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Echoes in memory: the lasting imprint of adult experiences from environmental education in fifth grade

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The study examines what adults remember from their participation in the program in fifth grade and explores the extent to which these memories and experiences are associated with their environmental values and attitudes in adulthood. A qualitative approach was employed using autobiographical narratives gathered through semi-structured interviews. Participants, aged 30 and above, were recruited via snowball sampling, and thematic analysis identified key patterns in their recollections. Five main themes emerged: experiential learning fosters long-term memories, collaboration enhances engagement, bridging theory and practice strengthens learning, the program cultivated self-efficacy, and environmental values persisted into adulthood. The study highlights the lasting effects of experiential environmental education. Although several participants reported a sustained emotional connection and heightened ecological awareness, few offered concrete examples of long-term pro-environmental behaviors in their adult lives. Findings point to the importance of long-term reinforcement in supporting pro-environmental behaviors, suggesting that structured follow-ups and continued engagement may help strengthen the long-term impact of such programs, although further research is needed to clarify this relationship.

KEYWORDS

environmental education, experiential learning, autobiographical memories, pro-environmental behavior, long-term educational impact, Lesser Kestrel conservation

Introduction

Environmental education plays a crucial role in shaping individuals' attitudes, knowledge, and behaviors toward the natural world (Pirchio et al., 2021; Sikhosana, 2025; Wals and Benavot, 2017). The long-term impact of such educational experiences often remains insufficiently unexplored (Dewille et al., 2021; Huoponen, 2024; Miller et al., 2021; Pirchio et al., 2021; Robina-Ramírez et al., 2020). This leaved a gap in understanding of how early environmental education influences adult perspectives and actions (Dewille et al., 2021; Dunkley and Smith, 2019). Follow-up assessments with adults who participated in environmental education programs during elementary school can provide valuable insights (Huoponen, 2024). These assessments reveal the enduring impact of environmental education on behavioral patterns beyond the school environment. This study aims to bridge this gap by examining the lasting memories and perceived impacts of the Lesser Kestrel program. It focuses on participants' experiences 19 years and more after their involvement, an area less explored in the literature (Dewille et al., 2021; Dunkley and Smith, 2019; Pirchio et al., 2021).

The Lesser Kestrel program, established in 1996 at “Falcon” School in Israel, engages fifth-grade students in a comprehensive, year-long curriculum focused on conservation efforts for the endangered Lesser Kestrel. This program exemplifies a holistic approach to environmental education, addressing not only cognitive aspects but also emotional and behavioral dimensions. Through a variety of interactive and experiential learning activities, including scientific research, role-playing, peer teaching, and hands-on conservation work, the program seeks to foster a deep connection between students and their local environment. This approach aligns with the concept of “head, hands, and heart” in environmental education, where students engage intellectually (head), practically (hands), and emotionally (heart) with environmental issues (Sipos et al., 2008).

This research emphasizes the importance of studying personal memories to understand learning and teaching processes (Grund et al., 2024). Unique insights into the aspects of the program that have remained salient over time, and into the ways in which participants’ environmental attitudes and behaviors in adulthood have been influenced by these experiences, are gained by focusing on participants’ autobiographical narratives (Gamze, 2018). This approach addresses the imbalance in environmental education literature between cognitive aspects and emotional and behavioral dimensions (Lovren and Jablanovic, 2023). By examining long-term memories and their associated emotions, this study provides a more holistic view of how early educational experiences shape not only knowledge, but also emotional connections and long-term behavioral changes related to environmental issues.

The personal educational experiences of adults are illuminated in this study through the analysis of their autobiographical memories. Specifically, this study aims to answer the following research question: What do adults remember from their participation in the Lesser Kestrel environmental program taught in fifth grade?

By addressing these questions, this study not only fills a crucial gap in the literature on long-term impacts of environmental education but also provides valuable insights for educators and policymakers in designing and implementing effective environmental education programs. These insights are especially valuable for policymakers, as they highlight the long-term benefits of investing in interactive, community-based environmental education programs. Understanding the enduring impact of such initiatives can inform decisions regarding the allocation of resources, the development of effective curricula, and the support for programs that foster environmental stewardship and civic engagement across generations.

Theoretical framework—the pedagogy of environmental education

The pedagogy of environmental education is characterized by a holistic and multidisciplinary approach, integrating experiential, active, and place-based learning (Araneo, 2024; Doulami, 2025; Ostrem and Hvenegaard, 2025; van de Wetering et al., 2022; Wals and Benavot, 2017). Its primary objective is to develop environmental awareness, ecological knowledge, problem-solving

skills among learners, and pro-environmental behavior (Doulami, 2025; Sikhosana, 2025; van de Wetering et al., 2022). This approach emphasizes the importance of connecting learners to their local environment and encourages active exploration of community environmental issues. Research indicates that place-based learning enhances student engagement and fosters a sense of environmental responsibility (Ardoin and Bowers, 2020; Ostrem and Hvenegaard, 2025; Sobel, 2004). The program’s hands-on, experiential learning model aligns with Csikszentmihalyi’s flow theory because it enables students to achieve deep immersion in both classroom and field activities that lead to meaningful and effective long-term learning (Ghaderi et al., 2024; O’Neill, 1999; Parr et al., 1998; Shernoff et al., 2003; Su et al., 2024; Whalen and Csikszentmihalyi, 1991). Moreover, flow experiences resulting from diverse pedagogical approaches explain how participants remember empowering experiences and their long-term effects on self-efficacy, motivation, and personal resilience (Ghaderi et al., 2024; Parr et al., 1998; Shernoff et al., 2003). Additionally, holistic pedagogy encourages emotional and practical engagement by fostering creative problem-solving grounded in learner autonomy, active participation, and the application of knowledge to real-world contexts. These same features, hands-on involvement, well-defined goals, and collaborative inquiry, also facilitate the emergence of flow within the learning process (Su et al., 2024; Tan and Nurul-Asna, 2023; Whalen and Csikszentmihalyi, 1991).

Experiential learning is another crucial component of environmental education, allowing learners to engage directly with the natural environment and develop practical skills. This approach includes activities such as nature excursions, environmental monitoring, and conservation projects. Studies show that experiential learning leads to improved understanding of ecological concepts and the development of pro-environmental attitudes (Giesen, 2011; Kolb, 1984; Stevenson et al., 2017). This approach relates to Bandura’s self-efficacy theory (Bandura, 1994; Bandura and Cherry, 2020), as successful experiences in environmental activities strengthen students’ belief in their ability to impact their environment. Critical thinking and problem-solving are additional key elements in environmental education pedagogy. Students are encouraged to analyze complex environmental issues, examine different perspectives, and develop creative solutions. This approach aids in developing higher-order thinking skills and prepares learners to address future environmental challenges (Tilbury, 2011; Wals and Benavot, 2017). This approach aligns with Vygotsky’s social learning theory (Vygotsky, 1978), which emphasizes the importance of social interaction in the learning process and cognitive development.

Environmental education also addresses broader spheres of influence beyond the students themselves. Teachers serve as key agents of change in this process, with their training and professional development in environmental education directly impacting the quality and effectiveness of instruction (Jadoon et al., 2022; Sikhosana, 2025). Parents, in turn, are influenced by the knowledge and values their children acquire, and are often involved in family or community environmental projects (Dillon et al., 2006; Monroe et al., 2019). This approach corresponds with the transfer of learning model, demonstrating how environmental knowledge and skills are transferred from the classroom to family and community

contexts. The broader community also plays a significant role in the spheres of influence of environmental education. School environmental projects often involve collaborations with local organizations, businesses, and municipal authorities, extending the impact beyond school walls. This leads to changes in environmental behavior at the community level and sometimes even at the municipal level (Chawla and Cushing, 2007; Krasny and Tidball, 2009). This approach aligns with Bronfenbrenner's ecological model (Bronfenbrenner, 1979; Darling, 2007; Snyder and Duchscher, 2022), which emphasizes the importance of interactions between the individual and their broader environment over time.

Methodology

Research approach

This study employs a qualitative approach based on autobiographical narratives (Barbosa and Marín-Suelves, 2024; Karabenick et al., 1999; Roberts, 2024). Autobiographical narratives, personal, reflective accounts of individuals' professional, personal, and pedagogical experiences, offer unique, detailed insights into participants' lived realities and the complexity of their development. Autobiographical narratives have been used in various research fields such as: teacher education and training, educational psychology, sociology of education, and qualitative research in education (Barbosa and Marín-Suelves, 2024; Brooks et al., 2024; Vanello, 2024). This approach is well-suited for researching memories of the Lesser Kestrel program, as it facilitates an in-depth exploration of participants' personal experiences and the long-term significance of the program in their lives. It provides a framework for examining how the program shaped their perceptions, values, and life choices over time (Barbosa and Marín-Suelves, 2024; Brooks et al., 2024; Vanello, 2024).

Research context

The Lesser Kestrel program, established in 1996, remains active to this day. Designed to support the Conservation Action Plan for the Lesser Kestrel, an endangered species, the program engages fifth graders at "Falcon" School in Israel. The program was conceived to foster ecological literacy by engaging fifth graders in hands-on study of Lesser Kestrel biology and habitat requirements, and to cultivate stewardship and personal agency through the design and construction of nest boxes and the subsequent monitoring of the kestrels' life cycle. It is conducted twice weekly throughout the academic year and has been taught by two educators since its inception: a science teacher and a Lesser Kestrel expert, who is also the author of this paper. The program addresses a wide range of topics related to nature, society, and their interconnections. Students engage with themes such as conservation vs. development, human-environment interactions, biodiversity, bird migration, public space management, and the integration of industry with nature conservation. Learning activities are structured to include scientific investigations, comprising data collection and analysis, role-playing exercises, peer-led teaching sessions, reflective writing,

facilitated group discussions with feedback, and the construction of nesting boxes for the Lesser Kestrel. The program fosters a teaching-learning environment that inspires students to participate in numerous extracurricular activities aimed at cultivating a positive attitude toward the environment. As part of the school's holistic approach, the program also integrates language and literacy skills. Students engage in writing assignments where they describe, summarize, compose letters, express and justify opinions, and articulate feelings under the guidance of language teachers in Appendix 1, the detailed curriculum on the Lesser Kestrel is presented. A standout feature of the program is "Lesser Kestrel Day," during which students guide over 1,250 visitors from across the country. Preparations for this event involve group training sessions where students familiarize themselves with the route, which includes eight stations around the school. Each station focuses on a specific topic, with students determining the content, methodology, and division of roles based on their learning throughout the year.

The pedagogical framework guiding the program is based on the "head, hands, and heart" model (Sipos et al., 2008), which integrates cognitive, practical, and emotional dimensions of learning. This model aligns with the program's mission to foster not only scientific knowledge but also hands-on skills and a deep emotional connection to conservation. The structure of the program culminates in the Lesser Kestrel Day, where students guide visitors through a series of interactive stations, each focusing on a different aspect of Lesser Kestrel conservation (e.g., species identification, ecological relationships, nest box construction, observation, and community engagement). Students are responsible for preparing, presenting, and leading activities at each station, thereby reinforcing their knowledge, skills, and sense of responsibility. This holistic approach aims to develop students' knowledge, skills, and values, supporting both immediate learning outcomes and long-term environmental stewardship.

Research tool

The research tool used in this study was a semi-structured interview. This interview format allows the researcher to combine pre-planned questions with the flexibility to delve into topics that arise during the conversation (Galletta, 2013; Wengraf, 2001). The interview structure included several main sections:

1. Introduction: The interviewer explained the research purpose and obtained informed consent.
2. Background questions: Age, occupation, and year of participation in the Lesser Kestrel program.
3. Open-ended questions about memories from the program, such as: "Tell me about your most significant experiences from the Lesser Kestrel program" and "Which activities or learning experiences do you particularly remember?"
4. More focused questions, such as: "How did the program influence your attitude toward the environment?" and "Did the program influence your life choices, and if so, how?"
5. Reflective questions, such as: "How do you view the program today, in retrospect?" and "What do you think were the advantages and disadvantages of the program?"

6. Conclusion: Participants were asked if they wanted to add any points that had not been addressed.

These questions formed the basis of the interview, with additional questions arising during the conversation to allow flexibility in directing the interview based on the responses received. The interviews were recorded and transcribed for in-depth analysis of content and central themes that emerged (John et al., 2022; Kallio et al., 2016).

Participants

Snowball sampling is a technique used to recruit research participants. Researchers begin with a small group of initial participants who meet the study's criteria and then ask them to recommend other potential candidates. This non-probability sampling method, where existing participants recruit future subjects from their own networks, is especially useful when the target population is difficult to identify or access. In this particular study, it aided in locating individuals aged 30 and over who had participated in a specific elementary school curriculum around the ages of 10 and 11. The main advantage of snowball sampling is that it allows researchers to efficiently reach a sizable sample. Furthermore, it provides access to diverse individuals within the relevant population who were exposed to the curriculum during their fifth-grade year. Referrals can also encourage participation from individuals who might otherwise be reluctant. However, snowball sampling is susceptible to selection bias due to its reliance on existing networks, and the non-random nature of the resulting sample limits the generalizability of findings (Badr et al., 2024; Net et al., 2025). A total of 17 graduates were interviewed for this study, but this paper presents only those 12 participants who were 30 years of age or older. Participant characteristics and a brief summary of their recollections of the program are presented in Table 1.

Data analysis

The study employed qualitative inductive analysis to explore the memories of adults who participated in the fifth-grade Lesser Kestrel program. The data collected through participant interviews were analyzed using first-cycle and second-cycle coding analysis (Saldaña, 2009), within the framework of thematic analysis (Braun and Clarke, 2021, 2023; Finlay, 2021). These coding methods provide a structured and systematic approach to qualitative data analysis, ensuring robust support for research findings and conclusions. First-cycle coding focused on the initial examination of the data, involving the identification and labeling of key concepts or reframing initial observations (Braun and Clarke, 2023). This process served as the foundation for the second-cycle coding, which entailed a more refined and focused analysis based on the codes generated during the first cycle. The analytic procedure encompassed the following steps: (1) familiarizing oneself with the data and drafting initial notes; (2) systematically coding the data; (3) generating preliminary themes from the coded and organized data; (4) refining and evaluating the emergent themes; and (5) clarifying, defining, and labeling the finalized themes

(Braun and Clarke, 2021). Through this methodical approach, the analysis delved into the nature of adults' memories from their participation in the program, shedding light on the long-term impact of the experiences they encountered during their fifth-grade studies. A sample codebook table with illustrative statements, the theme name, and the resulting categories attached in Appendix 2.

Findings

The inductive analysis of the data revealed five central themes. The first theme is called the power of experiential learning in creating long-term meaningful memories. This theme highlights how experiential learning fostered active student engagement in the educational process. The second theme includes the importance of collaboration and shared participation in the Lesser Kestrel Program, as emphasized by the interview participants. According to the participants, the program underscored the importance of cooperative learning and peer-based education, providing opportunities to develop social skills and the ability to function effectively within a group. The third theme, bridging theory and practice: a cornerstone of meaningful learning focuses on the connection between theory and practice. The learning experience in the program allowed students to observe how theoretical knowledge intersects with real-world contexts. The fourth theme reflects participants' descriptions of how the environmental education program on the Lesser Kestrel contributed to their self-efficacy and self-confidence in public engagement. Participants reported feeling capable of handling challenging tasks and developing independent thinking, leaving a lasting impact on their perception of their capabilities in the future. The fifth theme is value-based learning. This theme emphasizes how educational experiences extend beyond the acquisition of knowledge to shape fundamental values.

Interestingly, while the program focused on ecological and biological knowledge, such knowledge was notably absent from participants' recollections. The only biological knowledge recalled was the differences between male and female Lesser Kestrels. As Natalie (housekeeper) stated: "The only thing I remember is the difference between the male and female. The male has a blue head, and the female has a brown head. Also, the male has a smooth back, while the female's back is spotted." This finding underscores a gap between the program's intended educational outcomes and the long-term retention of specific scientific knowledge.

The power of experiential learning in creating long-term meaningful memories

The first theme highlights the significance of experiential learning in shaping participants' long-term, meaningful memories. Experiential learning allows students to engage directly with the subject matter, leading to deeply embedded and detailed recollections, even decades after the experience. Isaac (handyman), who took part in the program 27 years ago, illustrates this point: "I vividly remember building the nesting boxes for the first time... because we built them ourselves." This statement underscores the power of hands-on learning. The use of the word "vividly"

TABLE 1 Characteristics of the participants interviewed for this study and a summary of their personal memories of the program they studied in fifth grade.

Pseudonym	Gender	Age	Current profession	Sentences summarizing the participant’s experience in the program
Isaac	M	38	Works in plumbing and home/business services	The program shaped my approach to nature and left a positive impact. The experiential activities strengthened my personal connection to the environment. I continued to be involved in nature-related activities even after finishing school.
Natalie	F	38	Full-time mother, degree in Economics and Business Administration	The program allowed me to see nature from a scientific and practical perspective. I didn’t deeply connect with the program’s content at the time, but now I appreciate its importance. I feel regret that my children do not experience similar programs.
Madeline	F	30	Environmental education teacher	The program developed my teamwork skills and creative thinking. The experiences stayed with me throughout my life, giving me confidence and independence. I remember “Lesser Kestrel Day” as a significant and exciting event.
Oliver	M	30	Radio broadcaster	The program helped raise my awareness of conservation and endangered species. The combination of 5 theoretical learning and practical activities made the experience meaningful. The skills I gained helped me in my career and public speaking.
Roni	F	38	Student of Hebrew language education	The field trips and binocular observations made learning meaningful to me. The program contributed to my sense of independence and connection to the community. Today, I believe experiential learning is the most effective way to teach values.
Ram	M	30	Feldenkrais method instructor	The project gave me a sense of value and connection to my environment. Meaningful experiential learning brings personal value to each student. The learning experiences in the program were empowering and unforgettable.
Owen	M	30	Field technician	Experiential learning connected me deeply to the subject. My family embraced kestrels as part of our lives. The program gave me important skills such as teamwork and public speaking.
Eli	M	31	Works in vehicle software security	I mainly remember the visual elements and kestrel observations. The guiding experience on the open day was meaningful but challenging for me. Today, I appreciate the educational value of the program and want my children to experience similar programs.
Margaret	F	37	Gynecology resident doctor	The program developed my sense of environmental responsibility and community belonging. The experience of presenting the project in Jerusalem was a moment of pride. Practical learning added great educational value and empowered participants.
Sari	F	34	Dance teacher	The program was an exciting and unique experience for me. It connected me to nature and taught me the importance of conservation. Today, I understand the significance of experiential education for students.
Liz	F	32	Researcher at a university	The program was a meaningful and engaging educational experience, which gave students a sense of responsibility and active involvement and the lessons were different from regular classes as they focused on field-based research rather than just theoretical learning in the classroom.
Tibi	F	38	Science, Agriculture and Ecology Teacher	The program was a meaningful educational experience, not just a “regular lesson,” but an immersive project that strengthened her connection to nature and conservation and reinforced her sense of personal responsibility for the environment.

suggests the clarity and sharpness of the memory, despite the many years that have passed. The physical act of constructing the boxes created a tangible experience, one that became deeply engraved in the participant’s memory. He continues: “But I don’t remember many other specific details... I do remember that the male had a bit of blue.” This observation highlights the selectivity of autobiographical memory. While many details have faded, the visual and sensory aspects of the experiential learning process were retained. This suggests the efficacy of experiential learning in generating long-lasting and detailed memories, even when other aspects of the learning experience have diminished over time.

This theme also underscores the emotional impact of experiential learning. The emotions evoked during the learning experience play a crucial role in shaping participants’ long-term memories. Madeline (teacher) illustrates this through her account:

I remember the Lesser Kestrel program very well. We were so excited... it was something special that I eagerly anticipated, we were really looking forward to Lesser Kestrel Day... I don’t remember exactly what I taught, but I can say it was very, very educational, very interesting, and we had a lot of fun.

This statement highlights how positive emotions and anticipation for the event contributed to a strong, enduring memory, even though the specific details of the content have faded. The excitement and engagement experienced by the participant transformed the learning experience into something meaningful and enjoyable.

Natalie (housekeeper) describes the sensory aspect of the experience:

First of all, it was fun because it wasn't regular schoolwork... we weren't in a classroom, and that's the fun part I remember... we went out with binoculars, each child had his own binocular, and we watched the Lesser Kestrel... we really loved going on these field trips... even though many years have passed, I still remember those observations with the binoculars fondly.

This description highlights the importance of learning outside the classroom and using tangible tools such as binoculars. When Natalie (housekeeper) was asked what he remembered from the birdwatching observation, he replied:

Come on, how can I remember what we saw after so many years? In my mind, I see us walking out with binoculars around our necks, looking up at the sky for the Lesser Kestrel... but what we actually saw, or what we learned? I honestly don't remember... I remember the experience of learning with the binoculars.

The sensory experience of using binoculars and engaging in outdoor exploration created a positive and long-lasting memory, even though the specific details of what was observed have faded. This demonstrates how experiential learning fosters a strong emotional connection to the subject matter, even if the precise content diminishes over time.

All participants recalled the observations conducted with binoculars. The strong recollection of the binocular observations by all participants serves as compelling evidence of the power of experiential learning in shaping long-term, meaningful memories. Unlike passive learning methods, these hands-on experiences engaged students sensory-wise, emotionally, and cognitively, embedding the memory deeply. The act of physically using binoculars to observe birds transformed theoretical knowledge into a tangible, interactive experience, reinforcing the connection between active participation and memory retention. This highlights how learning through direct engagement fosters vivid, lasting impressions, even years after the experience itself.

The findings presented here illustrate how experiential learning is a powerful tool for memory retention, primarily due to its hands-on nature, emotional engagement, and sensory-rich experiences. By actively participating in the learning process, whether through constructing nesting boxes, anticipating a special educational event, or using binoculars in field observations, participants develop long-term, meaningful memories. Even when specific factual details fade, the emotional and sensory aspects remain vivid, underscoring the profound and enduring impact of experiential education.

The importance of collaboration and shared participation in the Lesser Kestrel program

The second theme emphasizes the significance of collaborative work and shared participation as remembered by various program participants. Their recollections illustrate how the program fostered multiple levels of cooperation, ranging from the students

themselves, through teachers and the local community, to a national-scale impact.

The student circle: learning through teamwork

Participants vividly recall the positive experience of working together with their classmates. Oliver (broadcaster) described: "This positive experience of working in our group with classmates... creating together operating things together." This memory highlights not only the enjoyment derived from group activities but also the developmental value of teamwork. Through collaborative work, students learned how to contribute as part of a shared effort. The use of phrases such as "creating together" and "operating things" underscores the active and dynamic nature of collaboration, leading to a sense of collective responsibility and shared achievement.

Ram (therapist) added: "We learned how to listen to one another and build content together that everyone could present." This quote demonstrates how the program deliberately fostered communication and teamwork skills. Through active listening and mutual respect, students were not only able to produce meaningful content but also ensured that it was inclusive and accessible to all members of the group. This aspect of teamwork extended beyond the completion of tasks and contributed to a collaborative learning environment where individual contributions were valued and integrated into a collective outcome.

These recollections reveal that the program's structured group work not only facilitated environmental learning but also instilled interpersonal skills and social dynamics with long-term implications. By engaging in problem-solving and group activities, students internalized the importance of cooperation, adaptability, and collective success. These experiences illustrate how collaboration in educational settings can transcend the immediate goals of a program, leaving a lasting impact on participants' personal and professional identities.

The teacher circle: teachers as partners in learning

Collaboration with teachers played a central and meaningful role in the program, as highlighted in participants' memories. Roni (student) recalled: "We had a wonderful teacher named Tirtza... I remember her accompanying us to the community... she helped us a lot... it was nice to suddenly see a teacher observing alongside you." This memory underscores the importance of teacher involvement in the learning process. The teacher's active presence, watching, and participating alongside the students, not only strengthened the student-teacher relationship but also modeled a collaborative educational leadership style. These recollections illustrate how a teacher's engagement fostered a sense of closeness and belonging, enhancing the depth of the learning experience, and reinforcing a strong classroom community. Other participants also highlighted their collaborative work with the program's teachers. They recalled not only the birdwatching observations but also the construction of nesting boxes, which was carried out in cooperation with the teachers. Additionally, they remembered the joint decision-making process between students and teachers in selecting the families that would host the nesting boxes.

In preparation for Lesser Kestrel Day, part of the participants emphasized that the station sequence was co-designed with the teaching staff rather than imposed from above. This collaborative planning fostered a profound sense of belonging and shared ownership: “We determined the order of the stations together with the teachers... what each activity would cover and how we’d guide the children... so we felt like integral partners in the decisions, not just implementers of someone else’s plan.” This involvement in designing the activities transformed participants into true stakeholders, giving them a sense of ownership and responsibility for the day’s success. Other participant said: “Sitting down with the team to map out the stations... deciding where to place observation points, discussion topics, and hands-on tasks, made us realize that this wasn’t ‘just another event’ but our project, connected to all of us.” Engaging in dialogue about the educational structure strengthened the community bond among teachers and participants and created a mutual commitment to the project’s success.

The local community circle: engaging parents and the school staff

The program provided a platform for collaboration with the local community, particularly with parents. Tibi (teacher) shared: “We actually built the nesting boxes with the parents and the school staff, building them together... it was special... And after that, we all went as a class to install the boxes on the rooftops.” This quote highlights the integration of students, parents, and school staff as active partners in the learning process. Such activities not only strengthened students’ sense of belonging to their community but also created shared emotional and hands-on experiences, bridging the gap between students, their families, and the school environment. This collaborative work nurtured cooperative skills and emphasized the importance of joint efforts toward a common goal.

Margaret (teacher) describes his memories as follows:

I remember going door to door as a fifth grader, asking families about their roofs and whether they would be willing to host a nesting box. At first, it felt a bit intimidating to approach people, but we quickly realized how much the community supported what we were doing. Some families were excited and told us stories about birds they had seen near their homes. It was the first time I felt like we, as kids, were actually contributing to something bigger than ourselves.

This sentiment was reinforced in the follow-up interactions after the nesting boxes were installed. Sari (teacher) shared:

What really made the project special was that after we placed the nesting boxes, some of the families we visited started updating us. They would stop us on the way to school to tell us if they saw a kestrel going in or out of the box. I remember a neighbor telling me one morning, “You won’t believe it! The falcon came back!” It made me feel like we had built a real connection with the community, not just as students but as young conservationists working together with them.

These reflections highlight how the nesting box survey fostered a meaningful connection between students and the local community, transforming the learning process into a shared experience of environmental responsibility. The program empowered students to engage actively with their surroundings, strengthening their sense of agency, and belonging while also instilling an appreciation for community-driven conservation efforts.

The national circle: expanding the program’s impact beyond the classroom

The program’s impact extended beyond the classroom and the local community, reaching evens a national level. Liz (researcher) recounted: “For Lesser Kestrel Day, everyone was invited and so many people, it wasn’t just the parents, or just the village, or just the school, people came from all over the country.” This memory demonstrates how the program generated widespread interest and engagement, drawing participation beyond the immediate educational and community circles. The national-scale event fostered a sense of pride among students and highlighted the importance of connecting schools with broader societal networks. This broader circle reinforced the significance and influence of the students’ collaborative work, emphasizing that their efforts had real meaning beyond their own classroom and community.

Looking back, participants vividly recall the overwhelmingly positive feedback they received during Lesser Kestrel Day, which made them feel truly valued and connected to a broader community effort, as Owen (technician) said:

In retrospect, I still remember how thrilled I was by everyone’s reactions on Lesser Kestrel Day... I can’t quote them verbatim, after all, it’s been years, but they told us we did great, that we really knew all about the Lesser Kestrel. It gave me such a good feeling, filled me with pride, a sense of accomplishment, doing something that helps the Lesser Kestrel and having people listen to you. It felt like the visitors on that day became part of our community of those who care about the Lesser Kestrel.

This recollection highlights how public recognition during the National Circle not only reinforced participants’ self-efficacy but also extended their sense of belonging to a wider network of stakeholders, thereby transforming a single-day event into a catalyst for lasting community engagement.

This theme highlights the diverse layers of collaboration that emerged within the Lesser Kestrel Program, spanning from student teamwork to national engagement. Participants’ memories underscore the educational and social value of the program, which encouraged teamwork, peer learning, and strengthened connections between the school and the community. The program is remembered as a positive experience of shared creation and mutual learning, contributing to the development of essential social and communication skills while fostering meaningful relationships across different levels of collaboration. By engaging students, teachers, parents, and broader audiences, the program demonstrated how cooperative learning environments can leave a

profound and lasting impact on participants' personal, social, and educational growth.

Bridging theory and practice: a cornerstone of meaningful learning

The connection between theory and practice is a fundamental component of meaningful learning. Participants' memories of the Lesser Kestrel Program illustrate how theoretical knowledge was translated into concrete actions, creating memorable and impactful learning experiences. This theme underscores the importance of bridging abstract concepts with tangible outcomes, leading to a deeper understanding and appreciation of environmental conservation.

The first aspect of this theme pertains to reflection and practical application. Margaret (teacher) shared: "There are houses that were undergoing renovations or had their roof openings sealed off, so at the time we built them nesting boxes... we did it because otherwise the Lesser Kestrels would have nowhere to nest." This recollection illustrates the practical application of theoretical knowledge, as the students learned about the nesting habits of the Lesser Kestrel and contributed directly to its conservation through hands-on efforts. The construction and installation of the boxes served as a bridge between theoretical understanding and meaningful field action.

The second aspect relates to the observations carried out by the students and the validation of those observations. Eli (engineer) noted:

Every house has its own Lesser Kestrel... and indeed, after a year, they would return to the same house to nest in the same spot... It was wonderful to see that alignment between what we were told and what we observed in reality.

This memory emphasizes how the students managed to verify the information learned in class through direct observation, thereby strengthening the connection between theoretical knowledge and lived experience.

The third aspect concerns real-time learning. During bird observations, Owen (technician) remarked:

To stop and actually see the birds suddenly descend in search of prey, we could witness it; it wasn't just a story. We could observe the birds on the power lines, for instance, and even distinguish between the male and female. That's not something you can identify from a book.

The experience of learning in real time helped the students deepen their understanding and transform abstract theory into something tangible.

The fourth aspect is linked to the transition from skepticism to understanding. Roni (student) her initial doubts at the start of the activity:

We built the boxes... I remember that they were supposed to be assembled, and I recall thinking it was odd: why would they [the Lesser Kestrel] enter the box? As a child, it just didn't seem real...and then it was suddenly extraordinary to see the Lesser Kestrel enter and nest in the box.

This shift from early skepticism to a sense of wonder illustrates the transformative power of witnessing the successful practical application of knowledge.

The final aspect concerns the participants' emphasis on the project's vitality and tangibility. Several participants stressed the project's real-world dimension. Isaac (handyman) stated: "Seeing reality and understanding it, that's the project. It isn't theoretical; it's real." Margaret (teacher) added:

We built boxes, hung them up, and indeed, the Lesser Kestrel entered; they laid eggs and hatched chicks... In other words, theory met reality. And when you're a child, it's a monumental experience, one of the first, if not the very first, times you encounter something like that.

These experiences demonstrate how the program created an immediate encounter between theory and reality, profoundly affecting the participants and instilling in them the value of experiential learning.

In conclusion, the participants' recollections illustrate how the Lesser Kestrel program successfully bridged the gap between theory and practice in a meaningful way. Activities such as building nesting boxes, observing the Lesser Kestrel, and experiencing firsthand successes in the field transformed theoretical concepts into tangible realities and left a lasting impression. This theme underscores the importance of integrating theory with practice in educational programs.

Self-efficacy and confidence: a key component of personal development

A sense of competence and self-efficacy is a central component in the personal development of students, especially within educational programs that integrate experiential learning and practical engagement. The Lesser Kestrel program offered participants unique opportunities to confront challenges, assume responsibility, and experience successes that reinforced their belief in their own abilities. This theme illustrates how these experiences significantly impacted the participants' self-efficacy, emphasizing the way in which an educational program can foster long-term feelings of efficacy.

Liz (researcher) emphasized how the Lesser Kestrel program empowered them and provided opportunities for personal growth: "The Lesser Kestrel program gave me the confidence to take initiative and grow, both academically and personally." Tibi (teacher) shared, "A program that empowers, that gives a child room to grow and flourish." Sari (teacher) noted, "Lesser Kestrel Day was a day that prompted us to be proactive, to engage in action, to constantly think outside the box. It greatly boosted our confidence and the sense that we can do it." These recollections illustrate how the program nurtured a sense of initiative and creativity, encouraging students to take responsibility for their actions and to think independently.

According to the participants, they recall that the program placed a strong emphasis on developing a sense of responsibility and leadership. Owen (technician) recounted, "Being responsible, organizing the trips, managing the buses... deciding who leads this

tour, who leads that one, and who is in charge of refreshments... it gave us a feeling of being grown-ups.” This memory underscores how the program entrusted students with significant roles that contributed to their sense of maturity and self-worth. Eli (engineer) added, “Even the construction of the nesting boxes, we built them on our own, and we succeeded. We received instructions and built them independently. At first, I didn’t believe we could succeed, but we did.” These experiences reinforced the participants’ belief in their ability to tackle challenges and succeed through their own efforts.

Another aspect of this theme relates to memories of gaining confidence in public speaking. Several participants highlighted how the program enhanced their ability to speak in front of an audience. Ram (therapist) stated, “I think it gave me a lot of confidence... in my ability to speak before an audience, in my ability to learn material and convey it... It gave me confidence as a child.” Oliver (broadcaster) remarked, “I gained a sense of competence in presenting knowledge and in being a leader within the group.” These experiences helped develop critical interpersonal skills, nurtured the participants’ self-confidence, and reinforced their belief in their capacity to present various topics to unfamiliar audiences.

Yet another aspect pertains to pride and achievement. The sense of pride and accomplishment recurred in the participants’ recollections. Tibi (teacher) shared, “I remember that back then they even told us that this was the largest group in the history of Lesser Kestrel Day, and they entrusted me and my friends with guiding it. It was an incredibly gratifying feeling.” Although there was a guide or a biologist present, the students were the primary leaders, which underscored their abilities and bolstered their confidence in their knowledge and skills. Natalie (housekeeper) explained in an interview that even at 11 she understood that this project was significant and important, a realization that instilled in him the sense that she could lead the initiative for the conservation of the Lesser Kestrel:

The project was extremely meaningful for us... they treated us as adults... they made us understand that we were leading something immensely important, the preservation of an endangered species... we felt its significance, we assumed the responsibility; it’s not something you experience as an 11-year-old girl... the way the teachers treated us gave us the morale to lead the project, and it greatly enhanced our self-confidence... we felt that they believed in us... It’s a very powerful memory, the feeling that we are responsible and that we can do it.

In closing, the Lesser Kestrel program significantly contributed to the development of the participants’ sense of competence and self-confidence. Through empowerment, the assumption of responsibility, the development of public speaking skills, and collaborative efforts, the participants cultivated a belief in their ability to succeed, to lead, and to make a meaningful contribution. These recollections underscore the long-term impact of experiential and values-based education on the self-confidence and autonomy of students. The program, with its focus on assigning responsibility and achieving tangible outcomes in the

field, provided the students with a robust foundation for personal growth and future resilience.

Values-based learning

For the participants of the Lesser Kestrel program, this theme captures the way the program fostered a connection to environmental stewardship and instilled a sense of moral responsibility. Even as children, the participants engaged with values that encouraged respect for biodiversity, a commitment to conservation, and an awareness of humanity’s role in the ecosystem. This theme reflects how such educational programs can profoundly influence personal development and cultivate lifelong values that transcend the classroom experience.

Based on the participants’ recollections, it is evident that the program instilled environmental and ethical values that have endured for many years after its conclusion. Madeline (teacher) describes the program’s impact on his value system: “...The values of nature conservation and the realization that we are part of a biological, ecological system... and not the owners of this planet, are insights I would never have encountered without this project.” This quotation demonstrates how the program broadened the participants’ worldview, moving beyond mere factual knowledge to foster a profound understanding of humanity’s place within the expansive ecological system.

Roni (student) added:

It is incredibly moving for a fifth grader to feel that he is a guide on the Lesser Kestrel in front of adults... and to contribute to the preservation of an endangered species... It is such a significant event... I don’t think many children ever experience something like this.

This account underscores the sense of meaning and responsibility that the program bestowed upon its participants. The experience of making a tangible contribution to nature conservation at a young age left an indelible and long-lasting impression.

Margaret (teacher) reflects on the program’s enduring influence on his values: “I believe it instilled in me a certain compassion and an awareness for endangered animals.” This quotation highlights how the values acquired during the program continued to shape the participant’s worldview even many years later, attesting to the program’s remarkable ability, first encountered in fifth grade, to cultivate lasting values and attitudes.

The program’s values-based learning approach was implemented through a combination of experiential activities, values clarification discussions, and community engagement. As fifth graders, students practiced responsibility and care for nature by building and monitoring nest boxes, leading educational stations, and reflecting on ethical dilemmas related to conservation. These experiences required them to make decisions, collaborate, and consider the broader impact of their actions. As adults, participants consistently recalled that these formative experiences instilled lasting values of environmental stewardship, empathy, and

a sense of agency, which continue to influence their attitudes and, in some cases, their community involvement (see [Appendix 3](#)).

Discussion

Even after 27 years, participants in the Lesser Kestrel program still retain memories of the curriculum they experienced at age 11. Although most alumni no longer recall detailed facts about the Lesser Kestrel's life cycle ("head"), their vivid memories of building and installing nest boxes and using binoculars in the field ("hands") reveal the true power of hands-on learning. Rather than retaining technical content, participants consistently describe how these activities fostered teamwork, a sense of accomplishment, and pride through collaboration and problem-solving. Physically contributing to conservation ingrained enduring self-efficacy and agency: each spring they still track the hawks' return dates and nesting behaviors, anchoring abstract ecological concepts in lived experience. This "muscle memory" not only gave them the confidence to launch further community initiatives—such as installing new boxes and organizing habitat restorations—but also created a reservoir of socioemotional resilience ("heart") that helps them persist when facing new environmental challenges. Although self-reported memories focus more on values and attitudes than on precise content or documented behavior change, these deeply felt experiences clearly shaped their environmental identity and long-term commitment to conservation.

The Lesser Kestrel environmental program acted as a seed, instilling values, skills, and worldviews in its participants. Oliver, a broadcaster who had completed the program only 19 years before the interview, noted: "I think it is like in education... you sow and you do not know what will sprout from it; you see the fruits and the flourishing tree years later."

Accordingly, the discussion in this study is principally grounded in the Expanded Circle of Influence model ([Figure 1](#)). Developed as a result of the study's findings, this model offers an innovative perspective on how a long-term educational program can influence participants at various stages of their lives. It resonates with the pedagogical principles of environmental education and casts the study's findings in a new light, encompassing four circles of influence through which the program impacts its participants.

The innermost circle—immediate experience

The study's findings underscore the importance of experiential learning and practical engagement, which serve as the foundation for the participants' immediate experiences. According to the literature ([Roberts, 2024](#)), such experiences evoke long-term memory. Learning through action is recognized as being particularly memorable ([Dunkley and Smith, 2019](#)). This assertion is consistent with the holistic and interdisciplinary approach of environmental education, which integrates active and place-based learning ([Araneo, 2024](#); [Douлами, 2025](#)). The vivid recollections of activities such as constructing nesting boxes and engaging in nature observations illustrate how experiential learning

generates significant and enduring experiences ([Giesen, 2011](#); [Kolb, 1984](#)). Moreover, these described experiences align with Csikszentmihalyi's flow theory, as they are characterized by intense concentration, enjoyment, and deep engagement ([Ghaderi et al., 2024](#); [Shernoff et al., 2003](#)).

The second circle—personal development

The findings demonstrate that participation in the program contributed to the development of self-efficacy, confidence, and independence among the participants. This aligns with Bandura's self-efficacy theory ([Bandura, 1982](#)), wherein successful experiences in environmental activities reinforced the participants' belief in their ability to effect change in their surroundings. The participants' recollections of mentoring others and leading projects illustrate how the program facilitated significant personal development. These observations are consistent with literature suggesting that when learning experiences acquire personal meaning, they become deeply embedded in memory and lead to more profound learning ([Roberts, 2024](#)).

The third circle—social skills

The study reveals enhancement in participants' teamwork, collaboration, and communication skills. An outcome that aligns closely with Vygotsky's social learning theory, which emphasizes the critical role of social interaction in the learning process ([Vygotsky, 1978](#)). Alumni vividly recall the collaborative projects and community engagement of the Lesser Kestrel program, and many report that these experiences planted a lasting appreciation for cooperation. Although adult collaboration often demands significant energy, those early memories of shared achievement continue to motivate them to seek out and lead joint activities (see [Appendix 3](#)). This sustained drive not only underscores the long-term impact of experiential group work on social skill development but also reinforces [Roberts's \(2024\)](#) finding that educational programs incorporating mentoring and peer collaboration foster deeper engagement in learning.

The outermost circle—long-term impact

The findings demonstrate how the program influenced the shaping of values, life perspectives, and decision-making processes among the participants over the long term. As noted in the literature ([Dunkley and Smith, 2019](#)) and corroborated by this study, the memories formed during environmental activities do not always directly translate into environmentally responsible behavior; nevertheless, they serve as a critical foundation for developing environmental awareness. This observation diverges from other studies ([Casey and Quennerstedt, 2015](#); [del Mar del Pozo Andrés, 2023](#); [Roberts, 2024](#)) that argue significant early environmental memories tend to foster social and environmental engagement in adulthood. Still, the enduring affinity of the participants toward environmental issues resonates with Bronfenbrenner's ecological

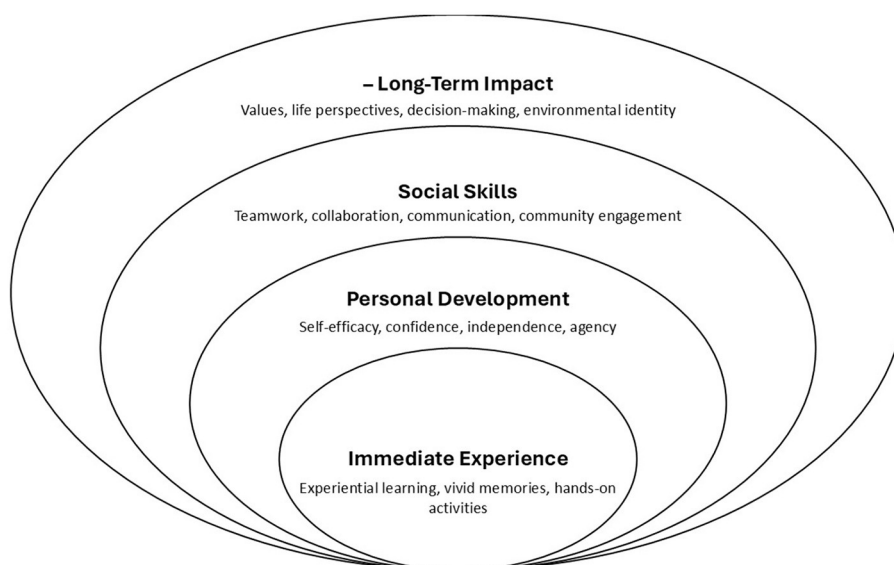


FIGURE 1

The expanded circle of influence model – developed from research findings. The model illustrates four levels of impact, each representing a different sphere of influence as identified in the study's qualitative analysis. The model was constructed inductively, based on the emergent themes from participant narratives.

model (Bronfenbrenner, 1979), which emphasizes the importance of sustained interactions between the individual and their broader environment over time.

A substantial body of research, led by Louise Chawla, has demonstrated that significant life experiences in childhood, especially direct, positive encounters with nature and the presence of supportive adult role models, are key factors in the development of environmental awareness, values, and lifelong commitment to environmental stewardship (Chawla, 1998, 2007, 2009, 2020; Jordan and Chawla, 2022; Stevenson et al., 2014; Williams and Chawla, 2016). Chawla's synthesis of qualitative studies shows that adults who are environmentally engaged frequently attribute their values and actions to formative childhood experiences in nature, often facilitated by family members, teachers, or community mentors (Chawla, 1998, 2007, 2009, 2020; Jordan and Chawla, 2022). The findings of the present study resonate strongly with this literature: participants consistently described how their involvement in the Lesser Kestrel program as children shaped their environmental identities and values as adults (see Appendix 3). Others described how the program instilled a sense of responsibility and agency, motivating them to “monitor nature,” “protect the environment,” and “remain driven to change it” in adulthood. These accounts illustrate how the program's experiential and value-based approach provided not only knowledge, but also a deep sense of belonging and ethical commitment, outcomes that Chawla identifies as central to the long-term development of environmental identity and pro-environmental behavior (Chawla, 2007, 2020; Jordan and Chawla, 2022). Thus, the outermost circle of influence in this study is grounded in both the participants' lived experiences and the broader theoretical framework established by Chawla's work on significant life experiences.

To sum up, the Expanded Circle of Influence model offers a comprehensive framework for understanding the complex,

multidimensional impacts of environmental education programs. It underscores how meaningful learning experiences can engender lasting effects on participants' identities, values, and behaviors, thereby generating waves of influence that extend from the individual to the community and society at large.

Conclusions

This study examined the long-term impact of the Lesser Kestrel environmental education program on participants who experienced it in fifth grade. The findings indicate that while participants do not retain detailed scientific knowledge from the program, they vividly remember the experiential aspects of their learning. Activities such as observing falcons, building nesting boxes, and guiding visitors were deeply embedded in their memories. These experiences contributed to a sense of personal agency, confidence, and responsibility, shaping their perspectives on education and community engagement.

The study also highlights the role of experiential learning in fostering enduring connections to nature. Participants reported an increased awareness of environmental issues, yet the extent to which this awareness translated into active pro-environmental behavior in adulthood remains unclear. While many expressed a deeper appreciation for wildlife and conservation, direct links between the program and concrete actions in their adult lives were less evident. This suggests that while environmental education programs can successfully instill values, additional reinforcement may be needed to translate these values into long-term behavior.

Several limitations should be considered when interpreting these findings. First, the reliance on retrospective self-reports introduces the possibility of memory bias, as participants were recalling experiences from more than a decade ago. Additionally,

the study employed a snowball sampling method, which may have resulted in a sample biased toward individuals with particularly positive recollections of the program. Furthermore, the absence of a control group makes it difficult to determine whether observed attitudes and memories are directly attributable to the program or influenced by other life experiences.

Despite these limitations, this study makes significant contributions to both educational research and practice. Scientifically, it proposes a circular impact model illustrating how environmental education influences not only individual students but also their wider community by fostering engagement and collective responsibility. The research adds to the growing body of literature on the long-term effects of experiential learning, reinforcing its role in shaping personal and social development.

From a practical perspective, these findings emphasize the importance of designing environmental education programs that prioritize experiential learning and community involvement. Educators and policymakers should consider integrating hands-on activities, student-led initiatives, and long-term reinforcement strategies to maximize the lasting impact of such programs. Although sustained engagement, through mentorship, alumni initiatives, and advanced educational opportunities, may reinforce environmental awareness beyond childhood, the degree to which this continuity translates into lasting behavioral change in adulthood remains to be determined.

In conclusion, this study underscores the potential of well-structured environmental education programs to create lasting memories and shape values. However, to bridge the gap between awareness and action, future initiatives should explore ways to sustain and reinforce environmental engagement over time. Further research, incorporating longitudinal studies and comparative analyses with control groups, would provide deeper insights into the mechanisms that drive long-term environmental commitment.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

Ethics statement

The requirement of ethical approval was waived by the Ethics Committee of the Kibbutzim College for the studies involving humans because the approval has not been revoked. According to the rules of the Kibbutzim College, when the participants in the research are adults, approval from the ethics committee is not required. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin. Written informed

consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

AG: Writing – original draft, Software, Writing – review & editing, Investigation, Project administration, Data curation, Methodology, Validation, Formal analysis, Conceptualization, Supervision.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that Gen AI was used in the creation of this manuscript. Given that English is not my native language, artificial intelligence helped me improve my English.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2025.1629969/full#supplementary-material>

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