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Review

Engaging Young People in Climate Change Action: A Scoping Review of Sustainability Programs

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Abstract: Young people are stepping forward and engaging in or leading programs promoting climate action and sustainability. To optimize program outcomes, it is important to understand the nature of these programs, as well as their successes and enablers. Consequently, a scoping review was conducted across six databases, Taylor and Francis, Medline, Web of Science, Scopus, Sage and Wiley, to examine existing programs that promote climate change action amongst young people aged 12 to 25 years. The review sought to determine what is known about these programs and their outcomes by documenting what elements contribute to successful behavior changes in young people. Forty-eight articles were included in the review, with almost half of the studies from the United States. Eight elements recurred throughout the reviewed journal articles including intersecting external and internal factors contributing to reported behavior change. External factors included the social environment, place, knowledge, leadership and goal setting development that fostered internal factors that included, self-efficacy, identity, agency and action competence, and systems thinking. Learning from these programs to improve design and ensure sustainable outcomes is key to improving the capabilities of young people to continue responding to the climate challenge.

Keywords: climate action; young people; youth; sustainability; behavior change; programs

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1. Introduction

With climate change one of the largest threats to the planet and humankind, urgent climate action is required to transition to more sustainable societies. Breaking down climate related issues and promoting effective climate action among young people is one way to prepare them for the challenges they will face in their future. Young people have expressed their concern about their futures [1–3] and their voices are now at the forefront of climate activism, leading them to become official stakeholders at COP27 [4].

Consequently, questions have arisen amongst researchers, activists, policymakers and others about how best to engage, support and empower young people. The need for climate education comes at a critical time, with the latest IPCC report [5,6] indicating that we are not on track to meet 1.5 °C and that young people and future generations will be the most impacted by climate change, creating a global intergenerational justice issue [5]. To address this, it is imperative that young people are provided with the support and opportunities for adequate climate education to ensure they have the agency and capacity to take action now and in the future [6]. Climate education for young people has also become an area of focus for the UNESCO's global Education for Sustainability Development 2030 framework [7],

where it has been recognized that education is key to empowering and mobilizing young people across the world to take action [7].

Despite this, young people do not always feel well equipped with knowledge and education around climate change. For example, Australian research conducted in 2020 by the Australian Institute of Disaster Resilience (AIDR) and World Vision on almost 1500 10-to-24-year-olds found that 90% expressed they were not sufficiently educated in school about climate change [8].

This raises questions about how to effectively engage more young people from across the globe in climate change programs to enrich their learning. A recent systematic review of the types of climate change education by Rousell and Cutter-Mackenzie-Knowles [9] found that top-down science education in school settings is the dominant approach, despite the need for climate education to address the cultural, political and economic aspects of climate change [6]. Other research has explored multi-dimensional modes of climate education through engaging young people as "co-researchers" [10] to empower and increase agency in young people [11].

However, there is a lack of synthesis and analysis that purposefully aims to better understand what elements of climate programs have a positive impact on young people's behavior. Therefore, this scoping review aims to map the literature currently available to identify what is known about programs focused on climate change and sustainability, and their outcomes in influencing young people's behavior. The age definition of young people varies in the literature; however, recent policies, youth advisory groups and programs uses the age bracket of 12–25 years as their definition of "youth" [12–14]. As such, this review serves to inform the design of targeted and effective programs for youth climate action.

2. Materials and Methods

We used Arksey and O'Malley's (2005) framework [15] for scoping reviews to identify programs that aim to change or enhance climate or environmental related behavior in young people aged 12 to 25 by: (1) examining the extent and range of the available literature to map the existing programs for young people; and (2) identifying research gaps in the existing literature. The review was guided by the following research question: what is known about the design of climate related behavior change programs and their outcomes for young people between the ages of 12 and 25?

Underpinned by a systematic search of selected databases according to PRISMA guidelines [16], relevant articles were described according to program type, population, geographical location, method and design, outcome, study aims and study quality (using Mixed Methods Appraisal Tool [MMAT] guidelines) [17]. The included studies' quality was appraised based on the checklist for the appropriate study type (mixed-methods, qualitative or quantitative studies) and given a star rating out of five (1 star = 20% of criteria met, two stars = 40%, etc.) However, as a scoping review, our aims were not to critically appraise the studies, but rather to synthesize what literature is available; as such, no papers were excluded based on this analysis. The overall aim of this review is to better inform the design and conduct of programs that seek to promote young peoples' climate change and environmental behavior; therefore, recurring elements are noted and presented within a narrative format.

Databases searched in April 2022 included Taylor and Francis, Medline, Web of Science, Scopus, Sage and Wiley. Included papers from the initial search were exported into the referencing manager Endnote. The key search terms across these databases were "("climate change" OR sustainable*) AND (youth OR "young adults" OR "young people" OR "emerging adults" OR adolescent*) AND (education OR program* OR intervention OR "environmental education" OR campaign OR activism) AND ("behavior* change" OR "behavior* change" OR "civic engagement" OR "political action" OR "environmental action"), using title, keyword and abstract or title options to identify papers. The search strategy was deliberately broad to ensure the inclusion of programs that were implicitly part of climate action. For example, due to the limited results using only "climate" as a key

word, we increased the search terms to include "sustainability" to ensure that we captured programs related to environmental actions (e.g., energy saving or consumption patterns) that may not have been explicitly named a "climate" program. Only peer-reviewed literature from 2010 to April 2022 was included to ensure the review was up to date with recent initiatives. Additionally, no exclusions on geographical location allowed for exploration of programs emerging in low to middle income contexts. The inclusion and exclusion criteria are presented in Table 1. While the demographic inclusion criteria included young people between the ages of 12 and 25, studies that focused on this demographic combined with older or younger people were also included. Following the PRISMA [16] steps, references of included studies were screened following those criteria outlined in Table 1 to identify any additional studies eligible for inclusion that were not identified in the database searches.

Table 1. Inclusion and exclusion criteria of studies to be included in scoping review.

Inclusion Criteria	Exclusion Criteria
• Intervention, programs or experimental studies aiming to educate and/or change behavior in young people related to climate change, climate action or sustainability • Peer-reviewed • No limit on geographical location • Within the last 10 years	• Studies where the primary age of participants was children under the age of 12 or adults over the age of 25 • Programs not related to climate change or sustainability • Book chapters, conference papers and grey literature • Studies not in English language

Studies included discussed both programs and interventions. Both were understood in the literature as being a set of activities that had the aim of mobilizing climate action amongst young people. We have used the term 'program' throughout; however, we acknowledge that studies, particularly those that were experimental in nature, used the term 'intervention'.

3. Results

Forty-eight articles met the inclusion criteria, including 10 that were identified by reference list searching of eligible studies (Figure 1).

Table S1 in the Supplementary Materials summarizes the characteristics of the included studies as they relate to the focus of this scoping review and includes a quality assessment rating, using the MMAT criteria (Hong et al., 2018). Thirty-five percent of the studies scored 60% or higher based on the MMAT criteria [17].

3.1. Study Locations, Designs and Methods

As shown in Table S1, almost half of the studies were carried out in the USA (n = 20 of 48). This was due to the inclusion of summer camp programs which are common in the United States. Two studies were related to the same program "Youth Leading Environmental Change Project". Four studies were multi-country studies. Four studies were based in Germany, four in Canada, two in Portugal, two in New Zealand, two in Malaysia and two in the Netherlands. One study occurred in Costa Rica, Colombia, Japan, Belgium, the United Kingdom, Thailand, Vietnam and China.

Table 2 describes the diverse research methods that were employed by the researchers. Surveys and interviews (semi-structured and structured) were the most common forms of data collection.

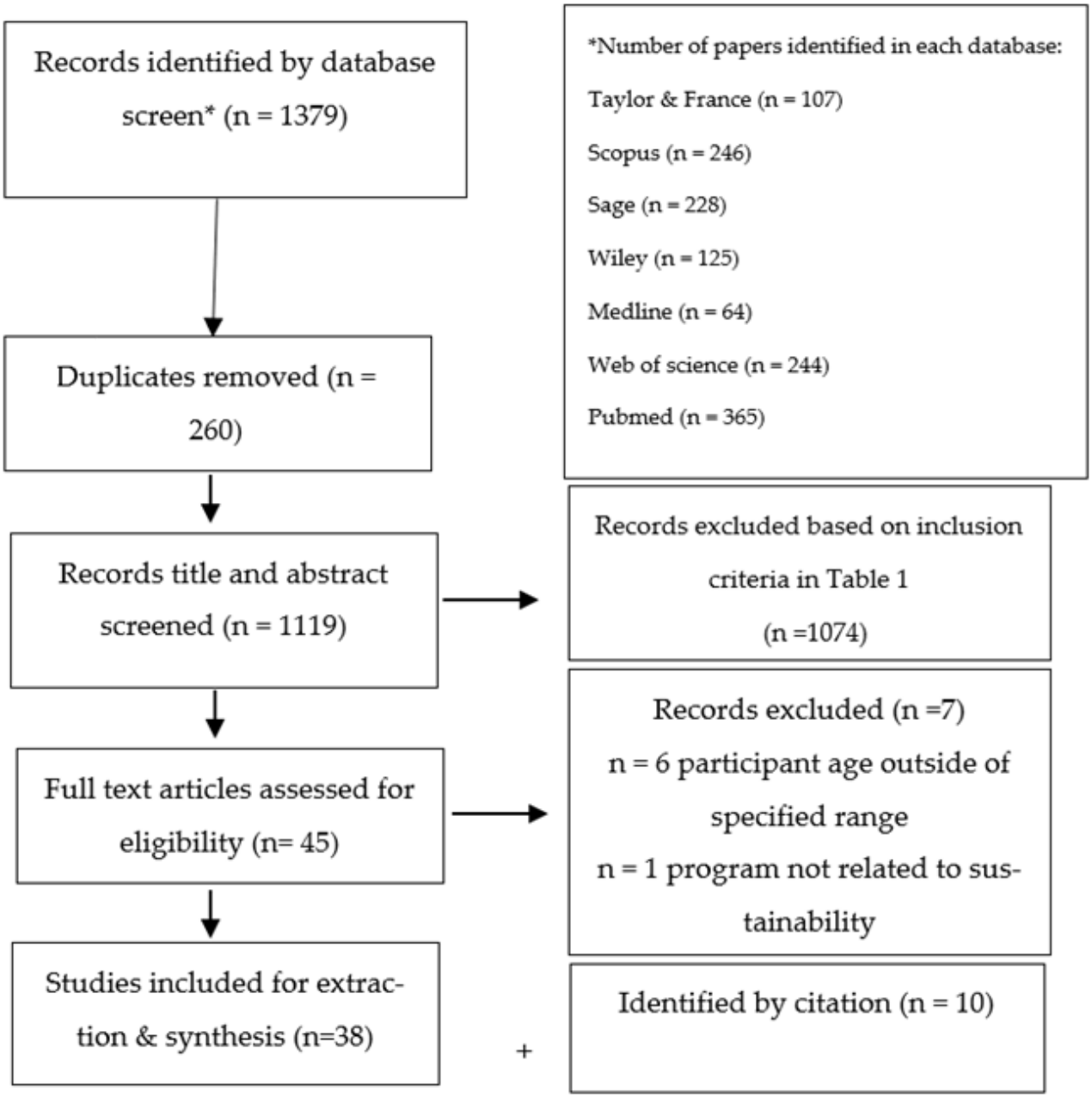

Figure 1. PRISMA flowchart of study screen process. * Databases used and number of papers identified in screening process.

Table 2. Research methods in included articles.

Research Methods	No. of Articles	% of Articles
Interviews	18	37.5%
Focus Groups	4	8%
Observation	6	12.5%
Surveys	29	60%
Document analysis	5	10%
Blogs/posts	2	4%
Group Discussion	1	2%
Item analysis	1	2%

Table 3 describes the types of study designs of the included articles: 21 of the studies were quantitative in nature (43.75%); 18 of the studies were qualitative (37.5%); and 9 of the articles were a mixed-methods design, 4 of which were quasi-experimental mixed-methods (18.75%).

Table 3. Research designs of included articles.

Research Design	No. of Articles	% of Articles *	Authors
Quasi-experiment	7	15%	Barata et al. [18]; Bissinger and Bogner [19]; Ernst et al. [20]; Flora et al. [21]; Ngo et al. [22]; Spangenberger et al. [23]; Vanatamay [24]
Mixed-methods quasi-experiment designs	4	8%	Marques et al. [25]; Riemer et al. [26]; Senbel et al. [27]; Stevenson et al. [28]
Case study designs	11	23%	Brigham and Imbertson [29]; Cheng et al. [30]; Griffin et al. [31]; Hehir et al. [32]; Kuthe et al. [33]; Mackay et al. [34]; Ouariachi et al. [35]; Sayal et al. [36]; Townrow et al. [37]; Williams et al. [38]; Young et al. [39]
Intervention study	3	6%	Lim et al. [40]; Lindemann-Matthies et al. [41]; Whitehair et al. [42]
Ordered probit	1	2%	Hooi Ting et al. [43]
Randomised control trial	1	2%	Cornelius et al. [44]
Participatory, utilization-focused evaluation	1	2%	Blythe et al. [45]
Impact evaluation	1	2%	Dann and Schroeder et al. [46]
Between subjects experiment	2	4%	Bekker et al. [47]; Trujillo et al. [48]
Mixed methods	6	12%	Becker-Leifhold and Hirscher [49]; de Vreede et al. [50]; Leitão, [51]; Selby et al. [52]; Tanye et al. [53]; Walsh and Cordero [54]
Ethnography	3	6%	Birmingham and Calabrese [55]; Ceaser et al. [56]; Oe et al. [57]
Pilot intervention	1	2%	Rudd et al. [58]
Critical sociocultural analysis	1	2%	Stapleton [59]
Exploratory content analysis	2	4%	Ruppert-Stroescu et al. [60]; Gallay et al. [61]
Participatory action research	1	2%	Molderez [62]
Interpretivist approach	1	2%	Zhang et al. [63]
Cross-sectional survey	1	2%	Liao and Li [64]
Qualitative description	1	2%	Pickering et al. [65]

* % of articles may not up to 100% due to rounding.

Ten of the studies were longitudinal, examining ongoing impacts of interventions. Ernst et al. [20], Reimer et al. [66], Spangenberger et al. [23] and Young et al. [39] followed up with participants within twelve months of program completion. Dann et al. [46] analyzed pre- and post-surveys of campers at the Great Lakes Camp from 1999–2012. Similarly, Griffin et al. [31] and Williams and Chawla [38] surveyed those who attended a wildlife camp or nature-based program between the years of 1995–2014 or within the last five to 40 years, respectively. Hehir et al. [32] also followed up a nature expedition, up to 10 years after original participant attendance. Zhang et al. [63] followed up students who participated in a university-based study abroad trip between 4 and 10 year post-program. A public commitment workshop with teenagers in Germany was also followed up three years post-project [41].

3.2. Study Theories and Frameworks

Of the articles, 35 used a framework or theory in either the design or analysis of the program, with a total of 11 different frameworks or models and 17 different theories. These terms represent how the authors referred to their underlying framing in their work. To provide clarity to these framings, the general literature tends to use the following definitions: a framework usually provides a structure, overview or outline and includes various concepts or variables and the relationship between these to describe a phenomenon [67]; a model

tends to describe a phenomenon in a deliberately simplistic and descriptive way; a theory can be defined as a set of analytical principles that provides structure to our understanding and explanations of the world [67]. As shown in Table 4, the theories and frameworks or models came from a variety of disciplines, with the majority emerging from psychology and education. However, we acknowledge that many of these framings are also used and have been applied and adapted in other disciplines.

Table 4. Discipline, theories, frameworks or models of included articles.

Discipline	Theory/Framework/Model	Authors
Environment	Place-based or attachment theories	Birmingham and Calabrese, [55]; Dann et al. [46]
	Environmental Identity theory (Clayton)	Young et al. [39]; Walsh and Cordero [54]
Psychology	Social Identity theory	Hehir et al. [32]
	Message Representation and Construal Level Theory (CLT)	Ngo et al. [22]
	Social Capital Theory	Cornelius et al. [44]; Mackay et al. [34]
	Theory of Change	Blythe and Harre [45]; Brigham and Imbertson [29]
	Social Environmental Identity	Stapleton [59]
	Theory of Commitment	Barata et al. [18]
	Theory of Planned Behavior (TPB)	Hooi Ting and Chin Cheng [43]; Molderez [62]; Liao and Li [64]; Lim et al. [40]
	Norm activation theory	Hooi Ting and Chin Cheng [43]
	Psycho-social framework	Townrow et al. [37]; Ernst et al. [20]
	Elaboration Likelihood Model of Persuasion	Whitehair et al. [42]
	Personal and social norm approach	Trujillo et al. [48]
Social Sciences	Community-Based Social Marketing Approach	Vantamay [24]
	Critical Theory	Ceaser et al. [56]
	Social Practice Theory	Williams and Chawla [38]
Education	Climate Change Education (CCE)	Rudd et al. [58]
	Environmental Literacy	Bissinger and Bogner [19]
	Transformative Learning	Blythe and Harre [45]
	Theory of Engagement	Riemer et al. [26]
	Pedagogical Learning Theory	Becker-Leifhold and Hirscher [49]
	Community-as-pedagogy framework	Selby et al. [52]
	21st Century Skills Framework	Pickering et al. [65]
	ESD framework	Oe et al. [57]
	Place-based civic science pedagogy model	Gallay et al. [61]
Behavioral Economics	Choice architecture	Trujillo et al. [48]
Public Health	Health Belief Model	Lim et al. [40]

3.3. Program Content and Activities

Most programs primarily focused on promoting pro-environmental leadership and stewardship. Summer camps and week-long student workshops or trips utilized a diverse range of learning activities. These included informal learning and hands-on science workshops in conjunction with outdoor recreational activities including hiking, bird watching or kayaking, and participation in reflection activities linking environmental education and experience in nature [20,22,31–33,38,39,43,45,46,52,59]. Some programs also included alumni communities for youth to stay in touch and be encouraged to continue engaging in pro-environmental behavior or volunteering activities [32,45]. Two studies were ongoing throughout the school or university year and aimed to include local communities to increase civic action through working groups and presentations [57,61], and one involved students in research for disaster preparedness in their community [65]. Four studies created interactive games or apps to enhance knowledge on renewables [23,30,35,51]. Three studies created projects related to sustainable fashion, two of which included the creation of a "fashion library" for students to swap and rent out clothing along with lectures on sustain-

able consumption [49,60,62], and one study utilized blogging as a technique to encourage fashion students to write about their experiences with buying less over a 10-week period. Five studies were school-based programs, where climate change education was implemented into the curriculum and involved teaching periods across disciplines, followed by activities and projects aimed at problem solving and goal setting [25,28,33,44,58]. One school-based study had a one-off interactive assembly [21]. Three studies involved student film making to engage students in climate change science and education [53,54,58].

Nineteen articles included an intervention or program that explicitly linked climate change to the program as a primary focus [18,20–22,26,28,32–36,39,43,44,52–55,58,59].

3.4. Outcome Measures

A range of quantitative outcomes measures and qualitative areas for exploration were used across studies as described in Tables 5 and 6.

Table 5. Quantitative outcome measures.

Quantitative Outcome Measure	Authors
Place	
Place attachment	Dann and Schroeder [46]
Stewardship	Dann and Schroeder [46]
Self	
Agency	Riemer et al. [26]; Walsh and Cordero et al. [54]
Nature in self	Hehir et al. [32]
Self-efficacy	Cornelius et al. [44]
Self-perceived attitudes	Dann and Schroeder [46]
Social identity	Hehir et al. [32]
Behavior	
Climate friendly behavior	Kuthe et al. [33]; Lim et al. [40]
Energy saving behavior	Cornelius et al. [44]
Environmental action	Barata et al. [18]; Flora et al. [21]; Hooi Ting [43]; Riemer et al. [26]; Stevenson et al. [28]
General ecological behavior	Hehir et al. [32]; Trujillo et al. [48]
Attitudes, intentions and norms	
Attitudes towards pro-environmental behavior	Vantamay [24]; Ernst et al. [20]
Behavioral intentions	Bissinger and Bogner [19]; Dann and Schroeder [46]; Bissinger and Bogner [19]; de Vreede et al. [50]; Lim et al. [40]
Concern for the environment	de Vreede [50]
Importance of environmental sustainability	Cornelius et al. [44]
Subjective norms	Vantamay [24]
Knowledge	
Knowledge	Bissinger and Bogner [19]; Cornelius et al. [44]; Flora et al. [21]; Griffin et al.; Kuthe et al. [33]; Leitão et al. [51]; Stevenson et al. [28]

Table 6. Qualitative Outcome Measures.

Qualitative Elements	Authors
Behavior	Lim et al. [40]; Lindemann-Matthies et al. [41]; Oe et al. [57]; Ouariachi et al. [35]; Trujillo et al. [48]; Zhang and Gibson [63]
Critical thinking	Rudd et al. [58]
Ecological and systems thinking	Molderez [62]
Environmental action	Ceaser [56]; Gallay et al. [61]
Environmental identity	Stapleton et al. [59]; Williams and Chawla [38]
Intention	Lim et al. [40]; Cheng et al. [30]
Leadership skills	Mackay et al. [34]
Sustainability-related attitudes	Oe et al., 2022; Zhang and Gibson, 2021; Oe et al., 2022
Systems thinking	Sayal et al. [36]; Young et al. [39]

3.5. Factors Influencing Program Outcomes

As identified in Table S2 in the Supplementary Materials, a range of outcomes were identified by authors, including five external factors: (i) social environment; (ii) place; (iii) knowledge development; (iv) leadership; and (v) goal setting, that fostered three internal factors: (i) self-efficacy; (ii) identity, agency, and action competence; and (iii) systems thinking, all of which contribute to a young persons' intentions and behaviors. These internal factors are important as they provide an individual with the inner confidence to alter their behavior effectively. These elements are described below.

3.5.1. External Factors

Social Environment

This broad element captures authors' descriptions and findings of the effects of young people's social environment on their behavior. There is various wording used within the studies to describe this, including "peer interactions" [27], "social norms" [24,50], "perceived social norms" [37], "social relationships" [52], "peer engagement" [27], "social interactions" [44,59], "subjective norms" [24,64], "social networks" [44], "social connections" [45] and "social transformation" [26]. These terms all capture the role of the social environment on young people's decision-making, intention and behavior. Two articles used validated scales to measure social and subjective norms [24,40]. Cornelius et al. [44], Senbel et al. [27] and Selby et al. [52] designed their own surveys to measure the influence of young people's social environment.

Six studies identified that social interactions impacted young people's behavior, with supportive social environments that allowed young people to create connections to their community [52,57,63,65], increase their social connection—" . . . you feel like you're part of a growing movement"—[45] (p. 88), create new social norms [44,50] and build trust with their peers [62]. These studies incorporated a wide range of designs and data collection, including a mixed-methods design [50,52], a randomized control trial [44] and qualitative research via interviews [45,62]. Riemer et al. [26] described the concept of "personal transformation" and stated that without "social transformation", personal transformation would be ineffective in creating behavioral change. Further, Townrow et al. [37], in their mixed methods case study, found that teenagers reacted to perceived social norms, which meant that those who were surrounded by peers who viewed picking up litter as "uncool" were less likely to participate in pro-environmental behavior. These studies highlight the importance of programs building positive social connections amongst young people to facilitate behavior change.

Place

Place was discussed in 11 articles through programs utilizing immersive experiences in nature with students. This element focused on a sense of attachment to a place, connection to nature, the self in a place (environmental identity) and the impacts of this element on their actions, motivations, attitudes and intentions by utilizing immersive experiences

in nature with students. One study by Bissinger and Bogner [19] uses Schultz's concept "Inclusion of Nature in One's Self" [68] in the application of a three and a half hour botanical garden intervention (n = 283) to enhance environmental literacy and pro-environmental behavior, which was found to be successful six weeks post-intervention in a quantitative quasi-experiment study. Two studies [46,55] use the word "insideness" to describe how participants framed themselves within nature and what actions they take to protect it. This particularly influenced those participating in the "Green Carnival" (n = 6) [55], a two-year ethnography project where researchers investigated an after-school science program where the youth put on a "green carnival" for their community and peers to inform them about energy use. This term "insideness" is partially related to what other researchers included in this review have described as "environmental identity".

"Environmental identity" has been utilized as a framework by multiple researchers in this review (n = 4) to define how a person describes themselves relative to the environment. Those whose environmental identity increased with the programs reported feelings of empowerment to take individual or community focused actions [54], a sense of responsibility towards the environment [38,39], increased recycling, reduced water intake and limiting their carbon footprint [39].

Furthermore, Stapleton's [59] qualitative critical sociological study found high school students who embarked on a four-week Southeast Asia trip (n = 13) where they participated in homestays and learned about the impacts of climate change. Working in collaboration with youth engaging with a range of sustainability actions in their communities, they acknowledged how their environmental identity had developed. Similar findings were identified in Zhang et al.'s [63] study on various field-based study abroad programs for university students in the USA travelling to Australia, New Zealand and Fiji. Participants reported adopting a "sustainability mind frame", with increased pro-environmental behavior and interest in local cultures and communities [63].

Similarly, youth who participated in conservation, wildlife and nature camps reported a longitudinal change in behavior. As reported in qualitative case studies by Williams and Chawla [38] and Griffin [31], participants reported an increased environmental identity, and that their career choices and conservation efforts were influenced by attendance at these camps. Similarly, in the nature-based program "Girls on Ice" [39], a mountaineering expedition, participants described knowledge and ecosystem linkages as effective for increasing recycling, reducing water intake and limiting their carbon footprint one year post-expedition, via interviews. "Students on Ice" [32], a two-to-three-week polar expedition to the Antarctic or Arctic. also increased conservation behaviors, according to the self-report GEB scale [69] reported up to 18 years post-voyage. The authors suggested that encouraging a sense of self in nature is important in developing programs that seek to promote behavioral change [32].

Knowledge Development

Thirty-eight articles contained knowledge building as an important component to their program. Twenty-one programs [20–23,28,31–33,35,38,39,43,45–47,49,52,55,59,63,64] utilized knowledge building as one of their primary tools for attitude, intention or behavior change, but they had mixed results. Programs that utilize a hybrid method of knowledge building, usually in the form of informal workshops coupled with experiences in nature in summer camps or study trips, were more likely to report behavior change [20,22,31–33,38,39,43,45,46,52,59,63]. A single exposure climate education presentation in a school setting also found an improvement of students' climate knowledge and increased short-term pro-environmental behavior in the home setting [21]. However, students who were considered disengaged or dismissive of the event did not have improved outcomes. These findings indicate that young people who react positively to climate education may become more engaged [44]. A second study based in a classroom setting found that while the education classes did have increased climate knowledge post-program, knowledge was not directly a significant predictor of behavior change [28]. However, the authors discuss the role of fostering concern and hope through knowledge

gain, which has previously led to increased pro-environmental Behavior [70]. The authors also suggest that the teaching of climate science using a cognitive approach (emphasis on knowledge and skills) as opposed to an affective approach (focus on awareness, concern and responsibility) may have impacted the outcomes [28]. This suggests that it is important to understand the mechanisms behind how climate change knowledge is imparted to young people. Programs included in this review used various methods to educate young people including interactive games and transformative learning styles, and some focused on the framing of messages, each with varying results.

For example, Ouariachi et al. [35] designed an interactive game (We Energy Game) on renewable energy sources. While participants (n = 15) reported that their knowledge levels increased, their intentions towards energy saving did not. Spangenberger et al. [23], similarly, in a quasi-experiment, designed an interactive game for teenagers and found an increase in knowledge 11 months post-program, though behavior was not measured. Despite these findings, the authors reiterate the differences between knowledge acquisition, behavior intention and behavior change, noting that behavior change may not have been within the scope of their research. Similarly, Leitão et al. [51], in their Ocean Literacy mobile app game, aimed to increase participants' knowledge by utilizing specific game elements including points, badges and leader boards. The authors noted a 30% increase in learning outcomes for the 98 participants but behavior change was not measured [51]. Increased behavior intention was the intended outcome in a two-day Edcraft Gamified Learning activity in Malaysia; however, the recycling game did not increase young people's (n = 29) intention to recycle post-game [30].

Six studies described how transformative learning styles (combined with other elements) to teach climate education had a positive effect on leadership and activism [45], developing a critical conscience [26,49] and reflective thinking, informing peers [49] and enabling systems thinking and agency [53,62]. Transformative learning approaches are described further below in the theme on identity, agency and action competence, given its key role in promoting action competence.

Furthering this, Ngo et al. [22] and Whitehair et al. [42] both tested how message framing affected intention. Ngo et al. [22], in a quantitative quasi-experiment, found that when messages are congruent—for example, if they give clear advice on actions or provide useful information—then messages were effective in increasing adolescent's perceptions on climate change severity and susceptibility, self-response efficacy and willingness to perform climate change mitigation behaviors. In addition, Whitehair et al. [42] implemented a quantitative intervention study and found promotional messages in a student cafeteria led to an overall 15% reduction of edible waste, with no difference between personal or neutral messages. These varying results demonstrate that while message framing is useful to reach a large population, its effectiveness is very much dependent on how a person perceives certain message types, and such messages must be congruent.

In summary, the programs included in this review demonstrate that knowledge is a key factor in building young people's climate action capacity; however, the evidence is inconclusive as to whether knowledge generation alone can be a causal factor in increased climate action. This is due to studies using outcome measures such as attitudes or intention, which may be indicative of behavior change but sustained behavior change itself was not directly measured.

Leadership

Leadership was identified in 11 articles, with studies demonstrating that leadership skills can increase agency and confidence in young people to empower them to take action and inform others about climate change. Four of the articles were based on programs aimed specifically to build leadership skills and capacity for young people to become peer mentors or leaders and educate others on environmental issues [45,46,50,52]. Leadership opportunities were provided to young people to act as leaders or mentors for their peers throughout the program [50,52], with students reporting increased social connections [52],

personal growth and increased pro-environmental behavior post-program [50]. Other programs, including the Make a Difference (MAD) three-day camp [45] and the Michigan 4-H Great Lakes and Natural Resources Camp [46], reported students taking on leadership opportunities post-camp to help influence others to take action. Further, the qualitative ethnography by Birmingham and Calabrese Barton [55] found that providing leadership roles to young people was found to be effective in increasing agency and the ability to speak "candidly" about climate change issues within the community. Similar findings were also identified in projects with local communities, providing the opportunity for them to be youth-led, increasing their leadership skills [57,65]. Mackay et al. [34] on their qualitative case study of Indigenous youth (n = 14) at the COP24 suggested that the leadership skills that were developed enabled continued learning, activism, and environmental involvement.

Goal Setting

Goal setting was discussed in 12 studies. In this review, goal setting refers to the use of a challenge, commitment or goal set by the program designers aimed at increasing environmental or sustainable behavior change in youth. Six articles used the word "goal" to describe the actions students or young people took throughout the program [39,44,50,55,60,62]. Two programs involved students setting their own goals. For example, The Student Swap Stuff program (n = 22; see Molderez [62]) allowed students to create the goal around what they wanted to achieve. Students responded positively to this, expressing that it gave them a sense of "autonomy". In addition, in the GHG-Saving program, students developed their own strategies to overcome the barriers of sustainable transportation reported, which, in a randomized-control trial using quantitative surveys, (n = 134; Cornelius et al. [44]) was found to be an effective way for students to adjust their actions. One program used the word "challenge" to describe the goal setting component in the Maui's Dolphin Challenge litter reduction project [37]. Results from the mixed-methods case study (n = 275) indicated a reduction in litter was attributed to a combination of goal setting and the moral component of saving the dolphin.

Five studies utilized commitment strategies to set goals and promote behavior change or action. Of these, four projects identified commitment as a successful element towards intention for future environmental action including volunteerism [20], sustainable consumption behavior [24] and community solutions [25]. Interestingly, Barata et al. [18] used public and private commitment strategies as part of a project to enhance water and energy saving in the household (n = 418). Using a quasi-experiment design and quantitative survey research methods, their findings identified public commitment in conjunction with environmental education led to effective short-term behavior change; however, private commitment was not effective. Collective public commitment was also demonstrated as a powerful element for behavior change, in conjunction with weekly workshops and public commitments, in Lindemann-Mattheis et al.'s [41] study. The team interviewed nine students in Germany who reported maintaining their pro-environmental commitments three years after the program, with some indicating they had become sustainable lifestyle ambassadors.

3.5.2. Internal Factors

Self-Efficacy

Self-efficacy was identified in nine of the reviewed articles. All studies referred to self-efficacy as a reliable indicator to predict behavior change; six of these articles described self-efficacy as a specific behavior the authors aimed to increase throughout the program, all using validated measures to quantify self-efficacy and identify its significance. Self-efficacy was described as perceived behavioral control to increase pro-environmental behavior, including sustainable consumption [24], community solutions [25], home energy saving behavior or starting up a climate change project [21], the subjective perception to successfully perform risk mitigation practices [22], the ability to switch off appliances, driving and eating sustainably [44] and community engagement towards environmental action [26,36,61]. Five of these studies demonstrated significant improved self-efficacy post-

intervention. However, a quasi-experiment, utilizing quantitative surveys by Flora et al. [21] in their one-time entertainment assembly by the Alliance for Climate Education did not significantly improve student's self-efficacy, post-assembly. Unlike the other programs that took place either over a period of weeks or months, this assembly was a stand-alone event, potentially reducing its overall impact towards behavior change; however, the study did report short-term changes around pro-environmental behavior in the home. Self-efficacy emerged in one qualitative article that did not explicitly aim to measure it. de Vreede et al. [50] in the Mindshift program (n = 23), identified self-efficacy when students described empowerment in themselves to achieve their goal, where pre-program they did not believe they could [50].

While the importance of self-efficacy as one of the primary factors contributing to behavior change was identified, only one program identified whether increased self-efficacy was effective long-term. The YLEC program, a longitudinal, mixed-methods quasi-experiment, identified an increase of collective self-efficacy as environmental agents in interviews at three, six and 12 months, suggesting self-efficacy is a successful factor in sustained behavior change for young people [26].

Identity, Agency, and Action Competence

Agency was another element recurring throughout the studies (n = 13) with some studies explicitly seeking to increase young people's sense of agency in the course of program completion. In this context, agency refers to the higher-cognitive processes an individual undertakes concerning their beliefs and contextual knowledge that contribute to their actions [71]. Eight studies explicitly explored agency in their research, either as part of their theoretical base or outcome [25,29,38,53,54,56,59,61]. Interestingly, "identity" was frequently used as a determinant for increased agency in the findings of several articles. Ceaser [56] reported students "feeling empowered and determined to make the world a better place" and described this as increased social and environmental identity, leading to a stronger sense of agency among young people to take responsibility for their actions towards the environment. Similar findings were found in the case study by Williams and Chawla [38], using social practice theory, where young people (n = 18) who took on responsibility for the natural environment were linked to increased agency and identity. "Environmental identity" [59] and "learner identity" [54] were also described as determinants of increased agency in interviews.

Four studies aimed to specifically include agency development within their projects. Agency was found to be effective with climate change education [54] (GENIE curriculum, n = 835), development of climate change and environmental solutions [53] (Lens on Climate Change program, n = 43), coursework development [29] (Grand Challenge Curriculum—Energy Transition Education) and the application of reflection and real-life scenarios [25] (WaterCircle Project, n = 361).

Action competence has also been included in this section as it refers to actions based on acquired knowledge and skills, in the same way agency does. Five studies included action competence [20,36,45,50,56,62]. Three studies identified transformative learning as an effective way to encourage action competence [45,50,62]. The Make A Difference (MAD) leadership program (n = 6) (see Blyth and Harre [45]), using a quantitative, participatory, focused evaluation approach and the Student Swap Stuff project (n = 22) (see Molderez [62]), utilizing qualitative participatory action research design, both incorporated transformative learning as a strategy to increase action competence and were found to be effective. de Vreede et al. [50] also found transformative learning to be effective in their mixed-methods case study of the MindShift program (n = 23). Two studies identified education as effective in increasing action competence—Student Climate and Conservation Congress (n = 98; see Ernest et al. [20]) and the YLEC program (n = 34; see Sayal et al. [36]).

Systems Thinking

Systems thinking, though not always explicit in the articles, appeared to play an important role in determining the thought processes, motivations, intentions and actions in young people participating in these programs. In this context, systems thinking refers to systems thinking competence (ST) and is described as "the ability to collectively analyze complex systems across different domains (society, environment, economy, etc.) and across different scales (local to global), thereby considering cascading effects" [72] (p. 6).

Eleven articles included an ST component when educating youth on the environment, usually in conjunction with agency or action competence, place and self-efficacy. Five projects explicitly identify ST in their work. The YLEC program [26,36] aims to increase systems thinking. Interviews with participants identified utilizing an ST approach increased motivation and engagement for collective environmental action. In the "Girls on Ice" program [39], instructors utilized an ST approach to describe ecosystem linkages. By incorporating ST in the exploration of problems, participants found the information "more meaningful". Brigham and Imberston [29] also incorporate ST into their Grand Challenge Curriculum course, as one of the solutions towards "wicked problems", and Rudd et al. [58] utilized the systems thinking component in the Climate Change Engagement framework for the "You and CO_2" project (n = 180).

Five studies inexplicitly demonstrated systems thinking in young people. For example, following Birmingham and Calabrese Barton's [55] "Green Carnival" (n = 6), in conjunction with the place element, participants were able to express the complexity of energy use on the environment within social, educational and political dimensions. de Vreede et al. [50] demonstrated similar findings with participants in the Mindshift program (n = 23) describing "whole mind shifts" with a deeper understanding of the environment and the importance of sustainability. Furthermore, a case study on "fashion libraries" (n = 10) [49] highlighted how students were able to foster systems thinking in terms of the origins of their clothing and the sustainability issues of fast fashion. The findings from the mixed-methods quasi-experiment, named the WaterCircle project (n = 361) [25] also enabled students to address the complex issue of climate change in terms of water scarcity and pollution. Posters created by students included names "For a planet where it is good to live in" and "Are we ready to save the world we live in?" and demonstrated their ST ability and the complexity of water scarcity and pollution contributing to climate change.

4. Discussion

This study highlighted that there are internal and external factors that contribute to successful program outcomes and behavioral change amongst young people. In particular, behavior change in programs is influenced by external factors including young people's social environment, connection to place, knowledge development, leadership and goal setting, as well as internal factors of participants including self-efficacy, agency, identity and action competence and systems thinking. The one-way and bi-directional relationships between these variables were determined by the findings of the results of included studies and is reflected in our proposed working model (Figure 2).

Our analysis identified that there are four elements that appear to be necessary conditions for change, and four elements that are components of behavior change but may not be necessary. For example, self-efficacy and knowledge development are both necessary elements, but could be boosted by other component elements such as a positive social environment and leadership skills to increase the likelihood of successful behavior change. It is the combination of at least one necessary element and component elements that would be sufficient for behavior change.

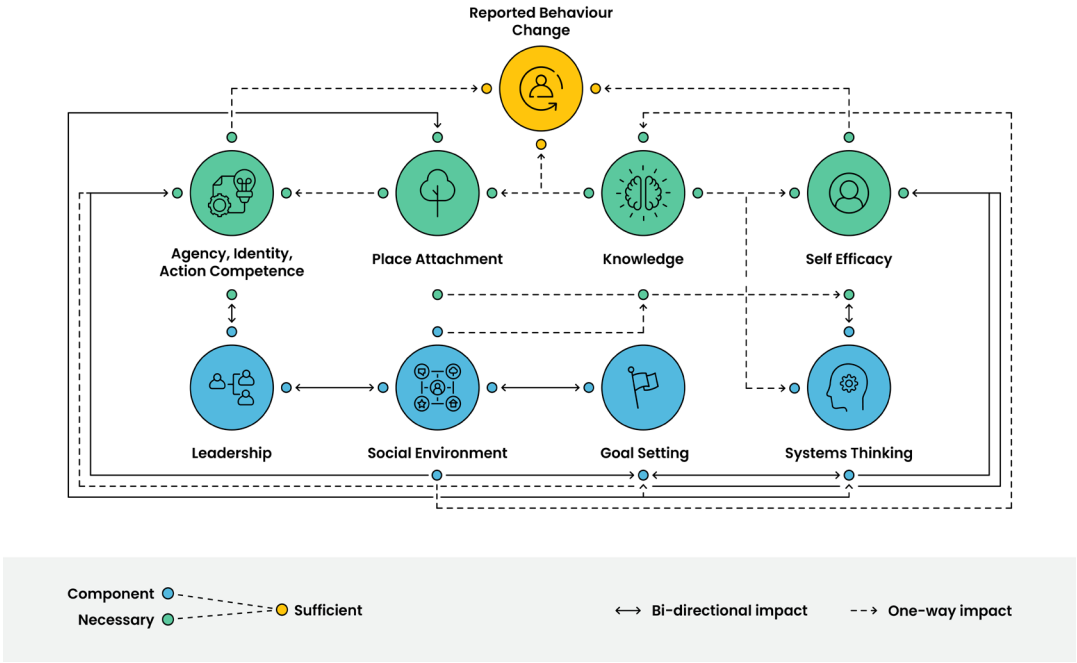

Figure 2. A model of key elements to enhance climate action in young people.

This review found that knowledge generation was a necessary component in almost all programs for engaging young people in climate action. However, it is still unknown if knowledge generation alone can directly impact climate action. The review found that different strategies used to promote knowledge acquisition are important. Similar findings by Reid [73], in their study in climate education literature, identified that knowledge acquisition needed to be paired with attributing conscious responsibility in order to empower young people. In this review, transformative learning approaches appeared more effective in influencing key factors, such as leadership, agency and systems thinking; thus, programs grounded in these approaches were more likely to lead to climate action. Further, programs that used multiple strategies appeared to be more effective than those relying on one single educational strategy. Supporting this, research by Novick [74] found that top-down, science-based approaches did not incorporate climate action strategies that could be undertaken by young people and that informal education programs were more supportive and empowering of youth in taking action. Thus, this review suggests that knowledge building be paired with other elements and strategies to encourage climate action.

Self-efficacy appears to be both a predicator of behavioral change and an outcome from some programs. However, self-efficacy is the most contextual of all elements. Many studies had increased self-efficacy post-study, but that alone did not necessarily lead to behavior change. It needed to be coupled with a sense of agency and action competence, along with activities that promote systems thinking [26,36] and goal setting [24,25,44]. The development of such qualities in young people was influenced by the external factors and elements. While not explored to any great extent, it appeared that individual self-efficacy is enhanced when there is collective efficacy; that is, when there is a shared belief amongst participants about their ability to achieve desired goals [18,27,66], indicating that the role of one's social environment positively impacts self-efficacy (see Figure 2). In particular, the YLEC program [13] found that the action-orientated, informal participatory workshops with young people were effective for promoting critical thinking, empowerment and collective efficacy. The group programs also enhanced group level agency.

This review also revealed the importance of young people's social environment; that is, where there was a greater acceptance of the need to act on climate change, this created a more supportive social environment in which to design such programs. The role of social norms, which prescribe what is socially acceptable behavior in a given group context [75], can be a

powerful influence on young people engaging in climate action [75,76]. Past research has suggested that people who visibly engage in climate action may also inadvertently become peer mentors and drive long-term behavior change [77], supporting the bi-directional link between leadership and social environment highlighted in Figure 2. Group programs need to focus on developing group cohesion, safety and respect for participants, therefore creating a helpful social environment for young people. Drawing from groupwork theory to explore the impacts of a person's social environment on individual growth, self-directed groupwork has shown to be a non-oppressive, safe and respectful approach to youth engagement where workers and students share equal power in social transformation programs with young people [78]. Another key element identified was goal setting. Several articles examined the value of goal setting. Personal goal setting was not as strong as publicly expressed goal setting based on the findings of included studies. Goal setting within self-directed groupwork research approaches has been an important aspect for empowering young people in the social activism space [78]. Self-directed groupwork research found that participants appeared to be held to account when goal setting was undertaken in a public forum, and where the goals were achievable. It was important that goal setting was undertaken in a safe space with likeminded people and when there was a planned course of action to achieve the goal [78]. Thus, these findings suggest that for goal setting to be effective it was important to have a conducive and supportive environment, reinforcing the findings of this review of a bi-directional relationship between social environment and goal setting (see Figure 2).

Developing programs that nurture youth leadership skills, while providing opportunities for young people to inform, teach and lead others were important. Studies that instilled leadership skills in young people can support young people to take stewardship actions, increasing agency and the ability and confidence to speak "candidly" about climate change issues with community members and peers [46,55]. Leadership is a critical element for changing social norms around climate action, providing these skills to young people can enable them to take on leadership positions in the youth-led climate activism space [78–80]. Etmanski [81] also emphasizes the role of self-identity and awareness in the leadership processes and how young people view themselves as capable of becoming leaders or mentors of a group [81]. This aligns with the findings of this review whereby young people with an increased agency and a sense of identity towards their leadership role improved their skills, indicating a bi-directional relationship between these two elements (see Figure 2).

The most effective long-term behavior change appeared when programs were undertaken over a period of time, using a range of intervention strategies. Congruent with other research [82,83], this study found that immersive experiences that promote connection to place, contribute to awareness of value and increase pro-environmental behaviors are important for supporting behavioral change. In this review, longitudinal studies that focussed on immersive experiences within nature were the most powerful indicators of behavior change [31,32,38,46]. Transformative immersive experiences need not only be about connection to nature; they are also about connection to local communities [55]. Such initiatives were powerful; however, they are costly and, consequently, this raises question about accessibility for those from low socioeconomic backgrounds. Whilst there is research into climate education being built into secondary and university curricula in the United States and European regions, there remains a gap in addressing the accessibility of climate programs particularly in East Asia and the Pacific [7].

This study presents several limitations to the findings of this review. The authors advise caution if applying this model to young people over the age of 20 as almost 2/3 of the includes studies were focused on (or the majority participants were) adolescents. This is likely due to the programs taking place in a school setting or as part of a program targeted towards school aged students (e.g., summer camps, school-based excursions). Ten studies were targeted towards university students, although the majority of participants were also under the age 20. Only two programs [26,56] were facilitated outside a university or school setting. This may suggest that there needs to be further research with age groups over the age of 20 and programs facilitated outside formal education settings. Further, with 20 out

of 48 studies taking place in the USA, the findings may not be applicable to countries in different geographical regions.

Despite these limitations, this review presents various research implications. We have presented the diverse research methodologies and theoretical applications that have been used by researchers across disciplines within this field of research. Synthesizing the findings, we have developed a working model that highlights the necessary and component elements of successful behavior change in young people. This model highlights the need for climate programs to be extended outside of the classroom and suggests utilizing a holistic and transformative approach that creates a safe environment to foster young people's attachment to place and build their leadership skills so they feel empowered to take climate action.

To build on this body of work and address the gaps in literature, this review identified a number of areas for further research. Firstly, more research is needed outside of the United States and, in particular, in low- and middle-income countries where research on this topic is less prevalent. As shown in Table 2, most studies were carried out in the USA (n = 20). This was primarily due to the inclusion of summer camp programs which are common in the United States. However, given differing socioeconomic and political nuances of countries, studies from the USA cannot necessarily be generalized to other countries and contexts. Future research should also consider including publications outside the English language, as it possible that these papers may exist in lower-to-middle income countries. While it was not within the scope of this review, future studies should evaluate the funding bodies of these programs and understand what roles schools, universities and private companies have in providing climate education to young people.

Secondly, the model presented in this paper needs to be tested, with more studies undertaken that are longitudinal in nature. It is important to better understand what factors are sufficient and necessary to promote climate action in young people. In the studies reviewed, very few controlled for confounding variables. Further, there was a lack of follow up to identify behavior change (either immediate or sustained). It is also unclear what specific strategies have led to improvements in self-efficacy. As stated above, researchers should be cautious of applying this model to those over the age of 20. We suggest that more research is conducted with young people in the 20–25-year age bracket.

Thirdly, concept analysis of key terms will be important, as more consistency is needed around how key terms are used in the field. For example, a number of terms were used interchangeably by authors; for example, transformative versus experiential learning, program versus intervention. Constructs need to be defined to be consistently evaluated.

Fourthly, there is also a need for consistent reliable scales to be used across studies to assist with comparison. For example, the concept of environmental identity came through as being an important outcome for climate action, but validated scales need to be consistently used for comparison across programs.

5. Conclusions

Numerous studies have emerged over the last ten years that evaluate programs focused on enhancing climate action amongst young people. This scoping review aimed to map this literature to identify what is known about these programs focused on climate change and sustainability, and their outcomes in influencing young people's behavior. Such studies have grown exponentially, which is likely due to growing global concerns about tackling climate change. Further research would benefit from being more longitudinal in nature, controlling for confounding variables, and testing existing models to determine the exact requirements of behavior change as it relates to climate action and young people. Existing studies suggest that programs that take a transformative learning approach, using multiple experiential learning strategies that draw from groupwork theory to create a safe space to learn, and which provide opportunities for young people to engage in leadership and systems thinking in a supportive social environment, have the best outcomes related to sustained behavior change.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su15054259/s1, Table S1: Description of articles included in review. References [18–65] are cited in the Supplementary Materials.

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