Discover Sustainability

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Promoting lifestyle changes for sustainability through participatory research

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Abstract

This paper examines whether participatory approaches can catalyze radical lifestyle changes consistent with strong sustainability. We analyze the ecoclubs format—participatory, peer-led research groups where university students meet regularly to develop sustainable consumption habits. Drawing on cooperative inquiry methods and 38 interviews across seven implementation waves (2021–2025), we investigated how peer-based learning influences lifestyle change. Our findings reveal a significant gap between participatory aspirations and transformative impact. While participants reported positive immaterial changes—increased environmental awareness, critical consumption attitudes, and strengthened nature connections—material changes remained limited to incremental adjustments like eco-friendly product switches or packaging reduction. Absent were transformative changes essential for strong sustainability: e.g. eliminating air travel, adopting plant-based diets, or fundamentally reducing consumption. Key barriers included perceived high costs, missing infrastructure, and crucially, the absence of interventions enhancing reflection and action on broader consumption patterns. We argue that purely participatory design, while creating supportive peer learning environments, fails to question the growth-consumerist paradigm. Without challenging dominant value systems, ecoclubs inadvertently reinforce weak sustainability—optimizing choices within existing systems rather than transforming the participants' lifestyles toward strong sustainability. The study argues that designing highly impactful behavior change programs requires, on the one hand, embracing the potentially productive tension between participatory methods, which drive engagement and socialization of norms, and, on the other hand, often demanding, strong sustainability oriented interventions. Programs should combine peer support with deliberate provocations, fact-based guidance, and critical facilitation that explicitly addresses structural barriers.

Keywords Behavior-impact gap, Cooperative inquiry, Participation, Radical lifestyle change, Action competence, Strong sustainability

1 Introduction

In 2022, Joshua Spodek began living below the world average ecological footprint in New York—powering his apartment with solar panels, quitting flying, and maintaining a near-zero waste lifestyle [1]. While his radical transformation demonstrates that profound

lifestyle changes are technically possible even in high-consumption urban contexts, such individual achievements remain exceptional. The critical question is not whether individuals can achieve strong sustainability, but how to create the cultural and social conditions where such practices become normalized rather than extraordinary.

There is an urgent need, especially among affluent populations, for sustainable lifestyle transformations. Research demonstrates that individuals and households can achieve substantial environmental impact reductions through lifestyle choices, with household consumption contributing to a significant share of global greenhouse gas emissions [2, 3]. The most impactful individual actions include living car-free, avoiding airplane travel, and adopting plant-based diets [4], while other consumption clusters provide less than 10% of total resource savings [5]. Top consumption options can yield 9.2 t CO2eq per capita reductions [6]—a substantial figure considering that in OECD countries in 2023 variation across member nations ranged from 14.4 in Canada to 1.7 in Costa Rica [7]. Globally, implementing low-carbon lifestyles among high emitters could reduce emissions by 10.4 gigatons CO2e, though rebound effects from re-spending savings offset 6.5–45.8% of expected benefits [8].

The urgency of achieving meaningful lifestyle change is compounded by systemic constraints that lock individuals into unsustainable consumption patterns. While individuals possess agency, personal goals, and value systems [9], they simultaneously face various incentives, choice constraints, and path dependencies often beyond their direct control. Current socio-technical systems create what Sanne [10] describes as deliberately constructed circumstances favoring work-and-spend lifestyles, while pervasive marketing, urban design prioritizing car-based mobility, and state subsidies for environmentally destructive practices—totaling at least $1.8 trillion annually [11]—maintain the "iron cage" of high material and energy infrastructures.

These structural forces manifest through what Siemoneit [12] terms "efficiency consumption"—the compulsion to consume goods primarily to increase personal time and cost efficiency, creating feedback loops that push both firms and consumers into a "logic of increase." Similarly, Curran, [13] identifies "defensive consumption," where individuals must increase consumption merely to maintain their current social position and practices. This defensive consumption is particularly powerful through "economies of dignity," where basic social participation requires certain consumer goods, effectively excluding those without them from important aspects of social life. Such systemic pressures mean that even within these constraints, motivated individuals often struggle to reduce their environmental impact significantly.

Yet research suggests far greater reductions are technically possible: decent living standards could be provided to the global population using 60–95% less energy than today [14–16], though such transformations require non-incremental changes in both provision systems and lifestyles. This gap between what is individually achievable within current systems and what is collectively necessary exposes what Akenji [17] terms "consumer scapegoatism"—the problematic tendency to place responsibility for sustainability solely on individual consumers while ignoring systemic drivers of unsustainable consumption.

Given these structural barriers, the question emerges: how can lifestyle changes toward strong sustainability be initiated and sustained? Participatory approaches have been identified as potential catalysts for change, with peer interactions recognized as

major driving forces behind sustainability transitions [18, 19]. Many behavior change interventions—especially top-down designs—overemphasize knowledge and information while neglecting that social practices are embedded in habits and norms [20]. In contrast, participatory initiatives start from the socially embedded nature of individual behavior, aiming to reshape pro-environmental social norms, provide mutual support, and challenge the dominant (over)consumption paradigm through collective action.

Central to achieving transformative change is the development of action competence, the capacity to act both now and in the future, and to be responsible for one's actions [21]. Action competence bridges the gap between knowledge and impactful practice by empowering people to identify sustainability problems in their own lives, evaluate alternatives, and take informed collective steps to change habits. Going beyond the mere transmission of facts, an action-competence approach develops critical skills in problem-solving, communication, and collaborative planning that increase personal agency and help situate individual choices within social and institutional contexts [22]. The development of action competence requires several key components: knowledge of available actions, confidence in one's ability to influence change, willingness to act, and, crucially, collective action and critical reflection that prioritize systemic change over narrow, individualistic approaches [23, 24].

This paper examines ecoclubs [25]—participatory research groups of university students who meet regularly to exchange practices and develop sustainable consumption habits—as a peer-to-peer approach to support lifestyle changes. Ecoclubs represent a distinctive, action-oriented research framework that combines elements from established programs, such as Global Action Plan's EcoTeam initiative, with principles of cooperative inquiry, but with a conscious emphasis on participatory design to harness peer influence and create new social norms within a group. Recognizing that social dynamics and peer interactions are major driving forces behind sustainability transitions, ecoclubs were designed as a peer-to-peer format to foster collective norm formation. In these groups, participants become co-researchers in their own lifestyle transformation, engaging in cycles of planning, action, and reflection on sustainable consumption practices within a supportive peer environment. By creating communities through ecoclubs, the self-reported experiences of lifestyle change in a democratic knowledge-creation process open the door to positive reinforcement and emotional support toward sustainability issues.

Our analysis focuses on a tension in behavior change towards strong sustainability: the relationship between participatory, bottom-up approaches and the achievement of strong sustainability outcomes. While participatory methods have been highlighted for their democratic knowledge creation and empowerment potential, questions remain about their effectiveness in catalyzing the radical lifestyle changes required by strong-sustainability standards. Specifically, we investigate whether participatory approaches can overcome the cultural barriers to reduced consumption, and whether participation can create engagement that leads to radical changes in the participant's lifestyle, achieving strong sustainability.

Through qualitative data analysis, this study explores the successes and limitations of a participatory, peer-led program intended to support lifestyle changes. We pay particular attention to the distinction between weak sustainability approaches—which focus on

optimizing choices within existing consumption systems—and strong sustainability [26], which demands that participants fundamentally reorganize their lifestyles.

Specifically, this study addresses three interrelated research questions: First, how can peer-to-peer participatory research methods (ecoclubs) enhance the transformation of sustainable lifestyle practices? This question examines the mechanisms through which participatory approaches facilitate or hinder lifestyle change toward strong sustainability. Second, how do peer-to-peer communities enhance sustainable lifestyle change beyond the individual level in ecoclubs? Here, we explore the collective dimensions of change and the potential for ecoclubs to generate spillover effects beyond individual behavior modification. Third, how can ecoclubs contribute to the development of action competence? This final question examines whether participation in ecoclubs enhances participants' capacity for continued and expanded sustainability action beyond the program itself.

Our findings contribute to understanding the dynamics of lifestyle change when strong sustainability is the goal. By examining the ecoclubs' peer-to-peer dynamics and their impact on radical lifestyle change toward strong sustainability, the research offers implications for the design of behavior change programs and contribute to ongoing discussions of the behavior–impact gap [27]. These results provide guidelines to design future behavior change programs that aim to navigate the productive tension between peer-led participation and expert intervention—creating spaces supportive enough for engagement yet purposeful and provocative enough—guided by a clear, strong-sustainability aim—to catalyze the behavior changes strong sustainability demands.

2 Behavior change programs

Sustainability behavior change programs have evolved from various theoretical and practical approaches, each attempting to address the gap between environmental awareness and actual behavioral transformation. Programs range from large-scale top-down interventions like Global Action Plan's EcoTeam Programme and Action at Home initiative [28], to university courses designed for long-term impact [29], to community-based initiatives supporting voluntary downsizers [30–32]. Meta-analyses demonstrate that while most interventions show potential for encouraging pro-environmental behaviors, their effectiveness varies considerably across contexts, target groups, and specific behaviors [33]. A review of university-based sustainability interventions [34] confirms this variability, finding that experimentation and intervention approaches achieved measurable behavior changes—such as 15% reductions in food waste and 7.6–19.4% decreases in energy use—while communication campaigns primarily improved awareness and attitudes without necessarily translating to behavioral impact. The review [34] notably highlights that interventions enabling sustainable choices through infrastructure changes, feedback systems, and incentives proved more effective than education alone, though most documented changes remained within incremental adjustments rather than the radical lifestyle shifts required for strong sustainability.

Accordingly, the most successful programs combine multiple intervention types—including information provision, feedback, goal setting, commitment mechanisms, and social support—rather than relying on single approaches [35, 36]. Critically, research shows that knowledge transfer alone is insufficient; successful behavior change requires

personal connection to issues, perceived agency, and sustained engagement that addresses both individual and structural barriers [29, 37].

The role of social dynamics and peer support emerges as crucial for achieving and maintaining lifestyle changes. Studies across different contexts—from Swedish voluntary downsizers to medical behavior change research—consistently highlight that being part of a collective effort multiplies individual impact and provides essential practical, cognitive, moral, and emotional support [30, 38, 39]. Participants in collective programs report that peer-to-peer interaction helps to overcome barriers through shared learning, mutual encouragement, and the creation of social norms that validate sustainability-oriented efforts.

However, reading the literature we see that this collective dimension can introduce a fundamental tension in program design. Gausset [40], studying 10 diverse Danish case studies ranging from individual-focused interventions such as energy-saving consultations to community-based initiatives such as eco-villages and cooperative housing, finds that community-driven efforts may require individuals to align their actions with collective goals and norms. In contrast, Singer-Brodowski [41] argues that to catalyze and accelerate sustainability transformations, participants need "spaces free of coercion" to engage in critical reflections regarding their lifestyles. This highlights an apparent contradiction at the heart of peer-to-peer sustainability initiatives: such spaces should remain non-coercive and participant-led, yet effective programs also require some degree of normative guidance and a strong sustainability orientation—a tension that successful programs must navigate.

Evidence suggests the most effective programs resolve this tension not by choosing one approach over the other, but by embracing this productive contradiction—creating environments where guidance and fact-driven facilitation coexist with participant agency and voluntaryism. For instance, successful interventions provide guidance on high-impact behaviors (reducing air travel, car usage, and meat consumption) while allowing participants to choose their own pathways within these parameters [35]. This approach acknowledges that while purely self-directed, peer-led processes may lead to minimal change, overly directive or coercive steering can undermine the intrinsic motivation necessary for sustained change [9], and suppress the emergence of peer interaction [28]. Programs that achieve substantial changes typically incorporate sustained support over extended periods, include real-world experimentation components, and crucially, address the structural conditions that constrain individual choices—often referred to as the handprint concept [42].

2.1 Participatory research in behavior change programs

Despite decades of research and implementation, significant limitations persist in achieving radical lifestyle changes through behavior change programs. Most documented changes remain at the level of low-cost or no-cost behaviors such as switching to eco-friendly products, while more fundamental shifts in consumption patterns—particularly reducing overconsumption—rarely emerge even among motivated participants [28, 39]. Hobson, [28] shows that large-scale, top-down, one-directional programs tended to conceptualize sustainable consumption as a technocratic, individualized rationalization task—focused on instrumental efficiency and consumer-preference change—while participants were more concerned with social justice, community, fairness and

structural constraints. Step-by-step information packs, assumed to trigger lasting change, were experienced as static, didactic, and simplistic; rather than mobilizing people, they often distanced participants from the project and left no space to explore what meaningful action on these wider concerns would entail. Svensson, [39] similarly finds that consuming less was hardly ever discussed as an attractive option: consuming less, was feared, could entail stepping outside the dominant social paradigm of consumer society, risking an image of not having enough money. These findings point to a need for approaches that can open deliberative spaces where participants collectively negotiate strong sustainability goals, address justice and structural issues, and critically engage with the social risks and meanings of consuming less.

Participatory research is particularly promising in this regard: unlike non-participatory behavior change programs that position people as recipients of interventions, participatory methods invite participants as co-researchers in their own change processes. Participatory and action-oriented research draws on diverse types of knowledge and aims to create actions based on such co-created knowledge. Crucially, this approach acknowledges that researchers and other participants are interconnected with their surrounding environment, making it impossible to separate themselves from it [43, 44]. Through collaboration, they can reflect on their subjectivity, emotions, and challenges while planning and implementing joint actions. This collaborative reflection addresses the need for critical examination of meaning perspectives, while the group setting provides the normative support that individual efforts often lack. This approach can foster individual responsibility concerning specific issues and enhance collective actions among participants [25, 45].

Moreover, action-oriented research can empower participants by encouraging them to feel that they can actively participate in shaping their futures, while also facilitating deeper and more critical understandings of their roles in influencing the world around them [45]. This empowerment directly addresses the limitations identified in conventional programs: by developing participants' capacity to question and reshape the very systems constraining their choices, action-oriented research moves beyond optimizing existing consumption patterns toward the radical transformations strong sustainability requires. The level of engagement and critical questioning of issues can be directed toward sustainability and sustainable consumption. Through democratic knowledge creation, a better understanding of sustainability can emerge, potentially leading to more democratic development of group actions by participants [25].

Participation is often emphasized in public debates and decision-making processes regarding sustainable consumption [46–48], yet there are still few initiatives that apply participatory or action-oriented approaches in research on sustainable lifestyles and consumption. This gap between theoretical recognition and practical application suggests an opportunity for empirical investigation.

Based on this research gap, we propose implementing an action-oriented experiment focused on democratic knowledge creation. Our ecoclubs represent an attempt to operationalize these participatory principles. Our objective is to measure how this participatory, action-oriented approach can lead to a more significant impact on ecological sustainability in individuals' lifestyles. In our research, we aim to explore how the participatory approach can facilitate radical changes and enhance action competence through the collective efforts of the participants.

3 Methods

3.1 Ecoclub as a cooperative research concept

To explore, understand and contribute to moving toward sustainable lifestyles, we have initiated participatory research among university students in the form of "ecoclub". Ecoclub refers to a group of students interested in sustainable consumption who regularly meet to exchange their everyday practices and habits. Our research relies on two concepts: (1) the concept of eco-teams developed by the Global Action Plan International organization (GAP) and (2) Eco-clubs and Eco-School programs in public education [49]. Following the principles of action research methods, among them especially cooperative inquiry, ecoclubs were organized as joint learning sessions in which every participant equally takes part in the process of knowledge creation and implementation of change. Participants all become co-researchers of sustainable consumption during the cycles of planning-acting-reflecting. (for more details of the research concept, see [25]).

Each wave of the ecoclubs was organised in the same setting, starting at the beginning of the university semester and lasting 12 weeks. Two initiating researchers began organising the group and invited co-researchers for the wave through their social networks. During this period, participants met biweekly and discussed different topics related to a sustainable lifestyle. (One exception was the first pilot wave, which was organised during COVID times, and this way was shorter and the format was online because of the restrictions of the pandemic.) Each participant was responsible for one occasion, presenting the topic, facilitating the discussion, or organising an interactive session. The topics of the ecoclub were decided in the first ecoclub meeting at every wave. For each two-week period, participants set challenges for themselves, and in the next session, they reflected on the experiences of those challenges. Those challenges led them to test sustainable lifestyle practices over the next two weeks.

The participatory nature of this program lies in the decision-making about the topics to be discussed. Participants shared responsibility for organising the meetings and set the challenges for the group. Each participant could raise their own challenges and learn from their peers' experiences. The democratic notion of ecoclubs is that all participants come from similar backgrounds and have similar roles in the process. Joining the ecoclub was voluntary, and it resulted in an engaged group of young adults who wanted to change their lifestyles to more sustainable ones and who dedicated their time and effort to doing so.

Trained researchers (the authors of this paper) served as mentors and provided methodological guidance to the initiating co-researchers through bi-weekly mentoring sessions. The mentors bridged the waves, collecting experiences and inviting new initiating researchers to the next wave. Mentors didn't take part in the ecoclub meetings, allowing participants to guide themselves and empowering them to serve as experts in their own sustainable practices. This way, participants could take ownership of their ecoclub process and create a democratic, safe space for honest reflection and discussion of sensitive topics.

For the details of the ecoclubs, see Table 1 below.

The voluntary approach to joining the ecoclub led to unbiased gender representation. As stated, in Hungarian society, well-educated women are more likely to be sustainable consumers [50].

Table 1 Context of data collection and sample characteristics.(source: own compilation)

	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7
Number of members	9	7	8	7	5	6	6
Gender of members	9 female	2 male, 5 female	1 male, 7 female	1 male, 6 female	1 male, 4 female	6 female	3 male, 3 female
Number of interviews	6	4	5	7	4	6	6
Timeframe	20/05/2021–22/06/2021	01/02/2022-30/06/2022	01/02/2022–30/06/2022	01/09/2022–30/01/2023	01/02/2023–30/06/2023	01/02/2024–30/06/2024	01/09/2024–31/01/2025
Format	Online	Offline	Offline	Hybrid	Offline	Offline	Offline
Community	University	University	University	Dorm	University	University	Dorm
Number of sessions	6	6	6	6	6	6	6
Regularity of sessions	Weekly	Bi-weekly	Bi-weekly	Bi-weekly	Bi-weekly	Bi-weekly	Bi-weekly

3.2 Data collection

During all waves of cooperative inquiry, qualitative data were collected in a systemic way using surveys, interviews and reflection diaries of the participants. In this paper, we analyzed the semi-structured interviews conducted at the end of all waves of ecoclubs by the participating co-researchers as those includes the data that can help us answer the research questions. The data was collected over seven waves of ecoclubs, between 2021 and 2025. Altogether 38 semi-structured interviews were conducted with ecoclub members, each between 25 and 60 min. All participants were university students of Hungarian nationality living in the capital city Budapest. To ensure anonymity of research participants, we collected limited demographic data (for details, see Table 1). The interviews were conducted in Hungarian by initiating co-researchers (students who organized the ecoclubs) after the ecoclubs ended. Although these students were not trained interviewers, which limited the depth of conversations, they all followed the same interview guide (see Appendix), ensuring consistency. Additionally, they knew the interviewees beforehand, which resulted in honest and insightful conversations.

All interviews were recorded and then transcribed. Due to the international research team, some interviews were translated into English and then coded. However, the majority of interviews were coded in the original language (Hungarian) to facilitate a deeper understanding of the data.

3.3 Data analysis

This study employs a qualitative approach, utilizing the thematic analysis method [51]. For the thematic analysis, a coding framework was developed to be employed deductively on the data. First, three members of the research team conducted a pretest on three interviews to test the initial framework and compare results. This process resulted in the integration of emergent themes. For instance, the barriers to change were included in the first version, which we later extended with the enablers of change. After refining the coding framework and discussing all coding differences within the research team to

Table 2 Summary of results.(source: own compilation)

	Immaterial aspects	Material aspects
Micro changes	Positive and more critical attitude towards sustainability Reflection on lifestyle choices Taking responsibility for achieving change Focus on small changes More planning and information gathering Stronger emotional or spiritual connection to nature Experiencing inner pressure to act	Mainly small, not radical changes in the household Choosing greener alternatives Reducing consumption in some areas Reusing some objects
Barriers of change	Lack of motivation Lack of social support Financial and time constraints Perceived lack of influence on the economic and political system Disliking green products/solutions	Missing infrastructure Living conditions Culture of overconsumption
Enablers of change	Peer learning in a structured environment Discussions in open-minded communities Experiences and sustainability challenges Relationship building with nature Long-term habits Family background and core values Inspiration from others and the media Climate anxiety	Living in an open-minded community Good infrastructure Green public spaces Financial stability
Spillover actions	Conversations with others Informing themselves more about sustainability Writing and publishing about sustainability Change in career or studies towards sustainability Organizing events	Building composting system in a dorm
Signs of action competence	Continuing habits Self-efficacy beliefs Being able to achieve change in other settings Intention to act sustainably in the future Willingness to volunteer	

enhance intercoder reliability, the data were coded using NVivo 15.2.2 software. Each interview was assigned to one researcher, and after coding, all results were compared and summarized across interviews within categories. We chose to follow this process because the pretest and the well-structured interviews ensured intercoder reliability.

The initial coding approach addressed behavior–impact gap, strong sustainability, and action competence. Analysis of the material revealed only limited codable findings, with no radical changes identified. The coding system was therefore refined with focus on (1) Micro changes, (2) Barriers of change, (3) Enablers of change, (4) Spillover effects – meaning actions that were conducted outside of ecoclub setting, and (5) Signs of action competence with 1–4 distinguishing between immaterial and material dimensions.

4 Results

In the following section, we first introduce how ecoclubs enhance the development of sustainable lifestyle practices, differentiating between immaterial and material changes and the factors that enable or hinder them. Second, we describe results showing how participants enhance sustainable lifestyle change outside ecoclubs – we refer to these as spillover actions. Finally, we explore how ecoclubs contribute to the development of action competence and map its signs among participants. For a short summary of the results, see Table 2. below.

4.1 Micro changes in the lifestyle and attitude of ecoclub participants

The results of our analysis show that ecoclub participants mainly experienced immaterial changes, although their bi-weekly challenges and discussions focused on reaching material lifestyle changes and creating new habits. Considering the immaterial changes, they developed a positive attitude towards sustainability and expressed a willingness to take more responsibility for environmental action. This attitude developed during the ecoclubs: "by the end, you feel like you are doing it for yourself" (wave 2, interview 1). The participants also expressed a more critical attitude towards their own lifestyles, the principles of minimalism, and paid more attention to signs of greenwashing and the durability of products. A reflection included: "I think that environmental protection is the consequence of a balanced lifestyle" (wave 7, interview 5).

They also invested more effort into informing themselves and planning new activities connected to sustainability which shows raised awareness of the topic. The following sentences showcase an open-minded approach: "I pay attention to what others can teach me" (wave 7, interview 2) and "It is very useful when we gain new perspectives from other people's stories. I also changed and became more open and interested in new opportunities" (wave 3, interview 1). In some cases, this sensitivity even resulted in a strengthened emotional or spiritual connection to nature.

In addition to these positive changes, we observed resistance towards profound change. Participants generally wanted to stay in their comfort zones and not divert from long-term habits: "Honestly, I don't think that I would do anything differently. I probably did things this way because I found these [choices] good" (wave 7, interview 2). The results also show a focus on small steps and an attention to details instead of strong sustainability lifestyle changes. "I think that this is an area where I can do something without too much effort and without having to give anything up" (wave 1, interview 1). However, some participants developed a feeling of guilt, which resulted in an inner pressure to act. For instance: "When I threw the plastic into the wrong bin, I went back and changed it because it did not let me rest" (wave 7, interview 5).

Besides these immaterial aspects, we also identified the material changes which happened on the individual level. These were mainly minor changes to the household based on the mindset that every small step matters in achieving a sustainable lifestyle. For instance, participants reported: "I no longer buy plastic bags at all. I bought textile bags, and I always use them to buy baked goods and fruit" (wave 4, interview 5) or "I pay attention not to buy clothes unnecessarily and wear each item at least 30 times" (wave 4, interview 7).

Despite these small efforts, multiple participants could not name more significant changes that they implemented during the duration of the ecoclub: "Maybe something happened, and I just don't remember, but I don't know" (wave 1, interview 3). Some argued that they already lead a sustainable lifestyle: "I felt that I was already dealing with this a lot, and during the conversations I often felt that, well, I already knew about this topic" (wave 1, interview 6). However, participants talked about switching to more sustainable products like environmentally friendly detergents or bamboo toothbrushes. "I think we have very good alternatives, and this is minimal effort that I am willing to put in to hinder the perishing of the world" (wave 3, interview 4). Others also talked about reducing their consumption (especially meat, packaged foods and clothing), reusing products (mainly clothing and electronics), and recycling (mainly waste and packaging).

However, we could not observe any strong sustainability practices, for instance, switching to a vegan diet or not flying anymore. Participants hardly changed their mobility or travel habits or their general consumption patterns.

4.2 Barriers to change

The previous results show that participants experienced difficulties when changing their lifestyles. Thus, we identified the barriers they mentioned in the interviews, including material and immaterial aspects. Considering the latter, lack of motivation and laziness were prominent barriers. For instance, some members continued the ecoclub challenges only in theory, not practice: "I see the alternatives now, for instance, I can image going to a packaging free shop again sometime" (wave 7, interview 2). Additionally, participants had a general lack of knowledge of major impact changes. Hence, their actions did not match the scale of transformation required to effect change. The heightened focus on packaging (not the products themselves) and on buying green alternatives rather than changing consumption patterns are signs of knowledge gaps.

Additionally, many participants had a high price perception and thought that a sustainable lifestyle is too expensive. Due to their limited budget as university students, this appeared to be one of the main barriers to change: "Lately, cost effectiveness is in the focus for me, not sustainable lifestyle" (wave 4, interview 4). Participants also had time constraints and a high workload due to side jobs and university studies. "The first barrier for me is money, the second is time" (wave 4, interview 6). Although this was a common perception among interviewees, some changed their approach: "My perspective changed because many things are not that complicated to make like I thought before. Making detergent at home for washing takes like ten, fifteen minutes" (wave 4, interview 2), "It could be cheaper, so I don't understand why we are not doing it" (wave 4, interview 2).

Participants also reflected on the lack of social support or experienced resistance. For instance, "the skepticism of my acquaintances hindered me. They said that I am a complete fool to prepare our own detergent" (wave 4, interview 2). Some participants also referred to political and economic conditions as barriers and emphasized the lack of action around sustainability. For instance, firms that do not aspire to be more sustainable and uphold the systemic status quo. "Obviously, it is very important that we take every small step we can, and I believe that I am doing so. However, most decisions are made at the state and corporate level, which I find extremely sad" (wave 3, interview 2). Hence, some participants perceived a lack of influence on the socio-economic system and the culture of overconsumption, which discouraged them from taking action.

In addition to these immaterial aspects, a few material barriers also emerged. Participants noted missing infrastructure in terms of mobility (for example, bike lanes) and sustainable shopping (for example, packaging-free stores). Their living situation also emerged as a barrier to change because most of them did not have their own households and lived in dorms, with the family, or shared a flat with roommates. The presence of others resulted in difficulties because notable changes should at least be implemented in households, and not everyone seemed to be open to more sustainable solutions.

4.3 Enablers of change

Some immaterial aspects of ecoclubs were noted as enablers of change in interviews. Peer learning, knowledge and experience sharing motivated participants: "It was helpful

that I was not going and trying things alone but together with others. I think it is better to do these things in a community" (wave 2, interview 2). The structure and rules of ecoclubs created a safe space: "It was so much easier to communicate and ask for help. And if we noticed something new, we could tell each other – this was very good" (wave 4, interview 5). The bi-weekly challenges participants completed helped reduce the complexity of issues and put theory into action: "When we had a meat-free week I felt like I have to figure out what to eat because I have to step out of my comfort zone" (wave 4, interview 2). The discussions during ecoclubs reinforced positive feelings: "I could tell them that I was good at something and from this small pride, very good discussions could emerge" (wave 4, interview 6). The shared successes contributed to a positive and more open-minded attitude towards sustainability. The conditions of ecoclubs also worked as enablers: some noted that public spaces like parks and time spent outside motivated sustainable behavior.

Participants were also inspired by others outside ecoclubs and consumed sustainability content on social media, especially from influencers and Facebook groups. Additionally, family background and values adopted in childhood helped bring about change. For instance, a participant explained that she grew up in the countryside, where her family grew their own vegetables, used compost in the garden, and paid attention to the environment. Thus, she could develop long-term habits which help her maintain a green lifestyle. This example also shows that building relationships with nature, for instance, caring for plants or going hiking, can be an enabler of change. Some participants also discovered connections between health and sustainability, particularly in nutrition and the reduction of climate anxiety. "I occupy myself by creating stuff which makes it easier for me to accept the situation [of the climate crisis]" (wave 4, interview 2).

Among the material enablers, financial stability emerged, complementing the belief that a sustainable lifestyle is expensive. Another solution was discovered by the ones living in dorms – they emphasized that sourcing as a community is beneficial to achieve change. They can coordinate efforts, discuss choices, make shared decisions on what to buy for the building, and shop in larger quantities. Good infrastructure in cities, like public transportation and bike sharing, can also enhance change.

4.4 Spillover: changes beyond ecoclubs

The changes achieved individually sometimes motivated participants to reach others outside of ecoclubs. The spillover effects of ecoclubs were mainly immaterial, like continuing habits started during the ecoclub in the long run. Conversations and debates with people close to them were more prominent: "I tried to pass on what I had learned here, because I really gathered a lot of information which I tried to apply in a smaller circle, like at university, and I also spread the word a bit among my circle of friends" (wave 1, interview 6). Multiple participants focused on achieving lasting changes within their families: "My grandma has a chicken coop, and I convinced my mother to bring leftovers there on weekends when we visit her" (wave 4, interview 2).

Participants also engaged in other communities by organizing sustainability-related events or volunteering. "Actually, I really missed doing something like volunteering, where you feel like you're part of a team, and you're not there because you're getting credit [at university] or because you have some interest or obligation, but because you're freely and voluntarily coming together for a good cause" (wave 6, interview 1). Others

wrote and published articles about sustainability and explored the topic deeper by consuming more related media content. Some even chose related courses at university or made a career change towards sustainability. "The ecoclub indirectly had a big impact on me. I changed my PhD research topic to focus more on environmental protection" (wave 5, interview 4).

We only found one material spillover in the data: participants collaborated in a dorm and built a composting system, which community members continued to use for years after the clubs ended. Despite these efforts, participants expressed frustration about the social context not changing and having difficulties convincing other community members.

4.5 Sings of action competence

The spillover activities of former ecoclub members show signs of action competence on the individual level. Some participants expressed a willingness to change their lifestyles even more and crafted plans for the future. "On the long run, I would like to have a garden where I grow vegetables. Currently, my [living] conditions don't allow it, but it is a long-term goal" (wave 7, interview 2). They showed determination to continue green habits and to achieve change in settings beyond ecoclubs. For instance: "I think I try to stick to cooking for myself as much as possible so that I don't have to buy single-serving meals, which produce a lot more waste" (wave 1, interview 4). This commitment shows that participants might identify problems in their own lives and evaluate alternatives. Some expressed self-efficacy and hope for the future: "You can convince others. There is change in the world, you can bring about change" (wave 1, interview 2). However, involving others in change processes – an integral part of action competence—was only mentioned by participants but not realized. Thus, we identified a missing element: striving to turn plans into collective action.

The results show a lack of radical behavior change. Most changes occurred at the individual level and did not amount to the kinds of lifestyle shifts that strong sustainability requires, as they left high-impact behaviors and overall consumption patterns largely unchanged. Efforts to organize changes that could foster beyond-individual shifts toward strong sustainability—extending beyond the immediate peer-to-peer group—remained at the level of ideas and were never translated into concrete, realized actions. The barriers causing this situation were mainly psychological, including preconceptions about the costs and efforts required for sustainable lifestyles. However, the results show that shared experiences in a peer-to-peer environment can enable change and lead to a new, more open and positive attitude towards sustainability. In addition, we identified signs of action competence and spillover actions completed outside of ecoclubs – these results show potential for taking steps toward more sustainable lifestyles.

5 Discussion

Our analysis of ecoclubs reveals a fundamental challenge in participatory sustainability programs: while these participatory peer-led groups successfully fostered pro-environmental attitudes, positive emotions and community building, they failed to generate the radical lifestyle transformations necessary for strong sustainability. This gap between participatory aspirations and transformative outcomes points to critical tensions in designing interventions for sustainable consumption. As mentioned above, the mentors

(faculty with a background in sustainability) first reached out to students willing to voluntarily organize ecoclubs and supported them in setting up the basic framework of the program—how often to meet, how to record data from their efforts. Contact between faculty and students focused on organizing and social-dynamics questions rather than on developing a strong sustainability orientation. Mentors did not participate in or intervene during the ecoclub meetings themselves; they only rarely suggested more demanding, strong-sustainability efforts, and even more rarely (with one notable case described above) did a student assume the role of a provocateur. As the students themselves did not possess a strong sustainability orientation, such an orientation did not develop within the groups. This absence of interventions or provocation that might have fostered more radical lifestyle changes contrasts sharply with more directive approaches that successfully achieve such changes.

5.1 Productive contradiction: peer-led participation and strong-sustainability expert intervention

Our findings address a central tension in behavior change programs: the potentially productive contradiction between voluntary, peer-led engagement and strong-sustainability expert intervention. Successful programs seem to resolve this contradiction not by choosing one approach over the other, but by embracing it, creating spaces where expert facilitation and participant agency coexist dynamically. The peer-led ecoclubs, however, did not capitalize on this tension. By prioritizing participation and operating with virtually no strong-sustainability expert intervention, they failed to create the conditions necessary for strong sustainability lifestyle transformations. This stands in sharp contrast to programs that deliberately combine participatory formats with strong sustainability guidance. One program that explicitly targets strong sustainability is the Finnish School of Self-Sufficiency. In an immersive, on-site setting, participants learn practical and process skills—such as growing and storing vegetables, composting, foraging, firewood production, basic repair and maintenance, and small-scale construction [52]—aimed at increasing independence from money [53]. These hands-on, peer-supported practices are reported to foster closer, more realistic relations to the local environment, greater appreciation of tools and bodily capacities, and awareness of personal limits and self-care [52]. The School thus exemplifies how participatory, community-based formats can be combined with a clear, strong sustainability orientation and demanding practical expectations, in contrast to more technocratic, non-participatory behaviour-change programmes.

While ecoclubs were successful in engaging participants in the program, there were no dropouts during the seven waves of the program; the sense of belonging and the community feeling kept participants staying throughout all rounds. This missing element becomes evident when comparing ecoclubs to more impactful university-based interventions. In a climate change course at San Jose State University, around 10% of the students reported significant 6–8 t CO_2/year reductions. Even if still below the deeper cuts implied by strong-sustainability targets, it is substantial for an educational intervention. These reductions came from changes across multiple domains: waste (more recycling and composting, buying less-packaged and reusable goods), home energy (energy-efficient bulbs and appliances, purchasing renewable electricity, installing solar panels), transportation (choosing more fuel-efficient cars, using public transit, bicycling,

carpooling), and food (selecting lower-carbon options). Crucially, the course combined intensive scientific content with structured, long-term engagement: a personal carbon-footprint plan, a year-long community action project targeting real-world emission reductions, and explicit work on communication and social norms, all designed around enhancing ownership and empowerment. Graduates reported a strong personal connection to climate solutions that carried into their daily lives and careers (Cordero et al. 2020)—precisely the kind of guided, high-impact, expert-designed framing that ecoclubs, as short, peer-led and largely unguided spaces, did not provide. An important caveat is that the Cordero et al. [29] results are based on students surveyed at least five years after completing the course, so while we can compare the program designs, we cannot yet know whether the impacts of ecoclub participation will look similar—or different—when our participants are reassessed after a comparable time span.

The persistence of the behavior-impact gap in ecoclubs reflects deeper challenges in achieving strong sustainability through voluntary group processes alone. As Neumayer [54] argues, strong sustainability requires acknowledging absolute ecological limits that cannot be substituted by technological or social innovations. Yet ecoclubs' discussions rarely approached these uncomfortable boundaries, focusing instead on incremental steps that ultimately reinforce weak sustainability approaches—optimizing within the system rather than transforming it. The few instances of genuine action competence we observed—such as the dormitory composting initiative—emerged when participants moved beyond individual behavior to address structural barriers collectively. It's important to note that ecoclubs consisted of university students who often have limited control over their living spaces, which may have constrained their ability to implement more radical changes.

5.2 Seeds of transformation: community norms and future potential

Despite these limitations, ecoclubs demonstrated significant potential in one crucial area: fostering a positive attitude towards sustainability and community engagement. As Douglas [55] argues, culture functions as a way of thinking that justifies a way of living. Participants in ecoclubs construct new normative frameworks through collective meaning-making. Ecoclub participants reported that peer support and shared experiences validated sustainable choices that might otherwise seem socially deviant or impractical. This normative shift represents what we conceptualize as seeds of transformation—foundational changes in values and social acceptance that may enable more radical actions in the future. The positive feelings, enhanced environmental awareness, and strengthened community bonds that participants developed may serve as crucial psychological and social resources for future sustainability actions. Given that participants were young adults at the beginning of their adult lives, these "seeds" of action competence and alternative norms may germinate into more transformative practices aligned closer to strong sustainability requirements as they gain greater autonomy over their living situations and consumption choices.

5.3 The limits of pure participation in self-organized formats: missing the provocateur

As our findings suggest, developing action competence may require more than peer support alone. The ecoclubs' inability to achieve strong sustainability changes can be understood partly through transformative learning theory [41, 56]. Transformative learning

contributing to behavior change requires "disorienting dilemmas" (Herbers and Nelson [57])—situations where existing meaning-making no longer suffices and thus trigger critical reflection and transformation [58]. Such dilemmas provoke examination of fundamental assumptions and the value system underlying consumption and lifestyle. However, ecoclubs' strong emphasis on supportive, non-judgmental peer environments appears to have shielded participants from these necessary disruptions: they largely remained within existing worldviews, optimizing consumption choices and only occasionally questioning the growth-consumerist paradigm itself.

Behavior change requires more than awareness: learners need in-depth issue knowledge, skills in analysing and investigating issues, citizenship skills for collective action, and an instructional setting that builds an internal sense of control over outcomes [59]. While ecoclubs nurtured sensitivity, interest and peer support, they offered little structured development or practice of issue-analysis and citizenship skills and did not systematically strengthen students' sense that they could effectively act together—key gaps for fostering strong-sustainability behavior change.

5.4 Implications for Behavior Change Model Design

Based on our results, we suggest that behavior change programs aiming at strong sustainability should be built on participatory design—capitalizing on socializing, engagement building, encouragement, and horizontal knowledge and experience sharing—while also incorporating mechanisms that steer thinking and practice toward strong sustainability, by intentionally channeling and conveying appropriate knowledge, practices and attitudes—whether through direct or indirect expert involvement or other suitable means. Specifically, future participatory behavior change programs should include further elements:

1. **Introduce deliberate provocations** that challenge consumption norms while maintaining psychological safety for exploration and habit development.
2. **Provide fact-based inputs** on systemic drivers and high-impact behaviors without diminishing participant agency or creating paralyzing feelings.
3. **Facilitate critical reflection** that connects personal choices to political-economic systems.
4. **Enable learning of strong sustainability practices** and application of fact-based planetary boundaries knowledge.
5. **Build action competence**, supporting development from individual behavior change to collective action addressing structural barriers.

The challenge for behavior change programs lies not in choosing between peer-led participation and strong-sustainability intervention(s), but in skillfully orchestrating their productive tension. We argue that programs should create spaces that are simultaneously supportive and disruptive, voluntary and steered by strong sustainability goals, comfortable enough for engagement yet impactful enough for transformation. We argue that this balance can enable peer-led interventions to move beyond reinforcing weak sustainability, and catalyzing the radical lifestyle changes that strong sustainability demands, and do this in a participatory, that is engagement-enhancing way.

6 Conclusion

This study examined whether participatory, peer-led approaches in a university setting can catalyze the radical lifestyle transformations necessary for strong sustainability. Our analysis of seven waves of ecoclubs reveals that while peer-to-peer groups successfully foster environmental awareness and community building, they fail to generate the radical lifestyle changes and practices consistent with strong sustainability.

The ecoclubs' methodology embodies a fundamental challenge faced by behavior change programs aiming for strong sustainability. By prioritizing non-judgmental peer support and community-based democratic rules over critical provocation, these groups inadvertently protected participants from the "disorienting dilemmas" that transformative learning theory identifies as essential for questioning foundational assumptions. Peers did establish connections with each other and got more engaged in the program, they did received positive emotional support that fostered a positive attitude toward sustainability issues. On the other hand, participants optimized consumption choices within existing systems rather than challenging the growth-consumerist paradigm itself—a pattern that reinforces weak rather than strong sustainability.

Yet our findings also identify important "seeds" of transformation. The positive environmental attitudes, strengthened community bonds, and emerging action competence developed through ecoclubs may germinate into more radical practices as these young adults gain greater autonomy over their life circumstances. The dormitory composting initiative—a rare instance of collective structural change—hints at what becomes possible when groups move beyond individual behavior modification.

These results suggest that impactful sustainability interventions must embrace rather than avoid the productive tension between engagement-building voluntary participation and demanding strong sustainability orientation. Programs require deliberate provocations that support participants in going beyond low-cost solutions, challenging consumption norms, providing fact-based insights into systemic impacts, and facilitating critical reflection that connects personal choices to political-economic structures. Without such intentional design, even well-meaning participatory approaches risk reinforcing the very patterns they seek to transform. We learned that university-based peer-led programs require a balance of peer-to-peer dynamics and strong sustainability-oriented interventions—creating spaces that are supportive enough for engagement yet provocative enough to engage with the values and systemic thinking necessary for adopting strong sustainability lifestyles.

As our study has a main limitation, it was conducted with university students who have restricted autonomy over living situations and consumption choices, representing a specific population whose experiences may not be generalizable. Additionally, the relatively short timeframe prevents assessment of longer-term impacts. For further investigation, addressing the limitations of this short-term intervention involves analysing long-term behaviour change and evaluating the long-term impact of participating in ecoclubs. It would be valuable to investigate how participants integrate aspects of action competence and strong sustainability into their personal or professional practices later in life and examine whether the assumed seeds of transformation grow into public engagement towards sustainability transformations in practice.

Appendix

Interview guide

Introductory questions

- Please recall what you remember about the ecoclub! What is your fondest memory?
- Looking back, what did you dislike? Do you have any particularly bad memories?
- How did you feel about the ecoclub sessions overall?
- Did you experience any significant changes in your lifestyle during the ecoclub?
- Is there an area in which you think you have changed or developed significantly? Which one is it? To what do you attribute the success?
- Was there a change that you had difficulty introducing or practicing during the ecoclub? What was it and why did you find it difficult?
- Overall, are you satisfied with the challenges you have taken on? What factors did you consider when choosing your challenges?

Thematic questions (asked about each ecoclub session, adjusted to the topics of sessions):

- What characterizes your current (insert topic of session, e.g. food consumption) habits from a sustainability perspective?
- What habits have you developed in this regard because of participating in the ecoclub?
- What characterizes your current (insert topic of session) habits in terms of sustainability?
- Have you developed any new habits in this area since the end of the ecoclub What hindered and what helped you?

Closing questions:

- Which habits have you introduced into your life during the ecoclub and still practice today?
- Have you experienced any significant changes since the ecoclubs ended?
- Are you currently taking steps to protect the environment?
- Are there any sustainable habits you would now like to introduce into your life? What helps and hinders you from starting them?
- Do you talk to others about sustainability? What do you talk about and who are they?
- When you adopt new habits, where do you get inspiration from?
- Are you part of any sustainability-related groups outside of ecoclubs?
- What advice would you give on organizing the next ecoclubs?

Author contributions

G.K. conceptualisation, writing, data analysis, literature review, T.V. conceptualisation, literature review, writingT.T. data analysis, data curation, writingM.S. data analysis, writingAll authors reviewed the manuscript.

Funding

Open access funding provided by Corvinus University of Budapest. No funding was received for conducting this study.

Availability of data and materials

The datasets generated during and/or analysed during the current study are not publicly available because they contain qualitative data obtained with the consent of the participant eligible for this study, but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The research has received ethics approval from the Research Ethics Committee of Corvinus University of Budapest, No. KRH/35/2022 and certify that the study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Consent to participate
Informed consent to participate in the study was obtained from participants.

Consent for publication
All participants provided informed consent for the publication of anonymized data collected during the study for publication.

Competing interests
The authors declare no competing interests.

Received: 30 September 2025 / Accepted: 9 April 2026
Published online: 25 April 2026

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