

Voicing green learning in rural areas through service-learning: A participatory action research study

Loredana Manasia*^a, Andrei Pârvan^b, Grațîela Ianoș^a

^aNational University of Science and Technology Politehnica Bucharest, 313 Splaiul Independenței, Bucharest, Romania

^bUniversity of Bucharest, 90 Șoseaua Pandurilor, Bucharest, Romania

Abstract

The paper explores the role of service-learning pedagogy in fostering green learning and skills, particularly in rural school setting. By triangulating data from photovoice, dyadic interviews, and reflective observations, the authors implemented an action research study, involving sixteen students from grades 5 to 8 in a Romanian public school. Initial and final interviews explored the participants' perceptions and strategies toward green learning, while photovoice documented their learning process. Observational tools further enriched data collection. The study found service-learning enhanced enjoyment, deep learning strategies, and a sense of community in multi-ethnic classrooms. Thus, experiential learning pedagogies coupled with participant research methods can significantly bolster green learning and competences.

Keywords: green learning; service-learning; action research

1. Introduction

A paramount strategy for readying ourselves for green economies and a carbon-neutral future involves making sure that qualifications, programs, and curricula impart green skills (UNESCO, 2021). The incorporation of environmental considerations into the curriculum, commonly referred to as "greening the curriculum," and the subsequent promotion of green learning in secondary education offer substantial pedagogical merits. These benefits encompass future readiness, social advancements, enhancements in health, and ecological outcomes, valuing sustainability, supporting fairness, and promoting nature (Ardoin et al., 2020; Droubi et al., 2023; European Commission. Joint Research Centre, 2022; Green & Rayner, 2022; Zhang et al., 2023).

The concept of *green learning*, alternatively referred to as *learning for the green transition* or *learning for sustainability*, pertains to an educational paradigm that places a strong emphasis on environmental sustainability (Elliott et al., 2020; Manasia et al., 2019). It entails the cultivation of ecological awareness, the development of environmentally responsible attitudes and behaviors, and the acquisition of pertinent knowledge and skills. The primary objective is to equip individuals with the necessary competencies to address environmental challenges and actively contribute to the pursuit of a sustainable future (European Commission. Joint Research Centre, 2022). Within this approach, five pillars could be unfolded, namely learning to know, learning to do and be, learning to live together, and learning to transform oneself and society. (Chapman et al., 2008, p. 8). By integrating environmental concepts, principles, and practices into the curriculum and teaching methodologies, green

* Corresponding author.

E-mail address: loredana.manasia@upb.ro

learning facilitates the development of learners' competences, enabling them to acquire the requisite knowledge, skills, and attitudes necessary to genuinely appreciate our planet and proactively engage in its preservation. Green learning aims to cultivate environmentally literate individuals who are equipped with the knowledge, skills, and values needed to contribute to a more sustainable and ecologically conscious society (European Commission. Directorate General for Education, Youth, Sport and Culture, 2022). Notwithstanding the strategic importance placed on green learning, an extensive global review conducted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2021, analyzing national curricula and policy documents, reveals that essential environmental themes are still inadequately addressed (Jensen et al., 2021). In addition, findings from the EU Commission's public survey on education for environmental sustainability underscore the significance of incorporating practical, experiential learning approaches. The survey highlights the value of engaging learners in hands-on activities, such as outdoor learning, and providing opportunities for them to identify and address problems that resonate with their personal concerns. These approaches are crucial for enhancing green learning and fostering a deeper understanding of environmental issues while empowering learners to collaboratively develop innovative solutions (European Commission. Directorate General for Education, Youth, Sport and Culture, 2022, p. 14).

In a broader sense, both pre-service and in-service teachers face challenges in terms of lacking certain skills and confidence necessary to effectively incorporate green learning approaches into their teaching practice (Green & Rayner, 2022; Manasia et al., 2019). Furthermore, while concrete practices have been extensively researched at the level of higher education curriculum, there is a scarcity of documented experiences in secondary schools (Hart-Anderson & Holme, 2022).

Within this broader context, the primary objective of this paper is to explore and examine contemporary, green teaching and learning strategies and practices implemented in secondary education. In light of this objective, the paper introduces an action research study designed to promote the cultivation of green skills and facilitate the adoption of deep learning strategies through pedagogical innovation. The paper further advocates for the utilization of service-learning as an innovative pedagogical approach, highlighting its potential for fostering green learning and enhancing the development of green competences.

The article starts by reviewing existing research on green learning and service-learning methods, then outlines the study's context and framework. It discusses the creation and execution of the Sustainable, Understanding, and Responsibility for an Eco-friendly Future (SURE) Project for 5th to 8th grade students. The engagement of students and teachers was recorded via action research and photovoice methods. Findings are categorized into three themes: students' perspectives on green learning, educational techniques enhanced by the SURE model, and the role of service-learning as a progressive approach in green education. The paper concludes by discussing the study's implications, especially its contribution to enhancing teacher abilities and confidence in using service-learning for sustainability education.

1.2. Service-learning as an innovative pedagogy for greening the curriculum

The European Union (EU) is actively pursuing the objectives outlined in the European Green Deal, with the ultimate goal of achieving climate neutrality by 2050. This commitment reflects the EU's dedication to driving transformative changes in our economy and society to address pressing environmental challenges. Similar to all sectors, the education and training domain must undergo a critical examination of its response to the climate and ecological crises. This scrutiny involves evaluating its operations, processes, and practices, with a crucial focus on how it prepares learners for the future in the context of these pressing environmental challenges (European Commission. Directorate General for Education, Youth, Sport and Culture, 2022, p. 8).

Drawing from the insights of the UNESCO report titled "Reimagining our futures together: A new social contract for Education," which emphasizes the need for a transformed education system to foster peaceful, just, and sustainable futures, service-learning emerges as a potent pedagogy of solidarity and cooperation. It significantly contributes to the realization of transformative education goals (Aramburuzabala & Cerrillo, 2023).

Service-learning is characterized as an experiential pedagogy that empowers students to actively participate in meaningful service activities addressing community needs. Through this engagement, students have the opportunity to reflect upon their experiences, leading to a deeper comprehension of disciplinary content, and fostering a heightened sense of civic engagement (Aramburuzabala Higuera et al., 2019; Aramburuzabala & Cerrillo, 2023; European Association of Service-Learning in Higher Education (EASLHE), 2021). It can include social initiatives, actions in schools, public institutions, non-profit organizations, provision of services for people with disabilities, among others, aiming to consolidate the contributions of educational institutions to social ecosystems, fostering personal development, civic engagement and green learning (Aramburuzabala & Cerrillo, 2023; Bringle & Clayton, 2021; Chan et al., 2021; Goggins & Hajdukiewicz, 2022; Grigorescu, 2020; Škutor, 2022).

This pedagogy aligns with a group of pedagogies valuing experiential learning (Paniagua & Istance, 2018), undertaken in authentic contexts. Consequently, learning experiences and community needs interconnect via services or activities performed by students. Service-learning provides students the opportunity to engage in tangible social commitment and connect this experience to learning and personal and social development objectives via reflection. It cultivates critical, responsible citizens, with learning being an essential part of the experience. Students learn not just about the people they meet but from and with them. The connection between experience and learning requires a critical process of reflection (Awang-Hashim et al., 2022; Moola et al., 2020).

The partnership between teachers, students, and community partners is crucial to implementing service-learning pedagogies (Aramburuzabala Higuera et al., 2019; Paniagua & Istance, 2018; Škutor, 2022). Through service-learning projects, teachers have the opportunity to conduct action research (Rutti et al., 2016), which can facilitate educators' understanding of teaching and learning and bring improvements in current teaching practices (Rutti et al., 2016). Service-learning requires students to take an active and responsible role in their own development and learning through direct interaction with the community (Chambers & Lavery, 2017).

Service-learning provides students with a unique opportunity to bridge the gap between theoretical knowledge and practical application. By engaging in service activities that directly respond to the needs of the community, students can apply their academic learning in real-world contexts, thus enriching their understanding of course content. This experiential approach not only enhances their critical thinking skills but also fosters a deeper sense of fairness and problem framing. Incorporating service-learning into pedagogical approaches in secondary schools supports the development of key competences emphasized in the GreenComp Framework (European Commission. Joint Research Centre, 2022). These competences, such as collective action and fairness, become more tangible as students actively participate in addressing societal challenges. By working collaboratively on community-oriented projects, students learn the value of cooperation, empathy, and community engagement, equipping students with both academic knowledge and practical skills while instilling values that contribute to a more sustainable and socially conscious future. (European Commission. Joint Research Centre, 2022; Grigorescu, 2020; Wall, 2019).

In the context of the action research synthesized in this paper, service-learning was understood as a pedagogy implying interdependence between the learning experiences and the services provided by students to a so-called global community to develop their green competencies, specific skills of the Technological education and practical applications (TEPA) discipline, while also raising public awareness about the sustainable use of materials and objects.

The nature of service-learning activities, focused on tangible actions in real-world contexts, encompasses the inherent complexities of the actual world, irrespective of the typology of service-learning activities. Consequently, four distinct approaches are possible: (i) direct services; (ii) indirect services; (iii) advocacy; and (iv) research.

Considering the specific learning outcomes targeted by the SURE intervention, which involved fostering green skills and discipline-specific competencies within the discipline of Technological education and practical applications, the advocacy type of service-learning was chosen. This approach aims to promote transformative change at both the student and community levels by actively advocating for sustainable practices and solutions. By engaging in advocacy efforts, students can effect meaningful change, making a positive impact on their communities and beyond, while also acquiring essential skills and knowledge associated with green initiatives and technological advancements.

1.3. SURE – A green learning design for sustainability and environmental awareness

Within the realm of science, technology, engineering, and math (STEM) activities, various factors exert an influence on learning outcomes and student achievement. However, it is imperative to recognize that the quality of the lived learning experience holds utmost significance.

This research paper addresses the demand for learning experiences that prioritize student experiential learning and emphasize green learning. It presents a student-centered design and implementation of a transformative, cooperative, service-based approach within the discipline of Technological Education and Practical Applications. The aim was to empower students in grades 5 to 8, enabling them to actively participate in their own learning process while promoting sustainability and environmental consciousness.

The TEPA discipline is specifically tailored for students in the 5th to 8th grades, involving weekly 1-hour lessons. These lessons provide students with an opportunity to explore and develop practical skills related to technology while gaining a deeper understanding of its real-world applications.

The SURE intervention originated from an analysis of the curricular context in relation to the United Nations Sustainable Development Goals (SDGs). It acknowledged the importance of cultivating and developing green and transformative competencies among students. Moreover, the intervention aimed to foster a sense of responsibility towards the sustainable use of limited resources to meet unlimited needs and desires, as suggested by the GreenComp Framework (European Commission, Joint Research Centre, 2022).

In their work, Paniagua and Istance (2018) shed light on the notion that research focusing on the fundamental principles of effective teaching has revealed that the efficacy of instructional practices is not primarily determined by superficial aspects such as specific teaching methods or student organization techniques. Instead, it hinges on the profound level of instruction, namely, the caliber of interactions between educators and learners centered around meaningful and substantial content (Paniagua & Istance, 2018, p. 22; Škutor, 2022).

The SURE approach to green learning presented in this paper has been developed based on The Service Learning Design Framework, as outlined by Manasia and Ianoş (Manasia & Ianoş, 2022) and Culcasi et al. (Culcasi et al., 2023). This framework encompasses three pillars and four clusters of design principles. The Service Learning Design Framework adopts an ecosystem perspective on learning, with the three pillars - places, partnerships, and people - serving as guiding principles for curriculum design, course design, service design, and the overall learning experience. These pillars provide structural directions for the design process, facilitating student engagement and achievement across the four clusters. A cluster refers to a grouping of principles and actions that span across multiple pillars, with the aim of facilitating meaningful and effective design of service learning experiences. The four clusters in the Service Learning Design Framework have been considered, namely, basic principles of service learning (cluster 1); instructional design principles (cluster 2);

engagement and inclusiveness (cluster 3); availability of digital skills and resources (cluster 4).

To enhance student engagement and enrich the overall learning experience (Grigorescu, 2020), a partnership between Ion Iorgulescu secondary school and University Politehnica of Bucharest was established. The partnership aimed to address the diversification of educators and vertical integration, leading to the involvement of in-service teachers, pre-service teachers (Master's students enrolled in a teacher certification program), and researchers in the implementation of the SURE approach. Furthermore, the learning environments were enriched as the classes were conducted both online and in-person (synchronous setting), as well as asynchronously. By implementing service-learning, a combination of pedagogies was made possible, including flipped pedagogies and challenge-based learning. This approach enabled students to have more centrality and control over their learning pace and encouraged them to engage meaningfully in their learning tasks.

1.4. Experiential learning based on real-life scenarios

The SURE approach was implemented with the purpose of infusing sustainability principles into the curriculum of the TEPA discipline. This endeavor involved employing an innovative pedagogical approach known as service-learning within a multi-ethnic school situated in a rural community.

During TEPA classes, students engaged in creating products using materials available in their households that were no longer in use, thereby repurposing them with new utility. To enhance the learning experiences, photovoice was employed as a method to stimulate students' reflection on the learning process and the outcomes achieved. Additionally, it served as a means of dissemination and advocacy. The photographs of the crafted products and their accompanying stories were shared on the project's social media accounts ¹.

The development of specific competencies outlined in the curriculum for TEPA was fostered through engaging students in activities that involved the creation of useful products and creative works using a diverse range of materials, including textiles, wood, metal, plastic, and other recyclable materials (such as egg cartons, plastic containers, PET bottles, etc.). At the end of the school year, an exhibition was held (see Fig. 1 and Fig. 2.)



Fig. 1. Artifacts crafted by students and showcased during the concluding exhibition (I)

¹https://www.instagram.com/super_students2022/



Fig. 2. Artifacts crafted by students and showcased during the concluding exhibition (II)

1.5. The present study

The primary goal of this qualitative study is to explore innovative learning designs that have the potential to enhance green learning outcomes. To achieve this objective, we have developed an action research study that triangulates semi-structured interviews, reflective observations, and the photovoice technique. These methodologies facilitate the tracking and comprehension of secondary school students' attitudes towards green learning in the context of the TEPA discipline (research question 1). Additionally, we seek to investigate the concrete achievements and transformative impacts resulting from the implementation of service-learning pedagogy on student attitudes and green learning strategies within the TEPA discipline (research question 2).

The qualitative approach employed in this research allows for a comprehensive exploration of the participants' perspectives and experiences, aiming to generate valuable insights and a nuanced understanding of the subject matter. By addressing the two interconnected research questions (RQs), we aim to contribute to the advancement of educational practices that promote sustainable and environmentally conscious learning in the context of TEPA.

Specifically, the following research questions were formulated:

RQ1: How do secondary school students perceive and experience learning in the TEPA discipline, with a focus on fostering green learning outcomes through innovative learning designs?

RQ2: What are the tangible achievements and transformative impacts resulting from the implementation of service-learning pedagogy on student attitudes and green learning strategies in the context of the TEPA discipline?

2. Methodology

2.1. Objectives

As previously mentioned, the core objective of this research endeavor is to explore innovative learning designs that can effectively enhance green learning outcomes within the context of TEPA. To fulfill this overarching goal, three specific objectives have been formulated:

To explore innovative learning designs that can enhance green learning outcomes within the context of the TEPA discipline.

To investigate secondary school students' perceptions and experiences of green learning in TEPA, with a particular emphasis on the facilitation of green learning outcomes through innovative learning designs (Research Question 1).

To examine the tangible achievements and transformative impacts arising from the integration of service-learning pedagogy on student attitudes and green learning strategies within the TEPA discipline (Research Question 2).

2.2. Participants

The significance of participant selection in action research has been underscored by Ciolan & Manasia (Ciolan & Manasia, 2017), as well as other scholars like Konrad et al. (Konrad et al., 2021) and Rania et al. (2021), owing to the participatory nature of such studies. In line with this perspective, our study involved a diverse sample of 16 students from the Ion Iorgulescu Secondary School in Argeş County, Romania, all actively engaged throughout the research stages. The selection criteria purposefully encompassed considerations of gender, grade level, and ethnicity.

The participant group exhibited considerable diversity, comprising 12 females and 4 males, representing various grade levels: 3 students from fifth grade, 5 from sixth grade, 6 from seventh grade, and 2 from eighth grade. Notably, the group also showcased ethnic diversity, with 5 participants identifying as Roma.

Aligned with our research objectives, which aim to investigate and enhance the learning strategies of middle school students, we present the academic averages of these students at the conclusion of the 2021-2022 school year:

- 4 students achieved an average grade of 10;
- 5 students obtained average grades ranging from 9.50 to 9.99;
- 5 students demonstrated strong performance with average grades ranging from 9.00 to 9.49;
- 2 students achieved commendable results with average grades between 8.50 and 9.00.

An integral aspect that distinguishes this action research is the active involvement of both in-service (one teacher) and pre-service teachers (3 persons) working with the sampled students across all research stages. In this capacity, the teachers assumed dual roles as researchers and educators, making significant contributions to the research design, instruction, data collection, and analysis processes. This collaborative engagement between teachers and researchers enhances the comprehensiveness and depth of the study, fostering a more profound understanding of the research domain.

2.3. Procedure

The study employed an action research perspective and utilized a triangulation of research methods, including semi-structured dyadic interviews, photovoice, and reflective observations. To guide our research, we adhered to an action research design model, which followed a systematic and stepwise approach, as illustrated in Fig. 3. As described by Dick and colleagues (Dick et al., 2009), action research involves a cyclical research process with a systematic methodology. This approach allowed us to explore the experiences and challenges encountered by the participants, enabling us to gain fresh insights into the phenomenon under study—socially green motivated learning.

The present work is rooted in an action research approach that follows the cycle of diagnosis, action planning, action implementation, evaluation, and reflection, as originally proposed by Susman and Evered (1978). The study extensively delved into the impact of service learning on both the learning process and outcomes, analyzing data collected from middle school students.

Fig. 3 outlines the systematic methodology of the action research process undertaken in this study. The initial diagnosis stage involved conducting semi-structured interviews with students, which will be detailed further in this section.

Insights gathered from these interviews guided the design of the learning environment and the service-learning project. Through continuous reflection and data analysis, the learning activities were customized to facilitate transformative experiences (Fitch et al., 2012).

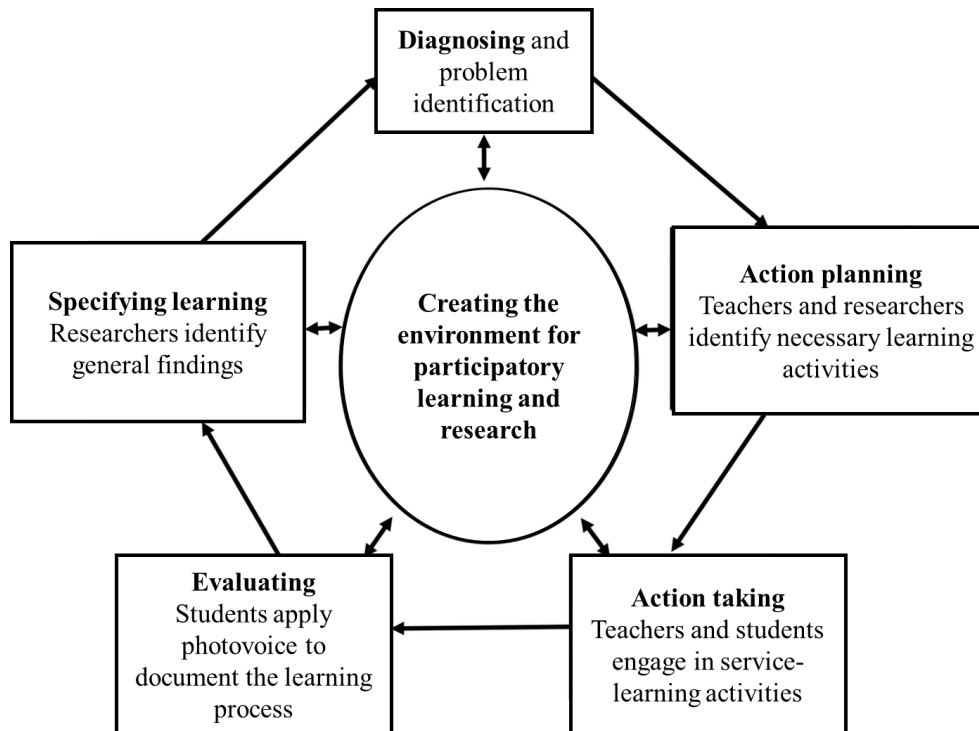


Fig. 3. Exploring the impact of service-learning on the green learning process and outcomes through a systematic action research approach

During the implementation phase of the service-learning project, we employed the photovoice method to gather data, enabling us to conduct a comprehensive investigation of the transformations occurring at the learning level. The details of how photovoice was applied will be explained in the dedicated *Instruments* section.

In addition to photovoice, we encouraged student reflection through evaluative interviews conducted at the end of the academic year. The study took place between September 2021 and June 2022, during which time the participants engaged in exploratory and evaluative interviews, as well as the implementation of the SURE service-learning project.

Participation in the study was entirely voluntary, and students had the freedom to withdraw from the participant group at any point. Prior to their involvement, both institutional and individual informed consent was obtained to ensure ethical considerations were met before commencing the study.

Before taking part, participants completed an informed consent form, which assured them that their photographs would solely be used for research purposes within the scope of this project. No compensation was provided to the participants for their involvement in the research project, as the service-learning activities were integrated into the instructional design of the TEPA subject.

2.4. Instruments

2.4.1. Semi-structured interviews

In our research, we utilized semi-structured interviews as both a diagnostic tool at the beginning of the action research and a reflective assessment at the project's conclusion. In the initial stage, we conducted eight dyadic interviews using the

Exploratory interview guide¹, which encompassed various aspects such as students' daily routines, social interactions, preferred subjects, learning perceptions, strategies, and hypothetical scenarios related to TEPA.

For the reflective purpose, we employed an adapted interview guide called the Conclusive interview guide, which focused on students' daily routines, preferred subjects, and learning experiences specifically within the context of TEPA. This guide also included creative hypothetical scenarios and a projective technique to gather insights into their learning strategies.

All interview data were meticulously recorded and transcribed verbatim. The information obtained from the interviews, along with the data collected through photovoice, contributed to addressing the research questions presented earlier.

2.4.2. Photovoice

As described in the literature, photovoice is a participatory action research method where subjects use cameras to capture images that represent specific aspects of their individual and/or social lives (Ciolan & Manasia, 2017; Harley, 2012; Konrad et al., 2020; Rania et al., 2021). To implement photovoice in our study, we followed a methodological framework proposed by Wang & Burris (1990) and adapted by Ciolan & Manasia (2017) which involved four distinct phases.

Phase 1 began with an introductory meeting with students and teachers, where the researchers explained the photovoice methodology and the basics of the photographic technique. Participants were provided with prompts to guide their image capturing related to their daily learning experiences in TEPA and the SURE service-learning project.

In Phase 2, participants took photos individually, selecting and commenting on two or three images that held personal and collective relevance to their learning experiences.

Phase 3 involved two focus group sessions with students and one focus group with teachers where participants viewed all the captured photographs and collectively chose images deemed most representative of their learning experiences. The moderator emphasized the selection should encapsulate familiar contexts, learning strategies, or factors influencing learning outcomes. Participants then engaged in an analysis of their chosen images.

The fourth and final phase included an exhibition of the photos and artifacts created by the students participating in the study, showcasing their learning experiences and insights.

Notably, both teachers and students participated in capturing images, resulting in 569 photos in the first semester and 344 in the second. All pictures are available on the Open Science Framework platform (Ciolan & Manasia, 2023). The analysis techniques employed for the photos will be further discussed in the *Data analysis* section.

2.4.3. Metacognitive Matrix Method

The concept of scaffolding metacognitive matrix (Manasia, 2018, p. 402) has been explored in the literature with various nuances. Its primary purpose is twofold: first, to collect narrative data on the metacognitive behaviors of the research participants, and second, to scaffold metacognitive reflection.

The metacognitive matrices employ strategic questions to guide teachers throughout the project's design and implementation stages. Four metacognitive matrices, namely the START, PLAN, WORK, and REFLECT sheets, were utilized by the teachers. Specifically, the matrices guided the identification and analysis of

¹Interview guides used in this study are available upon request for the sake of transparency and research reproducibility. Interested individuals can obtain access to the guides by contacting the corresponding author.

community needs (START and PLAN sheets), the organization and implementation of activities (WORK sheet), and the reflective analysis (REFLECT sheet).

The matrices have been made accessible and can be referenced in the scholarly work authored by Manasia and Ianoş (Manasia & Ianoş, 2022).

The narrative data collected through these matrices were then processed and analyzed, as described in the data analysis section.

2.5. Data analysis

The process of analyzing the gathered visual and narrative data closely followed the methodology delineated by Ciolan and Manasia (2017). Upon the completion of data collection, an initial analysis of all photographs and narratives was carried out by the researchers. A comprehensive coding process was applied to all images, titles, and narratives. A dedicated database was designed to hold image codes and their respective attributes, thereby ensuring the integration of photographs into the overall data analysis process.

The research team adopted a blended approach to data collection and analysis by combining the photovoice method with Interpretative Phenomenological Analysis (IPA). Given the intricate nature of the learning phenomenon, IPA was deemed appropriate for examining the attitudes and learning strategies elicited by service-learning initiatives. Preliminary findings guided the construction of a focus group protocol to support participatory analysis, capitalizing on the dynamic interactions and exchange of ideas fostered by focus groups.

The initial focus group phase involved the viewing of all photographs by participants, followed by the selection of images deemed to hold personal and collective relevance—these could depict familiar contexts, learning strategies, or factors influencing learning outcomes.

It was emphasized by the moderator that chosen photographs should encapsulate representative learning experiences. The participants then engaged in an analysis of their chosen images. This process began with a free association task, prompting participants to articulate spontaneous thoughts arising from viewing the images. Further probing was undertaken via the SHOWED questions (Ciolan & Manasia, 2017; C. C. Wang, 1999), fostering a deeper examination of the depicted learning scenarios and potential improvement strategies. This blend of the SHOWED model with construction and completion projective techniques further enriched the analysis.

Transcriptions of interviews underwent IPA, during which relevant quotes from participants were highlighted upon revisiting the transcriptions. To assist with identifying emerging learning strategies, commentary was associated with the identified quotes. Subsequently, quotes and observations sharing conceptual and experiential similarities were grouped together. The culmination of this process resulted in the identification of emergent themes (e.g., working with peer learners, regulation strategies, achievement emotions). These themes were ultimately collated into three clusters: attitudes towards green learning; learning strategies; and service-learning as a pedagogy of innovation.

3. Results

In this paper, we introduce an action research study aimed at exploring the potential of service-learning as an innovative pedagogy to boost green learning for 5th to 8th-grade students in a rural school setting. By triangulating data from photovoice, dyadic interviews, and reflective observations, we identified three core thematic clusters: 1) representations and attitudes toward green learning; 2) learning strategies for green learning; and 3) the perception of service-learning as an innovative pedagogy.

This research builds upon the learning pattern model, which introduces four central components to explain learning behaviors or patterns. These components include:

processing strategies: these represent cognitive tactics employed for specific learning tasks.

regulation strategies: centered around metacognitive capabilities, this involves the planning, monitoring, and assessment of learning.

learning conceptions: these reflect the students' beliefs and perceptions about the essence of learning.

orientations to learning: they encompass students' aspirations, motivations, attitudes, expectations, and potential reservations concerning their academic pursuits (Ciolan & Manasia, 2017; Gijbels, 2013; Manasia, 2017)

Drawing from these foundational components, the learning pattern model further distinguishes between four primary learning patterns: reproduction directed; undirected; meaning directed; application directed (Martínez-Fernández & Vermunt, 2015; Vanthournout et al., 2013; Vermunt & Vermetten, 2004).

The ensuing sections delve deeper into each thematic cluster, complemented by illustrative photos and direct verbatim quotes from interviews, picture narratives, and SHOWED focus groups.

3.1. Student representations and attitudes towards green learning

Upon analyzing the data, two distinct categories of reference emerged concerning student engagement with green learning: (1) an explicit frame of reference, represented by tangible academic metrics like grades and learning outcomes, and (2) an implicit frame of reference, characterized by a dichotomy of engaging and disengaging emotions relevant to the learning process. The model is presented in Fig. 4.

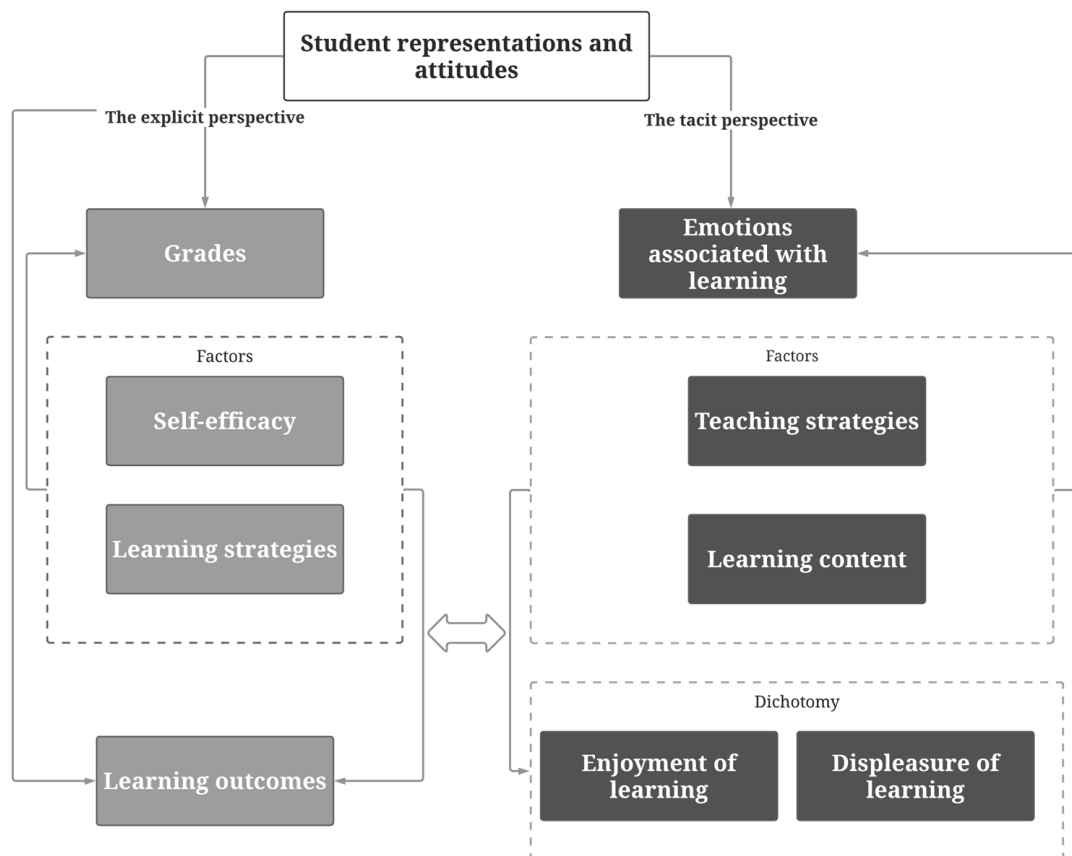


Fig. 4. Student representations and attitudes toward learning

As expected, students associated the concept of green learning with the TEPA discipline, given the explicit nature of contents and learning outcomes. The analyzed representations have revealed that the visible perspective on green learning is frequently expressed by students and involves associations with *grades* and, to a lesser extent, *learning outcomes*. The data illustrates a linkage between grades and

learning outcomes in green learning with the self-efficacy it nurtures and the learning strategies it fosters.

As depicted in Fig. 4, students' perception of self-efficacy models their approach to green learning. Self-efficacy is expressed in less specific terms, such as "I am able to perform a task" or "I am able to understand a subject" in TEPA. More importantly, green learning boosts self-efficacy by engaging students in activities that have a visible impact. Fig. 5 showcases a collection of photographs highlighting the potential impacts students believe the SURE initiative can achieve (i.e., creating artifacts with renewed functionality from objects or fabrics previously deemed redundant).



Fig. 5. 'Little by little we can change the world'

Similarly, of great significance is the interdependence between perceived self-efficacy and the emotions associated with green learning, as evidenced by the statements below:

"I enjoy technological education and doing projects, and they yield my best results. I feel good and I like that we can use or sale the artifacts we make." (A.T., student, 5th grade)

Regarding the tacit perspective, prior studies have demonstrated that the school environment is abundant in emotions (Goetz et al., 2006, 2021; Mesquita et al., 2017). These emotions play a critical and intrinsic role in students' motivation for learning, the actual learning process, academic performance, identity development, and overall well-being, as suggested by Schutz and Pekrun (2007). Our research has shown the presence of engaging emotions associated with green learning: enjoyment of learning, trust, empathy.

I enjoy TESA the most out of all subjects; I excel in it, and I find it particularly gratifying when I receive high grades. There are no subjects that I dislike (C.T., student, 6th grade).

Hence, positive emotions associated with learning appear to be subtly influenced by the grades achieved. The emotional spectrum is not highly nuanced, rather oscillating between engaging and disengaging learning emotions. The disengaging emotions weren't directly tied to the learning process per se, but rather to the service the students were offering:

At the outset, our Instagram account had only a handful of followers. As we began campaigning for our inaugural sales fair, I was somewhat disheartened by the lack of engagement on our page (A.T., 8th grade).

In the dynamics of emotions associated with learning, the role of the teacher is pivotal. The frequency analysis of codes regarding factors that stimulate interest and engaging emotions in learning revealed the centrality of the teacher in designing learning experiences. This aspect was expressed by students through photographs and statements related to factors that boost their engaging emotions, namely the teacher's behavior. Specifically, 'the way the teacher teaches' and the learning experiences they create are what stimulate student engagement. Consequently, we obtain empirical confirmation of what other studies and reports have asserted (Paniagua & Istance,

2018): the pedagogies employed by teachers are key in fostering student engagement and contribute to learning performance (see Fig. 6)



Fig. 6. Personally, I am captivated by the way the teacher teaches. I enjoy doing activities and projects. (C.T., student, 6th grade)

It is essential to underline that not only the learning designs are relevant in the students' opinion, but also the teacher ability to emotionally engage, fostering a secure relationship based on attachment and reciprocity.

*When I think about learning or education, it makes me envision my future self.
During classes, I am attentive, and I feel great when I understand the subject.
When I study, I tell myself that I need to learn to become better because that is
what the teacher always says. (P.V., student, 7th grade)*

An essential aspect to note is that the students' responses did not indicate ambivalent orientations expressed through difficulties associated with learning motivation. Additionally, green learning was reported as an activity that impacts students' self-confidence.

"Since integrating green learning into the TEPA curriculum, I've observed a distinct boost in students' self-assuredness. Their understanding of the concepts has deepened, and there's a palpable sense of pride in their demeanor, driven by the awareness of their positive impact on the environment.

Moreover, their dedication to the service remains steadfast, independent of regular school sessions." (F.D., teacher)

3.2. Learning strategies for green learning

When examining the codes related to the learning strategies used by middle school students during the SURE intervention, we utilized the conceptual model of learning patterns as defined by Gijbels et al. (2013; Shum et al., 2023), Panadero et al. (2021), and Vanthournout et al. (2013). The theoretical model was considered a suitable approach because it provides a comprehensive explanation of various aspects of learning. This model highlights processing and regulation strategies as fundamental elements of learning strategies. Within the overarching theme of learning strategies, four subthemes emerged: 1) learning context; 2) surface processing; 3) deep processing; and 4) learning regulation. These themes and subthemes are illustrated in Fig. 7.

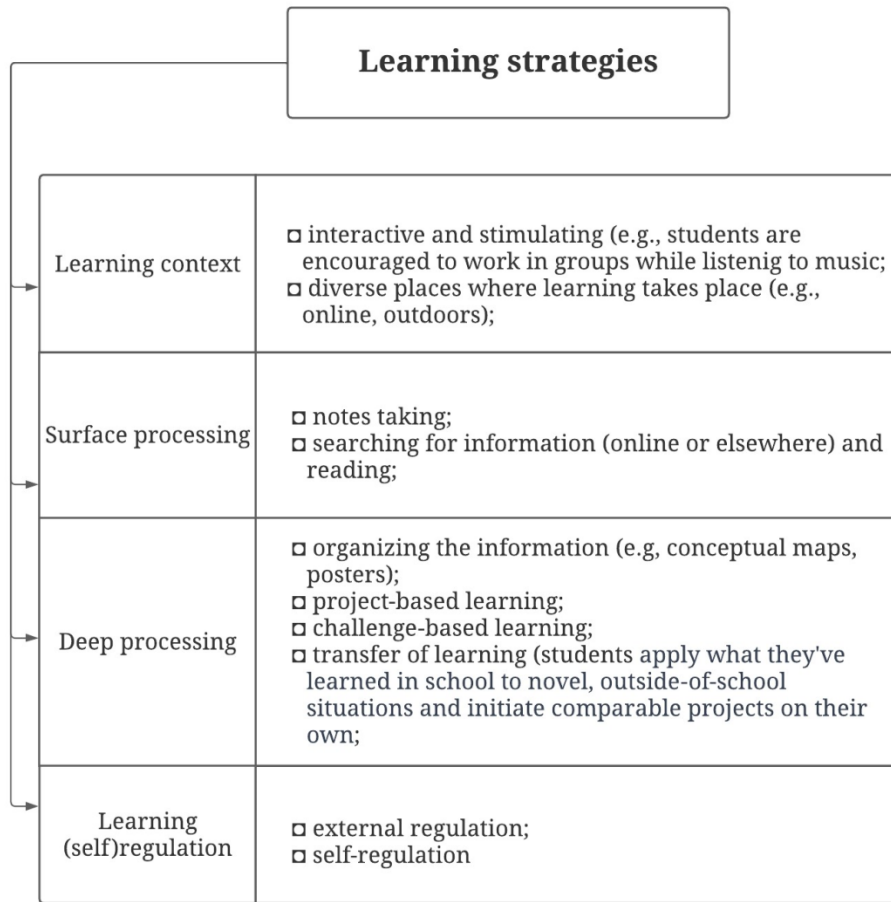


Fig. 7. Learning strategies applied by students in green learning

Both visual and narrative data underscored the pivotal role of learning conditions and context in establishing positive learning patterns. Beyond the cognitive dimension of the learning design, teachers highlighted the importance of the social and emotional dimensions intrinsic to green learning. Consequently, learning occurred within a flexible environment that accommodated group work and facilitated ongoing interactions between peers and educators (see Fig. 8).

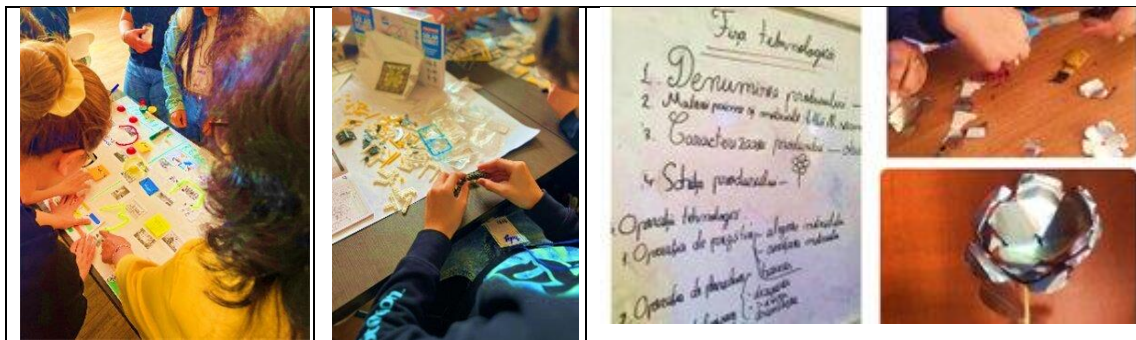


Fig. 8. 'This is how we learn in TEPA'

The students particularly valued the flexible learning environment, finding it not only adaptable to their individual needs but also invigorating and conducive to engagement. The flexibility was translated into music accompanying learning tasks,

the possibility to move freely in the classroom or the fact that learning took place outdoors or online as well.

Music relaxes me and makes me think better, without worries. (P.V., student, 6th grade)

Analysis indicates the presence of both surface and deep processing strategies. Notably, frequency analysis of codes highlighted a dominance of deep processing strategies. As a result, students often documented learning experiences where they utilized tools such as conceptual maps or other visual aids to systematically organize and process information. Additionally, service learning was strategically integrated with other pedagogical approaches (i.e., challenge-based learning, project-based learning) to ensure the attainment of the intended learning outcomes. In their photographs and narratives, students vividly expressed their appreciation for the concept of 'learning as making' (Kamp, 2019). For them, learning transcended mere rote memorization; it was about harnessing knowledge in a tangible way to effect meaningful change.

The SURE intervention not only focused on theoretical green learning but also on its tangible, real-world application, promoting the positive and mindful transfer of classroom knowledge into innovative initiatives. A prime example that encapsulates this positive transfer is the entrepreneurial endeavor of a student participant. Drawing inspiration from her lessons, she utilized household materials like sawdust, socks, buttons, and decorative items to craft unique teddy bears (see

Fig. 9). With the support of her mother and leveraging the power of social media, she managed to market and sell those teddy bears. This initiative not only underscores the student's ability to apply her green learning in a practical setting but also demonstrates the entrepreneurial spirit ignited by the SURE intervention.



Fig. 9. Handcrafted teddy bears: A fusion of sawdust, socks, buttons, and artistry

When it comes to *regulatory strategies*, we noted an external form of regulation driven by technology, which enhances the guidance received from classmates or educators.

I always seek insights from my peers. If I can't find a solution, I consult the teacher the following day, ensuring she sees my efforts." (P.V., 6th grade student)

The implementation of service-learning and the integration of innovative pedagogies amplified internal regulation. As a result, students cultivated robust metacognitive knowledge regarding tasks and strategies. They adeptly selected pertinent information and employed suitable processing strategies with an emphasis on deep comprehension. Consequently, this fostered engaging and positive learning emotions. From the interviews and visual evidence, students conveyed that engaging in learning felt 'effortless' and they had the freedom to seek feedback at any stage of their learning journey. Additionally, the students expressed a sense of security in their learning environment, indicating that they felt comfortable taking risks and understood that making mistakes was a part of the learning process.

3.3. Service-learning as an innovative pedagogy

Following an action-research model, the initial phase of the study encompassed diagnosis and problem identification, wherein dyadic interviews were employed. Subsequently, the second stage of the research-action, action planning, utilized a metacognitive matrix referred to as the PLANNING sheet. The third phase involved the actual implementation of the action, documented through the application of the photovoice method and the use of a metacognitive matrix designated as the WORK sheet. This section depicts the results related to service-learning as an innovative pedagogy. All the codes associated with the cluster of service-learning as an innovative pedagogy were synthesized in the model in Fig. 10.

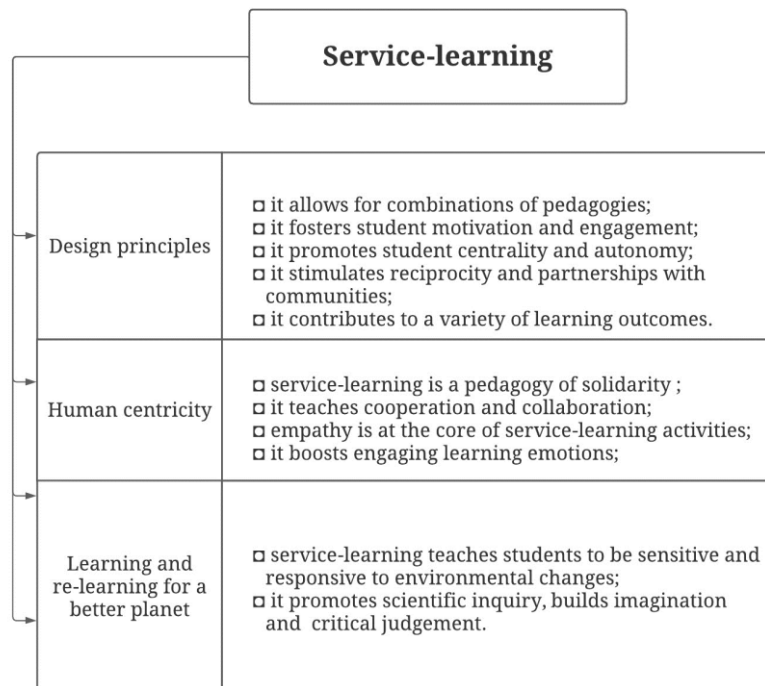


Fig. 10. The value of service-learning pedagogy in promoting green learning

To make green learning more visible within the TEPA discipline, all instructional sessions were rooted in a pedagogical framework that integrated service-learning alongside other experiential approaches, notably challenge-based learning and problem-based learning. The teachers pointed out the flexibility of service-learning activities that were implemented indoors and outdoors. Consequently, collaborative

learning activities were conducted with students, engaging them in the creation of utilitarian products and imaginative works employing textiles, wood, and other recyclable materials (e.g., egg cartons, plastic containers, PET bottles, etc.) – see Fig. 11.



Fig. 11. Building skills, imagination and cooperation through service-learning

Throughout these activities, students honed their abilities in crafting simple yet creative products, guided by provided technological sheets that instructed them to thoughtfully select raw materials, tools, and equipment. Furthermore, the investigative nature of the learning process fostered in students a spirit of exploration, information gathering from diverse sources, and proficiency in various informational mediums, including digital ones.

In addition, the students learned to discern textile materials based on their properties and understand their practical applications. They were guided to repurpose some textile materials from their households, creating other useful products for themselves or their families. Consequently, students not only improved their technical skills but also developed transformative competencies such as creating new value and taking responsibility.

Another notable aspect of service-learning was the opportunity it provided for integrating knowledge and emotions through fostering social and emotional interactions with peers, the community, and beyond. The images and narrative data highlighted empathy-building as a prominent feature of the experience.

A seemingly useless small piece of fabric from her grandmother came to life as a bunny in the hands of a student, who then gifted it to a younger classmate.

Learning occurred much faster and more effortlessly. The type of material, stitching techniques employed, work procedures, and safety norms were easily and joyfully grasped by the students. (C.M., teacher)– see Fig. 12.



Fig. 12. Toys for everyone

I like it when we work together at school because we are all friends; outside of school, I don't meet my classmates. (A.D., student, 5th grade)

Complementing curricular activities, extracurricular engagements were collaboratively designed and conducted with the involvement of a local artisan. Through these activities, the students had the opportunity to learn about their community's stories and experiences, as well as discover its customs and traditions. By engaging with the community in this way, they explored its sustainability, further enhanced by place-based learning facilitated by the presence of the local artisan.



Fig. 13. Artifacts designed in extracurricular activities with a local artisan

The study illustrated that service-learning serves as an innovative pedagogy that empowers students by placing them at the heart of the learning process. Analyzing the teacher's perspective, the integration of service-learning pedagogy has proven to enhance the allure of learning, foster increased interest and active engagement, and lead to higher quality learning outcomes with better retention of newly acquired knowledge.

Additionally, the impact of service-learning extends beyond the traditional classroom setting, bringing about significant changes in the learning process. It encourages students to overcome inhibitions and embrace innovation, while also acknowledging and valuing the development of transformative competencies. The dynamics between teachers and students are enriched, with a constant exchange of feedback, and a focus on connecting ideas for improved knowledge transfer.

Furthermore, the reuse of materials becomes a valuable aspect of contributing, even in small ways, to sustainable development. Services provided in the context of service-learning play a vital role in transforming classroom discussions into practical applications in real-life situations.

If I had the power, I would change the world. [...] I would like to do volunteer work in high school, I'm not sure in which field, but I want to do volunteer work.
(A.T., student, 8th grade)

4. Discussion

The main objective of this action-research study was to create and put into action the SURE intervention. This intervention aimed to boost green learning by leveraging service-learning. To assess the success of the SURE intervention, we adopted a triangulation method, which encompassed dyadic interviews, photovoice, and reflective observations. In line with this, we crafted specific research questions targeting student attitudes and perceptions regarding green learning within the TEPA framework (RQ1). Additionally, we sought to understand the transformative effects of service-learning on green learning strategies (RQ2).

4.1. Deep green learning is enriched by service-learning

In relation to RQ1, our findings delineate two frames of reference: explicit and implicit. The explicit reference, as observed, centers around tangible academic outcomes, with grades and learning outcomes being the prominent focal points. As these are pivotal metrics of academic success, students naturally associate green learning with the TEPA discipline. The connection between grades, learning outcomes, and the self-efficacy it fosters confirms the centrality of self-efficacy in influencing students' attitudes and motivation towards green learning. The implicit

frame brings to light the emotional resonance of the learning experience, showcasing a range of emotions, both engaging and disengaging, as critical components of the learning journey.

Our research highlights the TEPA discipline's capacity to cultivate positive emotions, boost self-efficacy, and yield tangible results in the realm of green learning. While further research is essential, existing evidence does support the link between engaging emotions, self-efficacy, and self-regulation (Villavicencio & Bernardo, 2016; Y. Wang et al., 2023; Zyberaj, 2022). The emotional responses elicited by green learning (e.g., enjoyment, trust, and empathy) are significant influencers of student and teacher engagement and satisfaction (Boffi et al., 2022; Oberauer et al., 2023), peers and teachers having a stimulating role (Caspersz & Olaru, 2015; Marcus et al., 2021). The relationship between grades and emotions emphasizes that emotional satisfaction from academic success can serve as a motivation booster.

Similarly with other findings (Macías Gomez-Estern et al., 2021; Mak et al., 2017), students experienced authentic learning that stimulated self-efficacy, with students feeling empowered by the results they achieved. According to Mak et al. (2017), experiential learning was employed to counter the abstract nature of classroom instruction and promote enduring learning experiences where the learner's identity is affected and transformed (Macías Gomez-Estern et al., 2021).

4.2. Transformative impacts of service-learning

Service-learning pedagogy has exerted a transformative impact on students' attitudes and strategies towards green learning, as addressed by RQ2. An examination of the learning strategies used during the SURE intervention illuminated the importance of both surface and deep processing strategies. The dominance of deep processing strategies in our findings is particularly promising, indicating students' drive to not only memorize but also comprehend, integrate, and apply their knowledge. The tangible achievements, exemplified through initiatives like the handcrafted teddy bears, reflect the students' capacity to transition classroom knowledge into actionable, real-world solutions, ensuring the transition from 'making to learning' (Chounta et al., 2017). Thus, the maker culture transcends the mere creation of products, emphasizing the collaborative process of crafting an artifact within a community setting (Chounta et al., 2017; Kukulska-Hulme et al., 2023).

Another pivotal finding is the amplification of internal regulation in students, indicating a heightened awareness and proactive management of their learning processes. This proactive and self-directed approach, coupled with the freedom to seek feedback and the comfort to embrace failures as learning opportunities, augments the learning experience (Bouffard et al., 2005; Goetz et al., 2021).

The role of the teacher (Marcus et al., 2021) emerges as a central theme in our findings. Beyond the provision of content knowledge, a teacher's ability to design engaging learning experiences and foster a secure emotional connection is vital in student engagement (Kukulska-Hulme et al., 2023; UNESCO, 2021). Teachers, as our data suggest, serve not just as transmitters of knowledge but as emotional anchors that guide, motivate, and inspire students. This aligns with UNESCO's perspective on the futures of education, which emphasizes that 'pedagogy is relational' (UNESCO, 2021, p. 51). The visual and narrative data provided an insightful perspective of the human-centric nature of service-learning within the context of the TEPA discipline. The study, conducted following an action-research model, explored the implementation and outcomes of service-learning activities with a strong emphasis on engaging students with their community and fostering transformative competencies (OECD, 2019).

Through the three distinct phases of the research-action model, the students not only learned about their community's stories, customs, and traditions but also actively contributed to its sustainability through place-based learning experiences facilitated by a local artisan. The incorporation of service-learning into the curriculum, alongside other experiential approaches, allowed for a flexible and inclusive learning

environment that extended beyond the classroom walls (Macías Gomez-Estern et al., 2021; Marcus et al., 2021; Martín-García et al., 2020).

The students' involvement in crafting creative products using textiles and recyclable materials not only honed their technical skills but also nurtured transformative competencies, such as creating new value and taking responsibility (OECD, 2019). Additionally, the integration of emotions and empathy-building, as highlighted by the narrative data, further emphasized the human-centric nature of service-learning, encouraging social and emotional interactions with peers and the broader community (Bingle & Clayton, 2021; Chan et al., 2021; Wall, 2019).

Overall, the study illustrated that service-learning serves as an innovative pedagogy that empowers students by placing them at the heart of the learning process. Through collaboration with a local artisan and active engagement with their community, students developed a deeper understanding of their surroundings while acquiring valuable skills and competencies. These findings underscore the significance of service-learning as a human-centered educational approach that fosters meaningful connections, empathy, and transformative learning experiences (Paniagua & Istance, 2018).

In our research, we have provided substantial evidence highlighting the transformative attributes of integrating green learning within the TEPA curriculum framework. An in-depth analysis of student perceptions, affective reactions, tangible achievements, and applied strategies offers a rich and multifaceted view of the prevailing educational paradigm. The data distinctly illuminates the interconnected dynamics between measurable academic accomplishments, intrinsic self-efficacy, the range of emotions, and the critical role educators play in this nexus. As we navigate the evolving terrains of educational methodologies, assimilating these insights becomes vital. Doing so can craft a blueprint for advancing more nuanced, immersive, and transformative academic terrains.

For future research endeavors, it would be constructive to delve deeper into discerning patterns of emotions specific to green learning. This can shed light on how these emotions fluctuate, evolve, and influence learning trajectories. Additionally, examining the emotions educators experience in relation to green learning could provide a dual perspective on the emotional dimensions of this educational approach. Finally, a critical examination of curricular transformation, particularly through the lens of pedagogies of cooperation and solidarity, might offer a pathway to a more holistic, inclusive, and collaborative learning environment.

Acknowledgements

We would like to express our gratitude to Ion Iorgulescu Secondary School in Argeş County for graciously hosting our research study and for their valuable support and cooperation throughout the project. A special acknowledgment goes to Ms. Florenţa Dogaru for her significant contribution to the data collection process, which greatly enriched the research findings. We sincerely thank all participants for their active involvement and invaluable insights, which have played a crucial role in enhancing our understanding of the research area.

Author Contributions

All authors had equal contributions to the elaboration of the manuscript. All authors have read and agreed to the published version of the manuscript.

Data availability statement

The pictures collected are openly accessible. They can be found on the Open Science Framework at the following link: <https://osf.io/wju6d/>

Interview guides used in this study are available upon request for the sake of transparency and research reproducibility. Interested individuals can obtain access to the guides by contacting the corresponding author.

References

1. Aramburuzabala H., P., McIlrath, L., & Opazo, H. (Eds.). (2019). *Embedding service learning in European higher education: Developing a culture of civic engagement*. Routledge.
2. Aramburuzabala, P., & Cerrillo, R. (2023). Service-Learning as an Approach to Educating for Sustainable Development. *Sustainability*, 15(14), 11231. <https://doi.org/10.3390/su151411231>
3. Ardoin, N. M., Bowers, A. W., & Gaillard, E. (2020). Environmental education outcomes for conservation: A systematic review. *Biological Conservation*, 241, 108224. <https://doi.org/10.1016/j.biocon.2019.108224>
4. Awang-Hashim, R., Kaur, A., Yusof, N., Shanmugam, S. K. A. S., Manaf, N. A. A., Zubairi, A. M., Voon, A. Y. S., & Malek, M. A. (2022). Reflective and integrative learning and the role of instructors and institutions—Evidence from Malaysia. *Higher Education*, 83(3), 635–654. <https://doi.org/10.1007/s10734-021-00689-5>
5. Boffi, M., Rainisio, N., & Inghilleri, P. (2022). The Psychological Impact of Global Education Approach to SDGs. A Study on Emotions and Sustainability Attitudes of European Teachers. *Frontiers in Psychology*, 13, 926284. <https://doi.org/10.3389/fpsyg.2022.926284>
6. Bouffard, T., Bouchard, M., Goulet, G., Denoncourt, I., & Couture, N. (2005). Influence of achievement goals and self-efficacy on students' self-regulation and performance. *International Journal of Psychology*, 40(6), Article 6. <https://doi.org/10.1080/00207590444000302>
7. Bringle, R. G., & Clayton, P. H. (2021). Civic Learning: A Sine Qua Non of Service Learning. *Frontiers in Education*, 6, 606443. <https://doi.org/10.3389/educ.2021.606443>
8. Caspersz, D., & Olaru, D. (2015). The value of service-learning: The student perspective. *Studies in Higher Education*, 1–16. <https://doi.org/10.1080/03075079.2015.1070818>
9. Chambers, D., & Lavery, S. (2017). Introduction to Service-Learning and Inclusive Education. In S. Lavery, D. Chambers, & G. Cain (Eds.), *International Perspectives on Inclusive Education* (Vol. 12, pp. 3–19). Emerald Publishing Limited. <https://doi.org/10.1108/S1479-363620170000012001>
10. Chan, S. C. F., Ngai, G., Lam, C. H. Y., & Kwan, K.-P. (2021). How Participation Affects University Students' Perspectives Toward Mandatory Service-Learning. *Journal of Experiential Education*, 44(2), 137–151. <https://doi.org/10.1177/1053825920948889>
11. Chapman, G., Down, L., Griffith, A. D., & Wittshire, W. (2008). *Teachers' guide for education for sustainable development in the Caribbean*. UNESCO Regional Bureau of Education for Latin America and the Caribbean.
12. Chounta, I.-A., Manske, S., & Hoppe, H. U. (2017). “From Making to Learning”: Introducing Dev Camps as an educational paradigm for Re-inventing Problem-based Learning. *International Journal of Educational Technology in Higher Education*, 14(1), 21. <https://doi.org/10.1186/s41239-017-0061-2>
13. Ciolan, L., & Manasia, L. (2017). Reframing Photovoice to Boost Its Potential for Learning Research. *International Journal of Qualitative Methods*, 16(1), 160940691770290. <https://doi.org/10.1177/1609406917702909>
14. Ciolan, L., & Manasia, L. (2023). *Capturing Innovation in Learning and Teaching in Higher Education—CAPTIVATE*. OSF. <https://doi.org/10.17605/OSF.IO/WJU6D>
15. Culcasi, I., Cinque, M., Manasia, L., & Ianos, M. G. (2023). e-Service-Learning for more digital and inclusive EU Higher Education systems: A new e-SL Design Framework. *RIDAS, Revista Iberoamericana de Aprendizaje-Servicio*, 16(2), 159–182. <https://doi.org/10.1344/RIDAS2023.16.10>
16. Dick, B., Stringer, E., & Huxham, C. (2009). Theory in action research. *Action Research*, 7(1), 5–12. <https://doi.org/10.1177/1476750308099594>
17. Droubi, S., Galamba, A., Fernandes, F. L., De Mendonça, A. A., & Heffron, R. J. (2023). Transforming education for the just transition. *Energy Research & Social Science*, 100, 103090. <https://doi.org/10.1016/j.erss.2023.103090>
18. Elliott, S., Arlemalm-Hagsér, E., & Davis, J. M. (Eds.). (2020). *Researching early childhood education for sustainability: Challenging assumptions and orthodoxies*. Routledge.

19. European Association of Service-Learning in Higher Education (EASLHE). (2021). *Policy Brief. A European Framework for the Institutionalization of Service-Learning in Higher Education*. https://www.eoslhe.eu/wp-content/uploads/2022/03/EASHLE-Policy-brief_SL-in-European-Higher-Education_web.pdf
20. European Commission. Directorate General for Education, Youth, Sport and Culture. (2022). *Learning for the green transition and sustainable development: Staff working document accompanying the proposal for a Council recommendation on learning for environmental sustainability*. Publications Office. <https://data.europa.eu/doi/10.2766/02392>
21. European Commission. Joint Research Centre. (2022). *GreenComp, the European sustainability competence framework*. Publications Office. <https://data.europa.eu/doi/10.2760/13286>
22. Fitch, D., Kaiser, M., & Parker-Barua, L. (2012). Student, Curricular and Public Agency Needs: A Focus on Competency Achievement. *Systemic Practice and Action Research*, 25(5), 417–439. <https://doi.org/10.1007/s11213-012-9232-1>
23. Gijbels, D. (Ed.). (2013). *Learning patterns in higher education: Dimensions and research perspectives*. Routledge, Taylor & Francis Group.
24. Gijbels, D., Donche, V., Richardson, J. T. E., & Vermunt, J. D. (Eds.). (2013). *Learning Patterns in Higher Education* (0 ed.). Routledge. <https://doi.org/10.4324/9781315885438>
25. Goetz, T., Bieleke, M., Gogol, K., van Tartwijk, J., Mainhard, T., Lipnevich, A. A., & Pekrun, R. (2021). Getting along and feeling good: Reciprocal associations between student-teacher relationship quality and students' emotions. *Learning and Instruction*, 71, 101349. <https://doi.org/10.1016/j.learninstruc.2020.101349>
26. Goggins, J., & Hajdukiewicz, M. (2022). The Role of Community-Engaged Learning in Engineering Education for Sustainable Development. *Sustainability*, 14(13), 8208. <https://doi.org/10.3390/su14138208>
27. Green, M., & Rayner, M. (2022). School ground pedagogies for enriching children's outdoor learning. *Education 3-13*, 50(2), 238–251. <https://doi.org/10.1080/03004279.2020.1846578>
28. Grigorescu, D. (2020). Curiosity, intrinsic motivation and the pleasure of knowledge. *Journal of Educational Sciences & Psychology*, 10(1), 16–23.
29. Harley, A. (2012). Picturing Reality: Power, Ethics, and Politics in Using Photovoice. *International Journal of Qualitative Methods*, 11(4), 320–339. <https://doi.org/10.1177/160940691201100402>
30. Hart-Anderson, L., & Holme, R. (2022). Developing an understanding of coherent approaches between primary and secondary teachers: A case study within the design and technology curriculum in Scotland. *International Journal of Technology and Design Education*. <https://doi.org/10.1007/s10798-022-09795-6>
31. Jensen, V., Benvot, A., & McKenzie, M. (2021). *Learn for our planet: A global review of how environmental issues are integrated in education*. UNESCO.
32. Kamp, A. (2019). *Science and Technology Education for 21st Century Europe*. <https://doi.org/10.5281/ZENODO.3582544>
33. Konrad, T., Wiek, A., & Barth, M. (2020). Embracing conflicts for interpersonal competence development in project-based sustainability courses. *International Journal of Sustainability in Higher Education*, 21(1), 76–96. <https://doi.org/10.1108/IJSHE-06-2019-0190>
34. Konrad, T., Wiek, A., & Barth, M. (2021). Learning processes for interpersonal competence development in project-based sustainability courses – insights from a comparative international study. *International Journal of Sustainability in Higher Education*, 22(3), 535–560. <https://doi.org/10.1108/IJSHE-07-2020-0231>
35. Kukulska-Hulme, A., Bossu, C., Charitonos, K., Coughlan, T., Deacon, A., Deane, N., Ferguson, R., Herodotou, C., & Huang, C.-W. (2023). *Innovating Pedagogy 2023: Open University Innovation. Report 11*. The Open University. https://prismic-io.s3.amazonaws.com/ou-iet/4acfab6d-4e5c-4bbd-9bda-4f15242652f2_Innovating+Pedagogy+2023.pdf
36. Macías Gomez-Estern, B., Arias-Sánchez, S., Marco Macarro, M. J., Cabillas Romero, M. R., & Martínez Lozano, V. (2021). Does service learning make a difference? Comparing students' valuations in service learning and non-service learning teaching of psychology. *Studies in Higher Education*, 46(7), 1395–1405. <https://doi.org/10.1080/03075079.2019.1675622>
37. Mak, B., Lau, C., & Wong, A. (2017). Effects of experiential learning on students: An ecotourism service-learning course. *Journal of Teaching in Travel & Tourism*, 1–16. <https://doi.org/10.1080/15313220.2017.1285265>

38. Manasia, L. (2017). *From Community to Individual. Re-Thinking Photovoice Methodology for Education Research*. 450–459. <https://doi.org/10.15405/epsbs.2017.05.02.55>
39. Manasia, L. (2018). Dezvoltare personală și psihologia diferențelor individuale în educație. In *Psihologia educației: Fundamente, procese, mecanisme, aplicații. [Handbook of Educational Psychology. Fundamentals, Processes, Mechanisms, and Applications]*. Polirom.
40. Manasia, L., Ianos, M. G., & Chicioreanu, T. D. (2019). Pre-Service Teacher Preparedness for Fostering Education for Sustainable Development: An Empirical Analysis of Central Dimensions of Teaching Readiness. *Sustainability*, 12(1), Article 1. <https://doi.org/10.3390/su12010166>
41. Manasia, L., & Ianoş, M.-G. (2022). *Pedagogia co-creării. Idei de activitati de invatare si instrumente pentru formarea profesorilor (I)*. Editura Universitara. <https://doi.org/10.5682/9786062814748>
42. Marcus, V. B., Atan, N. A., Md Salleh, S., Mohd Tahir, L., & Mohd Yusof, S. (2021). Exploring Student Emotional Engagement in Extreme E-service Learning. *International Journal of Emerging Technologies in Learning (iJET)*, 16(23), 43–55. <https://doi.org/10.3991/ijet.v16i23.27427>
43. Martínez-Fernández, J. R., & Vermunt, J. D. (2015). A cross-cultural analysis of the patterns of learning and academic performance of Spanish and Latin-American undergraduates. *Studies in Higher Education*, 40(2), Article 2. <https://doi.org/10.1080/03075079.2013.823934>
44. Martín-García, X., Bär-Kwast, B., Gijón-Casares, M., Puig-Rovira, J. M., & Rubio-Serrano, L. (2020). El mapa de los valores del Aprendizaje-Servicio. *Alteridad*, 16(1), 12–22. <https://doi.org/10.17163/alt.v16n1.2021.01>
45. Moola, F. J., Moothathamby, N., McAdam, L., Solomon, M., Varadi, R., Tullis, D. E., & Reisman, J. (2020). Telling My Tale: Reflections on the Process of Visual Storytelling for Children and Youth Living With Cystic Fibrosis and Muscular Dystrophy in Canada. *International Journal of Qualitative Methods*, 19, 160940691989891. <https://doi.org/10.1177/1609406919898917>
46. Oberauer, K., Schickl, M., Zint, M., Liebhaber, N., Deisenrieder, V., Kubisch, S., Parth, S., Frick, M., Stötter, H., & Keller, L. (2023). The impact of teenagers' emotions on their complexity thinking competence related to climate change and its consequences on their future: Looking at complex interconnections and implications in climate change education. *Sustainability Science*, 18(2), 907–931. <https://doi.org/10.1007/s11625-022-01222-y>
47. OECD. (2019). *OECD Future of Education and Skills 2030. Learning Compass 2030*. https://www.oecd.org/education/2030-project/teaching-and-learning/learning/learning-compass-2030/OECD_Learning_Compass_2030_Concept_Note_Series.pdf
48. Panadero, E., Alonso-Tapia, J., García-Pérez, D., Fraile, J., Sánchez Galán, J. M., & Pardo, R. (2021). Deep learning self-regulation strategies: Validation of a situational model and its questionnaire. *Revista de Psicodidáctica (English Ed.)*, 26(1), 10–19. <https://doi.org/10.1016/j.psicoe.2020.11.003>
49. Paniagua, A., & Istance, D. (2018). *Teachers as Designers of Learning Environments: The Importance of Innovative Pedagogies*. OECD. <https://doi.org/10.1787/9789264085374-en>
50. Rania, N., Coppola, I., & Pinna, L. (2021). Adapting Qualitative Methods during the COVID-19 Era: Factors to Consider for Successful Use of Online Photovoice. *The Qualitative Report*. <https://doi.org/10.46743/2160-3715/2021.4863>
51. Rutti, R. M., LaBonte, J., Helms, M. M., Hervani, A. A., & Sarkarat, S. (2016). The service learning projects: Stakeholder benefits and potential class topics. *Education + Training*, 58(4), 422–438. <https://doi.org/10.1108/ET-06-2015-0050>
52. Shum, A., Fryer, L. K., Vermunt, J. D., Ajisuksmo, C., Cano, F., Donche, V., Law, D. C. S., Martínez-Fernández, J. R., Van Petegem, P., & Yu, J. (2023). Variable- and Person-centred meta-re-analyses of university students' learning strategies from a cross-cultural perspective. *Higher Education*. <https://doi.org/10.1007/s10734-023-01062-4>
53. Škutor, M. (2022). Attitudes of high school students towards peers and teachers-connection between the school climate. *Journal of Educational Sciences & Psychology*, 12 (74)(1), 82–94. <https://doi.org/10.51865/JESP.2022.1.09>
54. Susman, G. I., & Evered, R. D. (1978). An Assessment of the Scientific Merits of Action Research. *Administrative Science Quarterly*, 23(4), 582. <https://doi.org/10.2307/2392581>
55. UNESCO. (2021). *Reimagining our futures together: A new social contract for education*. Educational and Cultural Organization of the United Nations.
56. Vanthournout, G., Coertjens, L., Gijbels, D., Donche, V., & Van Petegem, P. (2013). Assessing students' development in learning approaches according to initial learning profiles:

- A person-oriented perspective. *Studies in Educational Evaluation*, 39(1), Article 1. <https://doi.org/10.1016/j.stueduc.2012.08.002>
57. Vermunt, J. D., & Vermetten, Y. J. (2004). Patterns in Student Learning: Relationships Between Learning Strategies, Conceptions of Learning, and Learning Orientations. *Educational Psychology Review*, 16(4), Article 4. <https://doi.org/10.1007/s10648-004-0005-y>
 58. Villavicencio, F. T., & Bernardo, A. B. I. (2016). Beyond Math Anxiety: Positive Emotions Predict Mathematics Achievement, Self-Regulation, and Self-Efficacy. *The Asia-Pacific Education Researcher*, 25(3), 415–422. <https://doi.org/10.1007/s40299-015-0251-4>
 59. Wall, T. (2019). Service-Learning and Sustainability Education. In W. Leal Filho (Ed.), *Encyclopedia of Sustainability in Higher Education* (pp. 1–8). Springer International Publishing. https://doi.org/10.1007/978-3-319-63951-2_227-1
 60. Wang, C. C. (1999). Photovoice: A Participatory Action Research Strategy Applied to Women's Health. *Journal of Women's Health*, 8(2), 185–192. <https://doi.org/10.1089/jwh.1999.8.185>
 61. Wang, Y., Wang, Y., Pan, Z., & Ortega-Martín, J. L. (2023). The Predicting Role of EFL Students' Achievement Emotions and Technological Self-efficacy in Their Technology Acceptance. *The Asia-Pacific Education Researcher*. <https://doi.org/10.1007/s40299-023-00750-0>
 62. Zhang, M., Day, E. L., McFall-Boegeman, H., Petritis, S. J., & Cooper, M. M. (2023). Incorporation of green chemistry into undergraduate organic laboratory using cooperative project-based experiments and case studies. *Green Chemistry Letters and Reviews*, 16(1), 2183781. <https://doi.org/10.1080/17518253.2023.2183781>
 63. Zyberaj, J. (2022). Investigating the relationship between emotion regulation strategies and self-efficacy beliefs among adolescents: Implications for academic achievement. *Psychology in the Schools*, 59(8), 1556–1569. <https://doi.org/10.1002/pits.22701>