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# Compost for your seeds: implementation strategies for environmental education in Chile from the ERIC taxonomy

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## ABSTRACT

The increasing interest in climate change and environmental education has highlighted the importance of strategies to enhance the adoption, implementation, and sustainability of these initiatives. However, the field of environmental education has not extensively explored implementation strategies, despite the existence of frameworks and taxonomies. This study aims to address this gap by identifying strategies suggested by environmental education professionals in Chile. A total of 91 participants responded to an online survey that included open-ended questions. Through content analysis, 24 categories aligned with existing frameworks and 7 categories emerging from the local context were identified. These categories were organized in a descending order, revealing the prominence of scale-up, process, capacity-building, integration, and dissemination strategies. While strategies from established frameworks were found, the study also highlights the emergence of strategies specific to the environmental education field, contextual factors, and the implementation phase of environmental education in Chile.

## KEYWORDS

Contextual factors; environmental education; ERIC taxonomy; implementation science; implementation strategies

## Introduction

Climate change is a pressing global issue caused by human activities, posing complex threats to governments, societies, and individuals (Everth & Bright, 2022). Its impact reaches economic, social, and political domains, jeopardizing the well-being of all living beings on Earth (Watts et al., 2021).

The last report from the Intergovernmental Panel on Climate Change (2021) indicates that the planet crisis is at a flashpoint, with the highest CO<sub>2</sub> numbers in the last 800,000 years. This has led to the projection of possible scenarios for 2100.

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It is believed that the average temperature of the planet will increase between 1.8° and 5.6° C, leading to a higher probability of extreme climate events, and a progressive melting of parts of Greenland and the Antarctic, with the sea level possibly increasing from 14 to 114 centimeters.

Consequently, urgent actions must be taken to address the global climate emergency, including mitigation and adaptation measures, as well as strategies to reduce greenhouse gas emissions (Lorenzo & Bueno, 2020). Environmental Education (EE) plays a crucial role in achieving these objectives by fostering awareness and knowledge about the environment and climate change among individuals (Caride & Meira-Carrea, 2020; Feldbacher et al., 2023).

EE strategies are implemented at various levels: governments worldwide enacting local policies and programs such as Chile's SNCAE program or Australia's Sustainable Schools Initiative (Flowers & Chodkiewicz, 2009). Civil societies also contribute through initiatives like Eco Schools (Davis & Ferreira, 2009), while transnational level exists in global efforts such as the Paris Agreement and the Environmental Education International Program (González Gaudiano & Arias Ortega, 1969).

However, several barriers impede the dissemination, implementation, and sustainability of EE programs in achieving their global goals (Almeida et al., 2018; Evans et al., 2012; Feldbacher et al., 2023). These obstacles include the lack of specific legal frameworks, inadequate government funding (Saidón & Claverie, 2016), low priority given to EE in school plans (Berríos Villarroel & González Gamboa, 2020; Suárez-López & Eugenio-Gozalbo, 2021), and a misalignment between EE and traditional education models (Cho et al., 2022; Salinas, 2016). Given the urgency of the climate emergency, it is crucial to utilize all available resources to enhance the implementation of EE (Prosser et al., 2019).

### **Implementation strategies**

To address barriers in EE, it is crucial to study and apply strategies that can help overcome them (Fixsen et al., 2019; Nadeem et al., 2013; Slaughter et al., 2015; Waltz et al., 2019). Proctor et al. (2013) defines implementation strategies as methods, actions, or techniques that improve the adoption, implementation, and sustainability of innovations.

To categorize implementation strategies in different contexts, various research teams have developed typologies. This exercise provides clear labels, detailed definitions for each strategy, and guidance for efficient strategy selection (Waltz et al., 2015). One well-known taxonomy is the ERIC taxonomy created by Powell and colleagues (2012), which identified and described 73 implementation strategies. Common actions include champion preparation, generating educational materials for dissemination, and assessing local needs and feedback (Dopp et al., 2020; Hooley et al., 2020; Perry et al., 2019; Weir et al., 2021).

While the ERIC taxonomy is widely used, it is still subject to review and refinement in Implementation Science (IS) studies (Birken et al., 2020; Dopp et al., 2019). Leeman et al. (2017) introduced a temporal concept by differentiating between dissemination, process, integration, capacity building, and scale-up strategies, aiming to prioritize essential strategies for each stage of the intervention cycle (see [Appendix A](#)).

In the education field, Lyon et al. (2019) and Cook et al. (2019) refined the ERIC taxonomy and created the SISTER taxonomy by linguistically adapting strategy descriptions. They identified and defined 75 specific strategies for interventions in educational communities, with 53 of them originating from ERIC. The SISTER taxonomy also introduced new categories such as developing local policies, improving implementers' buy-in, peer-assisted learning, pre-correction prior to implementation, pruning competing initiatives, targeting/improving implementer well-being, and test-driving and selecting practices.

Grol et al. (2013) emphasize the importance of adapting and transforming taxonomies according to the specific application context. In the case of EE, there is a lack of exploration in implementation strategies. While current strategies can be adapted to EE (Cook et al., 2019; Powell et al., 2015), their applicability may be limited to contexts where they have been assessed. Literature suggests that in high-income countries, implementation strategies focus less on resource acquisition and more on intervention quality (Boyd et al., 2018; Bunger et al., 2017), whereas low-income Latin American countries require strategies that prioritize resource acquisition, with limited exploration of innovation quality.

Given the difference in these contexts, examining implementation strategy taxonomies in the Latin American context of EE allows for identifying urgently needed actions. This can facilitate increased adoption of EE, effective implementation of EE initiatives, and improved sustainability.

### ***Objective of the study***

This study aims to identify strategies recommended by EE professionals in Chile to enhance the adoption, implementation, and sustainability of EE processes. The ERIC taxonomy and the categorization by Leeman et al. (2017) will serve as a base, but the study will also incorporate a local and culturally-sensitive perspective to identify new strategies. Additionally, the study will explore strategies emerging from EE frameworks and concepts.

### ***Methodology***

A mixed study was conducted using a cross-sectional descriptive design (Creswell & Garrett, 2008). The study considered both the frequency and content of strategies provided by professionals. An inductive approach was employed (Liu, 2016), aiming to capture responses from participants that may not fit within the predefined categories of the study's taxonomies. The purpose of inductive approach was to then assess the agreement between the categories derived from the existing literature and the responses collected from participants.

### ***Data collection***

The data for this study is derived from a larger research effort aimed at characterizing the state of EE in Chile using implementation science frameworks. For this study, a self-administered survey was conducted using the SurveyMonkey platform to gather information from EE experts across Chile. The survey consisted of 25

items, including both open-ended and closed-ended questions. Five items focused on collecting sociodemographic data, twelve aimed to assess the extent of adult involvement in EE for children and adolescents, six aimed to identify determinants influencing the implementation of participatory activities, and two questions sought to explore strategies that participants would employ to promote the adoption, implementation, and sustainability of EE initiatives.

In this study, the answers to the last two questions of the questionnaire, both open-ended questions, are used as data. The first question is aimed at identifying actions at the local level (What tactics do you consider should be performed to achieve better EE in your professional context?); while the second question sought to detect tactics that were fundamental for the whole country (What strategies should be followed at the national level for a better implementation of EE?).

### Participants

Snowball sampling was employed (Pérez-Luco et al., 2017), sending the survey *via* three channels. (1) The Division for Environmental Education and Citizen Participation of the Ministry of Environment was reached, which assisted in sending the instrument to professionals from the Ministry and experts at the local and intermediate governance levels who implement public policies in EE. (2) In parallel, the instrument was sent to eight environmental social organizations that have an EE project or activity recognized at the national level. Additionally, the survey was sent to EE researchers recognized in Chile, who were contacted through the e-mail addresses provided in their scientific publications. (3) After the initial participation of these subjects, they were asked to send the instrument to other experts in EE at the national level. In this way, a sample of 91 people was finally accessed (see Table 1).

### Data analysis

A thematic content analysis was conducted using previously established categories (Braun & Clarke, 2006) with the assistance of Atlas.ti software. The reporting of

**Table 1.** Characteristics of participants ( $n=91$ ).

Characteristic	<i>k</i>	Characteristic	<i>k</i>
<b>Work setting</b>		<b>Experience in EE</b>	
Schools	26.9%	Between 5 and 10 years	35.7%
Higher education institutions	17.9%	Between 1 and 4 years	29.6%
Municipalities	16.7%	Between 10 and 20 years	17.3%
NGOs	16.7%	More than 20 years	12.2%
State programs and systems	10.3%	Less than 1 year	5.1%
Business	6.4%		
Self-employed	5.1%		
<b>Gender</b>		<b>Type of work</b>	
Woman	67.3%	Environmental pedagogy	59.3%
Man	32.7%	Environmental management	42.9%
<b>Age</b>		Environmental communication	37.4%
26 to 45 years	55.1%	Environmental activism	29.7%
46 to 65 years	30.6%	Environmental research	16.5%
18 to 25 years	10.2%		
More than 65 years	4.1%		

the content analysis followed the Consolidated Criteria for Reporting Qualitative Research (COREQ-32) guidelines (Buus & Perron, 2020).

Participants' responses were organized in a matrix, allowing for the identification of different strategies within a single sentence. This approach allowed participants to indicate multiple strategies in their responses. A total of 139 text units were constructed, ranging in length from 6 to 94 words.

The ERIC taxonomy was then applied to identify and classify the strategies mentioned by the participants, using the linguistic adaptations for educational interventions proposed by SISTER (Cook et al., 2019) where this best described the content. Out of the 73 ERIC strategies, 24 were identified from the initial open coding, while 49 strategies were discarded. Additionally, several text units could not be classified within the existing ERIC or SISTER taxonomies, leading to the creation of seven emergent subcategories. Overall, the 31 categories were organized according to the taxonomy developed by Leeman et al. (2017). As a result, five categories and 31 subcategories were used for analysis.

To organize the results narrative and determine the most recurrent and urgent strategies mentioned by participants, a descriptive statistical analysis was performed. This analysis involved calculating the frequency and ratio of appearance for each identified category and subcategory.

### **Ethical considerations**

The ethical guidelines proposed by Winkler et al. (2014) for studies on people were followed. Informed consent was requested from each participant, and the research team's contact information was provided. Additionally, the protection of anonymity, confidentiality and information was ensured, and participants were offered the possibility of receiving the results.

## **Results**

From the analyses, 24 ERIC subcategories were identified, which were mentioned 122 times. Eight of these subcategories are associated with scale-up strategies, five with process strategies, four with capacity-building strategies and integration strategies, and lastly, one with dissemination strategies (see Table 2).

Categories will be qualitatively explained following the same order observed in the Table above.

### **Scale-up strategies**

The most mentioned ERIC strategy was conducting scale-up actions (13.93%). Participants propose that they would scale EE at all ages of the life cycle, introducing the following measures starting from preschool age<sup>1</sup>:

Compulsory subject in the education plans and syllabus from preschool to the last year of secondary education (Woman 3, V Region).

Creating a comprehensive curriculum that addresses environmental education at all levels (from kindergarten to secondary school) and according to the cultural, territorial and natural reality (Woman 8, XIII Region).

**Table 2.** Frequency of default ERIC subcategories.

Categories	N <sup>1</sup>	k <sup>1</sup>	Subcategories	N <sup>2</sup>	k <sup>2</sup>
Scale-up strategies	67	54.91%	Conduct scale-up actions	17	13.93%
			Obtaining funds/resources	14	11.47%
			Mandating the application of the innovation	14	11.47%
			Generation or change the law	10	8.19%
			Promotion of network interweaving	6	4.91%
			Building alliances	3	2.45%
			Development of resource support	2	1.63%
			Creation or modification of new certifications/standards	1	0.81%
Capacity-building strategies	20	29.85%	Generation of training plans	14	11.47%
			Training of users as active subjects	3	2.45%
			Observation of other successful experiences	2	1.63%
			Identification and preparation of champions	1	0.81%
Process strategies	15	12.29%	Changes in the place where services/ programs are provided	5	4.09%
			Local consensus exercises	4	3.27%
			Creation of collaborative learning spaces	2	1.63%
			Promotion of innovation adaptability	2	1.63%
			Visits to significant places/spaces	2	1.63%
Integration strategies	14	11.47%	Generation of incentives/motivation from stakeholders	7	5.73%
			Development and/or distribution of educational material	3	2.45%
			Development of partnerships with scholars/universities	2	1.63%
			Educational experience exchanges/ visits	2	1.63%
			Dissemination strategies	6	4.91%

Note: Categories taken from Leeman et al. (2017).

Subcategories are based on the ERIC taxonomy (Powell et al., 2012)

Including children starting from preschool in participating and learning about the topic (Woman 4, VIII Region).

As indicated in one of the quotations above, scale-up should be conducted according to the local reality where EE is introduced. Based on this premise, EE is expected to be scaled to rural communities, especially “to inject resources into rural schools) (Woman 2, VIII Region), “strengthening rural schools and generating exchange networks with urban schools” (Woman 1, VIII Region).

The second most mentioned ERIC strategy is “obtaining funds or resources” (11.47%). As a participant indicates, this strategy implies that to improve EE adoption, implementation and dissemination, it is necessary “to have the material resources to achieve interactions and deep learning” (Man 1, I Region).

Despite being mostly an economic matter, the word ‘resource’ is often used to refer to other physical and/or material items that could improve EE processes (e.g. infrastructure, tools, manuals). In this sense, participants will obtain more funding or resources for the different levels involved in EE:

Increasing the resources of MMA to strengthen environmental education. (Men 1, XIII Region)

With more funding and budget at the different levels: a) Educational establishments, hiring staff and purchase of educational materials. b) Funds for territorial chapters, neighborhood councils, functional clusters, NGOs, among others. (Woman 4, XIV Region)

Additionally, the ERIC strategy “mandating innovation” is at 11.47%. Given the Chilean context and its educational structure, according to the experts, this refers to EE being “part of the national education curriculum” (Woman 19, VIII Region). Based on the accounts of participants, this tool from the Ministry of Education will allow for mandating EE in multiple aspects:

- Throughout the school period “from kindergarten to the last year of secondary education” (Man 4, XIV Region).
- As part of a common time in educational communities “in the study plans as a subject, not only as an extracurricular workshop” (Woman 7, VIII Region).
- With clear guidelines that “allow for assigning times and relevant activities as a part of the Ministry’s guidelines” (Woman 25, VIII Region).

Some participants go even further and believe that EE should be part of the new constitution of Chile:

As proposed by the new constitution and many voices, it is necessary that it is ecological; I believe that the charter of the country should involve EE topics, along with the educational policies, plans, programs that will translate into more children participating in EE. (Woman 2, XIII Region)

In this context, whether or not EE becomes part of the national curriculum or the new constitution, in this strategy, words such as “demand”, “obligation” and “establishment” repeat in the comments. Some participants go beyond the global aspects of EE and believe that both outdoor activities and work with life in school environments are fundamental actions that could be mandated:

Oof, several forms. But mainly adding outdoor education to the educational curriculum (Woman 5, XIII Region)

All schools of Chile should have (vertical and/or horizontal) gardens taken care of by students(...) Chile is a natural laboratory and it should be compulsory that students from each region know ALL their natural surroundings (Woman 3, V Region).

The ERIC strategy “Generation or modification of laws and policies” comes next (8.19%). Some participants indicated that EE “has to be a state policy” (Woman 3, XIV Region). These regulations ensure that this type of education has a binding nature:

I believe that to promote EE, it should be prioritized at the legislative level, to be a priority for the state and therefore there would be funding for educational campaigns, materials, professionals (Women 2, XIII Region).

Public policies linked to the development of skills, attitudes and behaviors for the care and protection of the environment (...) with specific funding associated (Woman 2, V Region).



Public policies play a fundamental role, as they would be the driver necessary for creating environmental awareness at all levels, from preschool onwards (Woman 3, XIII Region).

This binding nature would allow for obtaining the necessary results as well as monitoring objectives such as the development of pro-environmental attitudes or behaviors.

Another often mentioned ERIC strategy is “promotion of network building” linked to EE (4.91%). These networks should “involve all the social stakeholders in this type of project related to environmental education” (Woman 1, VII Region), establish and strengthen “teacher, institutional and university networks” in each territory (Woman 18, VIII Region) that are established as “local, provincial, and national networks that allow interactions with companies, among others” (Woman 2, VIII Region). From here, it is implied that these networks may comprise different levels and focus on multiple topics.

Other architectures are also crucial for EE networks, namely “a network of citizen participation in children’s organizations” (Man 3, XIV Region); “tutors’ local networks and communities” (Man 1, V Region). Lastly, the least mentioned ERIC strategies are “building alliances” (2.45%), “development of resource support agreements” (1.63%) and “creation or modification of new certifications/standards” (0.81%).

### **Capacity-building strategies**

The main ERIC strategy identified in this category is “generation of training plans” (11.47%), which should be implemented at all levels, enabling “teachers at the primary, secondary and university levels” (Man 5, XIII Region). Diverse topics are indicated to base training plans:

Training adults in charge not only in environmental education, but also in children’s and adolescent’s rights (...) aspects such as progressive autonomy for children and adolescents that would have a strong impact on listening to children and adolescents (Woman 6, XIII Region).

More guidance to apply to new projects (Man 4, VIII Region).

At the national level, it would be excellent to have environmental educators with training in participation topics, possibilities would open up for the implementation of more democratic dynamics in our environmental education practices (Man 2, XIV Region).

Participants remark that this training can be oriented to citizens in general: “something that affects the possibility of children’s participation is the environmental culture that may exist in the place where we develop; to achieve this I had to extend the participation to parents and colleagues who are not so aware of the topic and change their paradigms through education” (Woman 20, VIII Region). The least relevant ERIC subcategories mentioned are “Training of users as active subjects” (2.45%), “observe successful educational experiences” (1.63%) and “identification and preparation of EE champions” (0.81%).

### **Process strategy**

The most mentioned ERIC strategy is “changes in the place where services/programs are provided” (4.09%), with nature and outdoor EE as the main tools. Participants point out the need to add “the part of outdoor education to the educational curriculum (Woman 5, XIII Region) and ensure that “education principals and administrators are active promoters of outdoor environmental education” (Woman 1, VIII Region).

In this line, to improve the results of EE, the experts recommend “going outside to find nature” (Woman 1, X Region), “promoting the learning and teaching, generating coherence between what is taught, where and why” (Man 5, XIII Region).

From this change in setting, participants believe that the relationship of students with nature will be strengthened, as well as their environmental identity:

But, overall, promoting *in situ* contact between children and nature, whether in a park, square, reserve, but that the contact is progressively increasing in order to reconnect with our environment, developing a more significant awareness that makes us understand the relationship with our environment, tearing down the misalignment gradually learned about nature, as if this was an external agent instead of an intrinsic part (Man 3, XIII Region).

Additionally, the ERIC strategies of “creating collaborative learning spaces”, “promoting the adaptability of innovations” and “visiting significant places/spaces” were each mentioned twice (1.63%).

### **Integration strategies**

The most mentioned ERIC strategy in this case is “generation of incentives/motivation from stakeholders and key stakeholders (5.73%). This strategy may be oriented to students, with the purpose of improving their receptiveness during the implementation of EE by “executing projects that motivate children and give children the necessary materials, time and space ” (Woman 16, VIII Region) or “through entertaining projects of mass interest for students” (Woman 26, VIII Region).

According to participants, this can be directed at schools, seeking for them to adopt EE practices in their daily operation “by means of incentives to establishments that provide certifications like the current SNCAEs” (Woman 9, XIII Region).

Next are the ERIC strategies of “development and/or distribution of educational material” (2.45%), “development of partnerships with scholars/universities” and “educational experience exchanges/visits” (1.63%).

### **Dissemination strategies**

The only ERIC strategy of this category is “dissemination through traditional media” (4.91%). A series of traditional mass media is mentioned, such as “magazines, newspapers, television, ideas for some entertainment websites focused on environmental education” (Woman 12, VIII Region). Person-to-person dissemination is also mentioned; for example, “a good dissemination campaign by mass media and live talks at schools” (Woman 15, VIII Region).

### **Emergent categories**

As mentioned above, the analyses yielded seven emergent subcategories, which were mentioned 37 times. Two of them were associated with scale-up strategies; two with integration strategies and dissemination strategies; and lastly, one was associated with process strategies (see Table 3).

Categories will be qualitatively explained following the same order observed in the Table above.

### **Dissemination strategies**

Curricular innovation in the formal educational model is the most mentioned strategy (21.62% of total emergent categories). The comprehensiveness of this education is pointed out as a guiding principle, "giving priority to the training of people of integrity over a commercial education system. Connection and cognition should be focused on building people" (Woman 4, XIII Region).

In this line, some participants indicate aspects related to critical teaching, pointing first to the importance of avoiding punishment, e.g. "you're teaching them to take care of nature, nothing will come of shouting, there should be guidance so they know how to be in nature in a respectful way" (Man 1, VI Region), and second, by encouraging a dialogic attitude that recognizes the knowledge of students "trading the teaching strategy of responding for the strategy of questioning" (Man 1, XIV Region).

Those comments were differentiated from "dissemination *via* social networks" (in second place at 13.51%). In this sense, the "use of technology for dissemination" (Woman 16, VIII Region) is noteworthy. This has a special effect on EE receptiveness and acceptance "through social networks, since technology is so attractive for the new generations" (Woman 10, VIII Region), "publications of works, experiences from the same students through social networks".

### **Scale-up strategies**

In this set, "incorporation of innovation to undergraduate programs" stands out (13.51%). This strategy seeks to "train teachers at the primary, secondary and university levels. To establish environmental education as a topic in teaching programs" (Man 5, XIII Region). Teacher training is deepened through the incorporation of EE to initial teacher training, incorporating complementary topics:

Modifying educational plans and programs so they incorporate outdoor education from preschool and throughout the entire education process of students (...) Educating future teachers in sensitive topics about the importance of reevaluating the role of nature in human development (Woman 1, VIII Region).

Teacher training should incorporate children as subjects of educational action (Man 2, XIII Region).

Less mentioned is "creation or strengthening of an institutionality that supports implementation (10.81%), with improvements to SNCAE or Ministry of Environment as highlighted strategies. Here, ideas about creating new regulations, guidance and

**Table 3.** Frequency of emergent subcategories.

Categories	N <sup>1</sup>	k <sup>1</sup>	Subcategories	N <sup>1</sup>	k <sup>1</sup>
Dissemination strategies	13	35.13%	Curricular innovation in the formal educational model/system/practice*	8	21.62%
			Dissemination through social networks*	5	13.51%
Scale-up strategies	9	24.32%	Incorporation of innovation in undergraduate training*	5	13.51%
			Creation or strengthening of an institutional system that supports implementation*	4	10.81%
			Integration of children and adolescents in the continuous cycle of programs and measures*	8	21.62%
Process strategies	8	21.62%	Integration of children and adolescents in the continuous cycle of programs and measures*	8	21.62%
Integration strategies	7	18.91%	Integration of family/community into the educational process*	5	13.51%
			Change work conditions of teachers/implementers*	2	5.4%

Note: Categories taken from Leeman et al. (2017)  
Subcategories correspond to emergent categories

technical orientation appear: “Perhaps making a compilation of participative actions that, at the same time, teach how to take care of the environment or what is happening with climate change” (Woman 1, XIII Region).

### **Process strategies**

The “integration of children and adolescents in the continuous cycle of programs and measures” is the most mentioned emergent strategy in the category (21.62%). According to the participants, this is achieved by opening up and “giving opportunities. Children are happy and really enjoy these projects; they learn and become motivated easily; giving them the opportunity is the only thing they need” (Woman 5, V Region). It is clarified that in schools, this may imply trading “the organization of a traditional lesson, for a lesson in which children direct activities” (Woman 5, XIV Region).

This implies a change in all phases of the program’s continuous cycles: “creating environmental education programs and projects that are designed and implemented by children and youths” (Woman 8, XIII Region) or that “starting with activity design, children are incorporated” (Man 2, XIII Region). In summary, “to promote and support projects born from the initiative of children” (Man 2, XIV Region).

### **Integration strategies**

The fundamental emergent strategy in this category is the “integration of family/community into the educational process” (13.51%). The remarks reveal that this strategy develops in a continuum from “massive campaigns in which students participate eagerly and engage their families and promote them in their neighborhoods and schools enthusiastically” (Woman 6, V Region), to campaigns where family is seen as an active subject “also providing environmental education in this context” (Woman 14, VIII Region).

The emergent strategy “change work conditions of teachers/implementers” also appears here (5.2%). People emphasize better work conditions for people fulfilling

the role of educators in EE: “give more hours for planning and execution of activities with students” (Woman 2, VIII Region), “increasing resources for this, as well as the time of people in charge of environmental education” (Woman 17, VIII Region).

## Discussion

The objective of this study was to identify strategies suggested by EE professionals in Chile to enhance the adoption, implementation, and sustainability of these educational processes. A total of 24 out of 73 possible ERIC strategies were identified, which falls within the average range reported in international studies (Dopp et al., 2019; Perry et al., 2019; Waltz et al., 2019). Additionally, seven emergent strategies specific to the local context were identified.

The strategies were classified into five categories based on Leeman et al.'s (2017) taxonomy, with scale-up strategies, process strategies, capacity-building strategies, integration strategies, and dissemination strategies identified in decreasing order of relevance.

In the Chilean context, capacity-building strategies were found to be less relevant compared to studies from countries in the Global North (Leeman et al., 2015). Notably, there was a marked difference in the importance of scale-up strategies. While obtaining more funds was identified as the most important strategy in the Chilean reality, it was rarely mentioned in countries like the USA or UK. Scale-up strategies accounted for 11.47% of the cases in Chile, whereas they were around 0% to 2% in international studies (Boyd et al., 2018; Bunger et al., 2017).

Similarly, given that literature data originates from the health sector and mainly from primary health care, it could be expected that low attention is given to scale-up strategies for replicating innovations in new territories, mandating and strengthening them through regulations, as well as improving their supports in local networks and human resources. All these strategies are part of the basic pool necessary for implementing a primary health care system. Conversely, in a field lacking elemental supports such as EE in Chile (Salinas, 2016), all strategies are vital and basic to imagine greater adoption and subsequent execution of EE in the future (Almeida et al., 2018).

From a complementary perspective, our results suggest that this implies a need for processes such as professional training, creation of educational material, technical guidance and EE dissemination. In the literature, strategies are found that are specific to later implementation phases associated with the sustainability, maintenance and consolidation of EE. Therefore, in countries of the Global North, strategies related to service quality, data-based decision making, and digitalization of management, assessment and report mechanisms have a higher prevalence (Boyd et al., 2018; Bunger et al., 2017; Perry et al., 2019).

In a certain way, this is confirmed by the fact that some of the few studies of the Global North in which strategies are not centered on quality, evidence-based decisions or record and assessment mechanisms correspond to seminal fields such as children's mental health interventions under a family model or the clinical care of men who harm themselves (Dopp et al., 2020; Weir et al., 2021). In this sense, our results suggest that these strategies are related to development in the specific

context of the study, but also to the implementation phase, in which innovation is included, i.e. we are in a moment of exploring, installing, implementing or seeking sustainability of innovations over time (Fixsen et al., 2019).

Particularly, communication strategies associated with dissemination had a significant relevance, differentiating the environmental communication conducted by traditional media from that in online spaces. This emergent strategy, despite being included in the general ERIC categories, has special relevance in the current post-COVID-19 pandemic context, as technology and digital means have become the largest space for EE work (Assaf & Gan, 2021; Cho et al., 2022).

Three other emergent strategies are found because the framework of the instrument applied is a study about the participative approach of EE. Therefore, the following measures are considered important: 1) the integration of children and adolescents in the continuous cycle of programs and measures; 2) the integration of the family/community to the educational process; and 3) the innovation in the formal education model/system practice. All this would facilitate the adoption and implementation of EE, as well as the integration of participative EE, because the educational space would become democratic, changing the way EE is delivered, and building affective pedagogical and community bonds.

Finally, since in Chile EE would be in an installation phase (Fixsen et al., 2019), it may be supposed that the emergence of the three local implementation strategies is related to the readiness of schools for the adoption of EE as an educational innovation. These local strategies consist of incorporating EE into the undergraduate and graduate training of multiple programs across the country (Salinas, 2016). Currently, the country's teacher training considers EE to be in its early stages, and therefore teachers do not have the skills necessary to teach it when they finish their initial training and have to develop them in the daily practice or through in-service training (Berríos Villarroel & González Gamboa, 2020). Without trained teachers, it becomes difficult for educational communities to adopt, implement and sustain these educational actions.

A second strategy is to strengthen an institutionality that supports the implementation of EE, understanding that in Chile, there is a follow-up mechanism for environmental quality standards in the educational establishments, but this process does not monitor or follow-up on the innovations implemented (Prosser et al., 2019). This institutionality should consider the multiples drivers required by an educational innovation (Fixsen et al., 2019), i.e. to have: (1) competence supports that offer training and supervision, (2) administrative supports that allow for adequate follow-up, assessment and data-based decision making, and (3) as well as leadership supports that facilitate teamwork, peer technical advice and advocacy for certain actions.

In this line, changing the work conditions of people implementing these initiatives is related to how EE is being implemented. Currently, a good part of EE actions in Chile lie in highly motivated teachers or educators interested in developing this topic in their establishments or territories (Salinas, 2016); however, in addition to having scarce social support, they are not economically or symbolically supported and therefore can only use a few effective hours. Beyond any questioning to this reality, suggesting changes to these work conditions may help these people effectively maintain the implemented initiatives.

After this summary, this study evidences the usefulness of the ERIC taxonomy (Powell et al., 2015) for analyzing EE, as it was possible to group diverse remarks in a category originating from this framework. Consequently, it is feasible to believe that diverse educational spaces and organizations devoted to the topic could use this pool of strategies to define what is most necessary for the current stage of the processes. Through this, it is acknowledged that despite sharing a general condition, EE can exist in as many different stages as contexts exist, and thus adapting strategies to each phase is a fundamental challenge for the future.

In line with this study, future research should focus on measuring the effectiveness of the strategies here detected for the adoption, implementation and sustainability of EE. Likewise, other studies could use the ERIC or SISTER taxonomy in a checklist format to offer participants the possibility of responding based on pre-established definitions of the strategies they believe are more necessary for their local reality (Grol et al., 2013).

Finally, it should be noted that referring to “decentralized” strategies implies a challenge. Most studies in this field address the strategies that would be used to improve the adoption, implementation and sustainability of a specific policy or intervention, which contributes in a better way to the possible improvements that implementers and decision-makers could make based on the results. Therefore, future studies in the country or Latin America could use the implementation strategies framework to assess and give feedback on a local project or program.

In addition to the theoretical and scientific implications, the findings of this study have practical implications for decision-making at various levels. It is important to approach the results with a critical perspective, considering that the participants are involved in the implementation of actions at the national, intermediate, and local governance levels.

To effectively use implementation strategies as a framework, it is necessary to establish processes for identifying problems and challenges, which can help define the critical elements of a policy, program, or project. Combining a temporal notion of implementation stages with a specific classification can assist in prioritizing strategies and adapting them as needed. Creating spaces for such reflection will undoubtedly contribute to better adoption, implementation, and sustainability of EE actions.

## Conclusions

Practitioners in the field have highlighted the importance of adapting strategies to local contexts and of establishing processes of continuous reflection to improve the adoption and sustainability of environmental actions. The diversity of strategies proposed by EE experts in Chile reflects the complexity and multidimensionality of environmental challenges in the country. From training-focused approaches to cross-sectoral collaborative strategies, there is a wide range of options to strengthen the implementation of EE programs at different levels.

The integration of temporal approaches in the implementation stages, together with a specific classification of strategies, can facilitate the identification of key problems and challenges in environmental policies and programs. This perspective

can contribute significantly to the effectiveness and sustainability of EE actions in Chile and other countries around the world.

Future research should test the effectiveness of these strategies and how they are best adapted to each territory. Comparative studies between regions and even countries should also emerge to identify the strategies that should receive greater support from agencies at various levels. Standards, guidelines and technical guidelines can be formulated based on the identification of these needs.

## Note

1. The quotations extracted from participants have been clarified when necessary.

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## Data availability statement

The data that support the findings of this study are available on request from the corresponding author, G. Prosser. The data are not publicly available due to their containing information that could compromise the privacy of research participants.

## References

- Almeida, S. C., Moore, D., & Barnes, M. (2018). Teacher identities as key to environmental education for sustainability implementation: A study from Australia. *Australian Journal of Environmental Education*, 34(3), 228–243. <https://doi.org/10.1017/aee.2018.40>
- Assaf, N., & Gan, D. (2021). Environmental education using distance learning during the COVID-19 lockdown in Israel. *Perspectives in Education*, 39(1), 257–276. <https://journals.co.za/doi/full/10.18820/2519593X/pie.v39.i1.16>
- Berrios Villarroel, A., & González Gamboa, J. (2020). Educación para el desarrollo sustentable en Chile: Deconstrucción pedagógica para una ciudadanía activa. *Actualidades Investigativas En Educación*, 20(2), 26. <https://doi.org/10.15517/aie.v20i2.41664>
- Birken, S. A., Haines, E. R., Hwang, S., Chambers, D. A., Bungler, A. C., & Nilsen, P. (2020). Advancing understanding and identifying strategies for sustaining evidence-based practices:



- A review of reviews. *Implementation Science: IS*, 15(1), 88. <https://doi.org/10.1186/s13012-020-01040-9>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Boyd, M. R., Powell, B. J., Endicott, D., & Lewis, C. C. (2018). A method for tracking implementation strategies: An exemplar implementing measurement-based care in community behavioral health clinics. *Behavior Therapy*, 49(4), 525–537. <https://doi.org/10.1016/j.beth.2017.11.012>
- Bunger, A. C., Powell, B. J., Robertson, H. A., MacDowell, H., Birken, S. A., & Shea, C. (2017). Tracking implementation strategies: A description of a practical approach and early findings. *Health Research Policy and Systems*, 15(1), 15. <https://doi.org/10.1186/s12961-017-0175-y>
- Buus, N., & Perron, A. (2020). The quality of quality criteria: Replicating the development of the Consolidated Criteria for Reporting Qualitative Research (COREQ). *International Journal of Nursing Studies*, 102, 103452. <https://doi.org/10.1016/j.ijnurstu.2019.103452>
- Caride, J. A., & Meira-Carrea, P. Á. (2020). La educación ambiental en los límites, o la necesidad cívica y pedagógica de respuestas a una civilización que colapsa. *Pedagogia Social Revista Interuniversitaria*, 36, 21–34. [https://doi.org/10.7179/PSRI\\_2020.36.01](https://doi.org/10.7179/PSRI_2020.36.01)
- Cho, C. K., Kim, B. Y., & Stoltman, J. P. (2022). Design, implementation, and outcomes of an in-service program with photovoice as a pedagogical tool for geography teachers. *International Research in Geographical and Environmental Education*, 31(2), 123–138. <https://doi.org/10.1080/10382046.2021.1924983>
- Cook, C. R., Lyon, A. R., Locke, J., Waltz, T., & Powell, B. J. (2019). Adapting a compilation of implementation strategies to advance school-based implementation research and practice. *Prevention Science: The Official Journal of the Society for Prevention Research*, 20(6), 914–935. <https://doi.org/10.1007/s11121-019-01017-1>
- Creswell, J. W., & Garrett, A. L., University of Nebraska-Lincoln. (2008). The “movement” of mixed methods research and the role of educators. *South African Journal of Education*, 28(3), 321–333. <https://doi.org/10.15700/saje.v28n3a176>
- Davis, J., & Ferreira, J. (2009). Creating cultural change in education: A proposal for a continuum for evaluating the effectiveness of sustainable schools implementation strategies in Australia. *Australian Journal of Environmental Education*, 25, 59–70. <https://doi.org/10.1017/S0814062600000409>
- Dopp, A. R., Parisi, K. E., Munson, S. A., & Lyon, A. R. (2019). A glossary of user-centered design strategies for implementation experts. *Translational Behavioral Medicine*, 9(6), 1057–1064. <https://doi.org/10.1093/tbm/iby119>
- Dopp, A. R., Parisi, K. E., Munson, S. A., & Lyon, A. R. (2020). Aligning implementation and user-centered design strategies to enhance the impact of health services: Results from a concept mapping study. *Implementation Science Communications*, 1(1), 17. <https://doi.org/10.1186/s43058-020-00020-w>
- Evans, N., Whitehouse, H., & Gooch, M. (2012). Barriers, successes and enabling practices of education for sustainability in far North Queensland schools: A case study. *The Journal of Environmental Education*, 43(2), 121–138. <https://doi.org/10.1080/00958964.2011.621995>
- Everth, T., & Bright, R. (2022). Climate change and the assemblages of school leaderships. *Australian Journal of Environmental Education*, 39(1), 17–36. <https://doi.org/10.1017/ae.2022.8>
- Feldbacher, E., Waberer, M., Campostrini, L., & Weigelhofer, G. (2023). Identifying gaps in climate change education—a case study in Austrian schools. *International Research in Geographical and Environmental Education*, 33(2), 109–124. <https://doi.org/10.1080/10382046.2023.2214042>
- Fixsen, D., Van Dyke, M., & Blase, K., (2019). Science and implementation. Active Implementation Research Network
- Flowers, R., & Chodkiewicz, A. (2009). Local Communities and Schools Tackling Sustainability and Climate Change. *Australian Journal of Environmental Education*, 25, 71–81. <https://doi.org/10.1017/S0814062600000410>

- González Gaudiano, E., & Arias Ortega, M. Á. (1969). La educación ambiental institucionalizada: Actos fallidos y horizontes de posibilidad. *Perfiles Educativos*, 31(124), 58–68. [https://www.scielo.org.mx/scielo.php?pid=S0185-26982009000200005&script=sci\\_abstract&tlng=pt](https://www.scielo.org.mx/scielo.php?pid=S0185-26982009000200005&script=sci_abstract&tlng=pt). <https://doi.org/10.22201/iisue.24486167e.2009.124.18835>
- Grol, R., Bosch, M., & Wensing, M. (2013). Development and selection of strategies for improving patient care. *Improving patient care: The implementation of change in health care*, 165–184. <https://doi.org/10.1002/9781118525975.ch10>
- Hooley, C., Amano, T., Markovitz, L., Yaeger, L., & Proctor, E. (2020). Assessing implementation strategy reporting in the mental health literature: A narrative review. *Administration and Policy in Mental Health*, 47(1), 19–35. <https://doi.org/10.1007/s10488-019-00965-8>
- Intergovernmental Panel on Climate Change. (2021). *Climate Change 2021: The Physical Science Basis*. Cambridge University Press. <https://www.ipcc.ch/report/ar6/wg1/>.
- Leeman, J., Birken, S. A., Powell, B. J., Rohweder, C., & Shea, C. M. (2017). Beyond “implementation strategies”: classifying the full range of strategies used in implementation science and practice. *Implementation Science*, 12(1), 9. <https://doi.org/10.1186/s13012-017-0657-x>
- Leeman, J., Calancie, L., Hartman, M. A., Escoffery, C. T., Herrmann, A. K., Tague, L. E., ... & Samuel-Hodge, C. (2015). What strategies are used to build practitioners’ capacity to implement community-based interventions and are they effective?: a systematic review. *Implementation Science*, 10(1), 80. <https://doi.org/10.1186/s13012-015-0272-7>
- Liu, L. (2016). Using generic inductive approach in qualitative educational research: A case study analysis. *Journal of Education and Learning*, 5(2), 129–135. <https://doi.org/10.5539/jel.v5n2p129>
- Lorenzo, C., & Bueno, M. D. P. (2020). La conservación de la naturaleza en las relaciones Norte-Sur: El pago por los servicios ecosistémicos. *Revista de Estudios Sociales*, 71, 40–50. <https://doi.org/10.7440/res71.2020.04>
- Lyon, A. R., Cook, C. R., Locke, J., Davis, C., Powell, B. J., & Waltz, T. J. (2019). Importance and feasibility of an adapted set of implementation strategies in schools. *Journal of School Psychology*, 76, 66–77. <https://doi.org/10.1016/j.jsp.2019.07.014>
- Nadeem, E., Gleacher, A., & Beidas, R. S. (2013). Consultation as an implementation strategy for evidence-based practices across multiple contexts: Unpacking the black box. *Administration and Policy in Mental Health*, 40(6), 439–450. <https://doi.org/10.1007/s10488-013-0502-8>
- Pérez-Luco, R., Lagos, L., Mardones, R., & Sáez, F. (2017). Taxonomía de diseños y muestreo en investigación cualitativa. Un intento de síntesis entre las aproximaciones teórica y emergente. *Ámbitos. Revista Internacional de Comunicación*, 39, 1–18. <https://idus.us.es/handle/11441/68886>.
- Perry, C. K., Damschroder, L. J., Hemler, J. R., Woodson, T. T., Ono, S. S., & Cohen, D. J. (2019). Specifying and comparing implementation strategies across seven large implementation interventions: A practical application of theory. *Implementation Science: IS*, 14(1), 32. <https://doi.org/10.1186/s13012-019-0876-4>
- Powell, B. J., McMillen, J. C., Proctor, E. K., Carpenter, C. R., Griffey, R. T., Bunger, A. C., ... York, J. L. (2012). A compilation of strategies for implementing clinical innovations in health and mental health. *Medical Care Research and Review: MCRR*, 69(2), 123–157. <https://doi.org/10.1177/1077558711430690>
- Powell, B. J., Waltz, T. J., Chinman, M. J., Damschroder, L. J., Smith, J. L., Matthieu, M. M., ... Kirchner, J. E. (2015). A refined compilation of implementation strategies: Results from the Expert Recommendations for Implementing Change (ERIC) project. *Implementation Science: IS*, 10(1), 21. <https://doi.org/10.1186/s13012-015-0209-1>
- Proctor, E. K., Powell, B. J., & McMillen, J. C. (2013). Implementation strategies: Recommendations for specifying and reporting. *Implementation Science: IS*, 8(1), 139. <https://doi.org/10.1186/1748-5908-8-139>
- Prosser, G., Bonilla, N., Pérez, M., Prosser, C., & Rojas Andrade, R. M. (2019). No basta con la semilla, se ha de acompañar al árbol: Importancia del contexto de implementación

- en los programas de educación ambiental. *Revista Colombiana de Educación*, 1(78), 73–96. <https://doi.org/10.17227/rce.num78-9322>
- Saidón, M., & Claverie, J. (2016). Percepciones de docentes y directores sobre los factores que promueven u obstaculizan la educación ambiental en escuelas del Área Metropolitana de Buenos Aires. *Ciência & Educação (Bauru)*, 22(4), 993–1012. <https://doi.org/10.1590/1516-731320160040010>
- Salinas, D. (2016). Educación ambiental para el desarrollo y consumo sustentable en Chile. Una revisión bibliográfica. *Revista Electrónica Educare*, 20(2), 41–55. <https://doi.org/10.15359/ree.20-2.3>
- Slaughter, S. E., Hill, J. N., & Snelgrove-Clarke, E. (2015). What is the extent and quality of documentation and reporting of fidelity to implementation strategies: A scoping review. *Implementation Science: IS*, 10(1), 129. <https://doi.org/10.1186/s13012-015-0320-3>
- Suárez-López, R., & Eugenio-Gozalbo, M. (2021). How is sustainability addressed in primary and secondary education curricula? Assessing the cases of Spain and Portugal. *International Research in Geographical and Environmental Education*, 31(2), 106–122. <https://doi.org/10.1080/10382046.2021.1924498>
- Waltz, T. J., Powell, B. J., Matthieu, M. M., Damschroder, L. J., Chinman, M. J., Smith, J. L., ... Kirchner, J. E. (2015). Use of concept mapping to characterize relationships among implementation strategies and assess their feasibility and importance: Results from the Expert Recommendations for Implementing Change (ERIC) study. *Implementation Science: IS*, 10(1), 109. <https://doi.org/10.1186/s13012-015-0295-0>
- Waltz, T. J., Powell, B. J., Fernández, M. E., Abadie, B., & Damschroder, L. J. (2019). Choosing implementation strategies to address contextual barriers: Diversity in recommendations and future directions. *Implementation Science: IS*, 14(1), 42. <https://doi.org/10.1186/s13012-019-0892-4>
- Watts, N., Amann, M., Arnell, N., Ayeb-Karlsson, S., Beagley, J., Belesova, K., ... Costello, A. (2021). The 2020 report of the Lancet Countdown on health and climate change: Responding to converging crises. *Lancet (London, England)*, 397(10269), 129–170. [https://doi.org/10.1016/S0140-6736\(20\)32290-X](https://doi.org/10.1016/S0140-6736(20)32290-X)
- Weir, A., Presseau, J., Kitto, S., Colman, I., & Hatcher, S. (2021). Strategies for facilitating the delivery of cluster randomized trials in hospitals: A study informed by the CFIR-ERIC matching tool. *Clinical Trials (London, England)*, 18(4), 398–407. <https://doi.org/10.1177/17407745211001504>
- Winkler, M. I., Alvear, K., Olivares, B., & Pasmanik, D. (2014). Psicología Comunitaria hoy: Orientaciones éticas para la acción. *Psicoperspectivas. Individuo y Sociedad*, 13(2), 43–54. <https://doi.org/10.5027/psicoperspectivas-Vol13-Issue2-fulltext-353>

## Appendix A

**Table A1.** Strategy taxonomy.

Categories	Definition
Dissemination strategies	Include any action or group of actions that promote the awareness, knowledge, attitudes and intention to adopt participative EE by decision-makers, implementation professionals, teachers and other people relevant to the field.
Process strategies	The strategies of the process are focused on how implementation teams execute the required activities to select, adapt and integrate a participative EE. Strategies are often classified into stages, for example, exploration, adoption, preparation, implementation and maintenance.
Integration strategies	Any action or group of actions aimed at the factors contributing to or detracting from the optimal integration of participative EE in practice. Integration strategies are mainly focused on determinants at the people level (motivation, self-efficacy) and internal environments (leadership commitment, communication).
Capacity building strategies	The creation of systems to support the general capacity of people (motivation, self-efficacy, technical knowledge) and organizations (preparation, positive climate, effective communication) to conduct participative EE.
Scale- up strategies	Implemented in order to make it possible for multiple scenarios to adopt participative EE. This implies deepening the practice in a territory where it is already installed, integrating new levels as well as spreading these participative actions to new territories.

Source: Adaptation to EE and translation into Spanish of the taxonomy offered by Leeman et al. (2017)