environment (mean = 4.19, *SD* = 0.93). A further 78.1% agreed that young people can contribute to soil protection (mean = 4.28, *SD* = 0.96), an important agency-related signal for adolescent engagement.

The second secondary pilot showed that students are receptive to responsibility and moral-salience framing. For example, when asked whether people would behave more responsibly if damage to soil were visible on human skin, 95.5% answered yes. Similarly, 86.4% said people would protect soil more if they had to cultivate it at least one day per year, and 86.4% said behaviour would change if people were required to consume only food produced from local soil. These findings suggest that adolescents can engage with soil protection when it is connected to visibility, responsibility, embodiment, and everyday consequences – leveraging well-established psychological mechanisms of moral salience and concrete framing (Lewin, 1947; Cialdini & Goldstein, 2004).

**Table 3– Student responses, Secondary Pilot 1.**

Question	Response	<i>n</i>	%
Exposure to eco-topics at school	Never	4	12.5
	Rarely	9	28.1
	Sometimes	14	43.8
	Often	5	15.6
Prior knowledge about soil protection	None	3	9.4
	A little	13	40.6
	A lot	16	50.0
Clarity of content	Did not understand	1	3.1
	Partly clear	2	6.2
	Mostly clear	11	34.4
	Completely clear	18	56.2
Intention to change habits	No	1	3.1
	Maybe	14	43.8
	Yes	17	53.1

Source: Author’s own

The peat module appears particularly promising. Students displayed solid general ecological awareness but lower familiarity with peat alternatives – exactly the gap that targeted intervention can fill. This indicates that peat-focused education can bridge a specific knowledge gap by connecting soil literacy to resource chains, horticultural production, climate impacts, and substitution options.

### **C. Cross-site Synthesis**

Synthesising across the five pilots, three patterns are particularly notable. First, acceptability among teachers was uniformly high across all sites and intervention formats, with net-positive ratings ranging from 70% to over 90% on key indicators. The consistency of this pattern across rural, sub-urban, and urban settings, and across primary and secondary levels, suggests that the materials and delivery formats are robust to contextual variation. Second, the type of engagement varies systematically with age: younger pupils engaged most strongly through creative and visual mechanisms, while older pupils engaged most strongly through applied reasoning and trade-off analysis. Third, the strongest behavioural-intention signals emerged in interventions that combined experiential anchors (composting, drawings, and scenarios) with persistent visual cues (posters and stickers) and identity-recognition elements (certificates) – supporting the conceptualisation of these artifacts as integrated behavioural infrastructure rather than discrete components.

A further cross-site observation concerns the relationship between perceived clarity and behavioural intention. Across both secondary pilots, students who reported high clarity also reported a greater willingness to change habits, suggesting that comprehensibility is a precondition for action. This is consistent with broader social marketing evidence that perceived ease of action is a primary driver of pro-environmental behaviour (McKenzie-Mohr & Tabanico, 2025; Peattie & Peattie, 2009). It also implies that intervention designers should prioritise communication clarity as a first-order design criterion rather than treating it as a downstream concern.

## **V. Discussion**

The findings support the central argument of the paper: soil literacy is more effective when soil is made visible, tangible, and decision-relevant through deliberate communication and behavioural design. Across the five pilots, students and teachers responded positively not only to the topic but to the way it was translated into concrete educational and behavioural design elements. This is consequential because soil is often cognitively and visually hidden. The interventions addressed this invisibility through composting, drawing, posters, stickers, scenarios, and peat-based sustainability dilemmas – each functioning as a salience and engagement mechanism rather than a pure information vehicle.

One of the most important contributions of the study is the conceptualisation of intervention materials as behavioural infrastructure. In many educational projects, posters, stickers, certificates, and quizzes are treated as secondary materials. In this study, they played a central role. Posters created repeated exposure; stickers enabled identity signalling and peer diffusion; certificates legitimised participation; quizzes converted assessment into learning; and scenario prompts encouraged applied reasoning. The qualitative teacher feedback confirms this interpretation: descriptors

such as “charming,” “thought-provoking,” and “loved by pupils” indicate that the artifacts achieved both motivational and cognitive functions.

This interpretation aligns with social marketing theory, which emphasises that behaviour is shaped not only by information but also by cues, reinforcement, identity, convenience, and social context (Andreasen, 1995; Kotler & Lee, 2008; McKenzie-Mohr & Tabanico, 2025). It is also consistent with retail and packaging design research showing that the format of information shapes consumer choice (Cadario et al., 2016; Parguel et al., 2015). Posters and stickers in classrooms function similarly to point-of-sale prompts in retail environments: they shape decision-making by making relevant information persistently available at the moment of choice.

The results also show that soil literacy should not be delivered through a single standardised module across all grades. Younger pupils responded well to creative and emotional engagement, while older pupils benefitted from scenario reasoning and hands-on application. This supports prior evidence that soil education must be developmentally differentiated (Hayhoe, 2013; Hirai et al., 2020; Ogelman, 2012; Ribič et al., 2024).

For scale-up, this means that soil literacy should be designed as a tiered competence track. Lower primary students can focus on soil as living material, observable features, and care behaviours. Middle primary students can engage with organisms, decomposition, and simple cause–effect relationships. Upper primary and secondary students can work with soil degradation, land-use trade-offs, peat extraction, climate linkages, and policy choices. This corresponds to the staged conceptual progression supported by the broader soil education literature.

The peat module demonstrates how soil literacy can move from general awareness to transition literacy. Generic statements such as “soil is important” may be insufficient for adolescent learners. Peat extraction, by contrast, offers a concrete resource chain linking soil, climate, horticulture, consumption, and alternatives. This makes it possible to discuss substitution, regulation, production systems, and consumer responsibility – thereby connecting soil literacy directly to a contested market category in which European voluntary commitments and forthcoming regulatory action are reshaping demand.

This finding supports recent calls to understand soil literacy as a competence for sustainability transitions (Katicas et al., 2024; Roca Vallejo et al., 2025). It also addresses the documented weakness in students’ understanding of soil–climate linkages (Johnson et al., 2023). By using peat as a concrete case, educators can help students understand how soil protection is connected to broader economic and policy systems, including the role of consumer choices and corporate commitments in driving market transitions.

## **VI. Conclusion, implications and limitations**

This paper examined how soil literacy may be supported through school-based social marketing interventions. Drawing on five Serbian pilot interventions, the findings suggest that soil literacy is not strengthened simply by adding more environmental

content, but by designing learning contexts in which soil-related knowledge becomes visible, understandable, and connected to everyday decisions.

The pilots indicate that low-cost tools such as posters, stickers, certificates, quizzes, creative tasks, composting demonstrations, and peat-focused modules may support engagement, early learning, and behavioural intention. These tools appear to work as simple behavioural supports that help pupils recognise soil as a relevant sustainability issue rather than as an abstract environmental topic.

For practice and policy, the findings point to the value of a modular and age-differentiated approach. Younger pupils may benefit most from visual, creative, and emotionally engaging activities, while older pupils can engage with hands-on tasks, scenarios, debate, and concrete sustainability trade-offs. Secondary-school students appear particularly well placed to consider resource-chain issues such as peat extraction and peat-free alternatives, which connect soil literacy to climate, production, consumption, and transition policy.

Overall, the Serbian pilots offer preliminary evidence that modest, school-based interventions can create early signals of capability development. However, these findings should be interpreted as formative rather than conclusive. Future research should examine whether such early signals lead to sustained knowledge retention, behavioural change, intergenerational diffusion, and measurable contributions to broader soil-literacy objectives.

### ***A. Theoretical Implications***

Although the empirical setting is educational, the paper offers several implications for marketing and management research. First, it shows how social marketing principles may be applied to sustainability issues that are important but often weakly visible in everyday decision-making. Second, it suggests that simple communication artifacts can support visibility, engagement, and diffusion potential, in line with research on environmental labelling, decision architecture, and greenwashing prevention. Third, it reinforces the idea that sustainability communication should be designed not only around message content but also around how information is encountered, remembered, and used.

The study also contributes to research on children and adolescents as participants in sustainability communication. Rather than treating pupils only as recipients of knowledge, the findings suggest that they may also act as intermediaries within households and communities. This perspective is consistent with consumer socialisation theory and with evidence on child-to-parent environmental influence (Filipović, 2010; Damerell et al., 2013; Easterling et al., 1995).

More broadly, the study suggests that when environmental problems are abstract or invisible, marketing communication can help make them perceptible and actionable. This principle may be relevant beyond soil literacy, including environmental labels, product communication, school-based sustainability programmes, and corporate sustainability reporting.

## **B. Managerial and Policy Implications**

The study offers practical implications for managers, policy designers, and educators concerned with sustainability communication. For responsible marketing and corporate sustainability professionals, the findings suggest that effective communication depends less on the amount of information provided and more on how information is designed. Retail signage, packaging, and digital communication should make sustainability attributes salient at the point of decision. In this sense, communication artifacts can function as behavioural supports rather than merely informational supplements.

For educators and curriculum designers, the findings support a tiered, competence-oriented approach to soil literacy. Lower primary pupils may benefit from creative and visual activities; middle primary pupils can engage with basic ecological reasoning; and older pupils can address applied scenarios, governance trade-offs, and resource-chain cases. Such progression can help soil literacy develop cumulatively across school years rather than being introduced as isolated activities.

For policy designers, particularly in relation to the EU Mission Soil and similar sustainability initiatives, the pilots suggest that school-based soil literacy may be more feasible when embedded into existing subjects rather than added as a separate topic. Soil literacy can connect naturally to science, geography, civics, art, and sustainability education. Scaling efforts should therefore preserve developmental differentiation, support teachers with simple materials, and include concrete cases such as peat extraction and peat-free substrates.

The Serbian pilots also point to a broader policy lesson: the challenge is not only to increase environmental concern, but to make soil knowledge usable in everyday learning and consumption contexts. While the evidence remains preliminary, the interventions suggest that modest investments in well-designed educational materials may support early engagement with soil health and sustainability.

## **C. Limitations and Future Research**

Several limitations should be acknowledged. First, the interventions were exploratory pilots and were not based on randomised or controlled designs. Second, several outcomes were self-reported, including perceived clarity, perceived learning, and behavioural intention, which may be affected by social desirability bias. Third, the study did not include long-term follow-up and therefore cannot assess retention or actual behavioural change. Fourth, the interventions varied across schools and age groups, which increases ecological relevance but limits direct comparability.

Future research should build on this formative evidence using stronger research designs. A next phase could include pre- and post-measures of soil knowledge, attitudes, competences, and behavioural intention. Follow-up measurement after several weeks or months would allow assessment of retention. Quasi-experimental or randomised designs could compare different intervention components, such as posters alone versus posters combined with hands-on demonstrations, or factual instruction versus scenario-based reasoning. Cross-country research would also be valuable, particularly in European contexts where soil policy, horticultural markets, and sustainability education differ.

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