State of the Art: Vegetable Gardens, Food Security, Technology, and Dialogue of Knowledge as a Proposal for Micro-Curricular Transformation from the Epistemologies of the South

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"Degrowth, just as it promotes the recycling of material waste, must also be concerned with the rehabilitation of the excluded. And if the best recycling consists in discarding less, the best form of social rehabilitation consists in avoiding exclusion."

Serge Latouche

Abstract

Background: The integration of vertical home gardens in educational settings has gained attention as a strategy for food security and environmental education. This study explores the state of the art on vegetable gardens, food security, technology, and the dialogue of knowledge as a means for micro-curricular transformation from the epistemologies of the South.
Methods: A systematic bibliographic review was conducted following the methodology proposed by Mora (2018). Scientific databases such as Scopus, Elsevier, Eric, Google Scholar, and Science Direct were used to identify relevant literature. The selected documents were analyzed using Atlas.ti software to extract emerging categories and establish relationships between concepts.
Results: Key themes identified include food security, environmental education, micro-curriculum development, and the role of blended learning in sustainable pedagogical practices. The findings highlight the relevance of urban gardening in fostering ecological awareness, food sovereignty, and socio-community interactions. However, gaps remain in integrating vegetable gardens into school curricula and in designing participatory micro-curricular approaches for environmental literacy.
Conclusions: The study underscores the potential of vegetable gardens as pedagogical tools to bridge traditional and scientific knowledge. Future research should focus on curricular adaptation, digital integration in environmental education, and the role of home gardens in promoting degrowth and food sovereignty in educational settings.

Keywords: Vertical home gardens; Food security; Environmental education; Micro-curricular transformation; Blended learning; Epistemologies of the South; Food sovereignty.

Introduction

This paper addresses the main studies carried out on vertical home gardens and food security in educational contexts and their micro-curricular adjustments as a means to articulate school scientific knowledge and traditional ecological knowledge, in an exercise of dialogue of knowledge. From this perspective, the methodology implemented for the bibliographic search of such information and the strategies analyzed for developing a study about the research project question in the Inter-institutional Doctorate in Education (DIE-UD), under the research line of Inclusion of the Environmental Dimension in Science Education, focusing on the "environmental micro curricular strategy for food security in secondary education as an educational experience of *blended learning* around the home vertical vegetable garden", to finally develop conclusions in relation to trends, gaps and limits, in order to elucidate the scientific, original and innovative contributions to the nature of the study.

For developing the state of the art, the methodology proposed by Mora (2018) will be used, where the practical guidelines for carrying out a rigorous study of the documents are established. Initially, the selection of a list of keywords around the research is proposed, which in the case of this study were selected a priori and as the documents to be worked on were selected, new emerging categories emerged, which will later be called nodes. The first selection was the result of approaches to the literature on gardens, food security, community education and dialogue of knowledge and microcurriculum (Blended learning, Learning Transitions, Environmental Education and Curriculum) to then elucidate new concepts, as shown in Table 1.

The search for information was carried out through the bibliographic databases of Scopus, Elsevier, Eric, Google Scholar and Science Direct, selecting the relevance of the documents, based on the reading of abstracts and citations of articles from scientific journals, and then processing them in a first draft of content analysis, in the Mendeley bibliographic manager. The selected documents were loaded and read in the specialized qualitative analysis software Atlas.ti-Version 6, with which the Nodes or emerging categories of the a priori categories were systematized, as well as the selection of textual quotations or "Quotes" that allowed the development of each of the nodes. Memos" or reflections were structured around the documents processed in the software, to finally generate two Networks for each of the a priori categories, the first with the organization of the documents worked on by category and the second around the bridges or relationships that can be evidenced between the nodes, the above to demonstrate the search, systematization and argumentation of the trends, gaps, and limits.

Table 1

Categories and documents of the State of the Art

A priori Categories - Codes	Doc. databases	Doc. Mendeley	Doc. Atlas.ti
Huerta	2670	408	39
Food safety	575	33	18
Dialogue of knowledge and community education	1086	32	30
Micro-curriculum Blended learning	82	80	25
Micro-curriculum - Environmental education	2181	62	35
Micro-curriculum transitions	26	10	5
Micro-curriculum curriculum	756	15	3
ALFAM micro-curriculum	350		

	Emerging Categories and Nodes
Huerta	Access to land, Access to food, Community agriculture, Well-being, Biodiversity, Good living, Quality of life, Pro-environmental behavior, Environmental awareness, Ecological awareness, Traditional knowledge, Ecosystem conservation, Food consumption, Household consumption, Pollution, Smart crops, Culture, Ecologization, Environmental education, Pedagogical strategy, Governance, Consumption habits, Horticulture, Vegetable garden, Home garden, School garden, Vertical home garden, Socio-community interactions, Monoculture and polyculture, Nutrition, Leisure and free time, Medicinal plants, Poverty, Food production, Health and food safety.
Food safety	Access to land, Urban agriculture, Quality of life, Climate change, Community awareness, Traditional knowledge, Consumption, Hydroponic crops, Culture, Specialized curriculum, Degrowth, Dietary diversity, Greening, Community economics, Environmental education, Nutrition education, Case study, Ecosystem management, Ecosystem management, Hunger, Community gardening, School garden, Home gardens, Food justice, Socio-ecological memory, Mixed methods, Community organizing, Participation, Poverty, Urban agriculture policy, Production, Resilience, Health, Food security, Food system, Sustainability and Times of crisis.
Dialogue of knowledge and community	Action, Urban agriculture, Agrobiodiversity, Agroecology, Food literacy, Environmental literacy, Food and nutrition, Alterity, Anthropocentric, Biocentrism, Good living, Community, Social consciousness, Ancestral knowledge, Ecosystem conservation, Food consumption, Counterhegemonic, Culture, Decolonial, Democracy, Dialogue of knowledge, Education, Community education, Emancipation, Epistemologies of the South, Epistemologies, Ethics, Globalization, Hunger, Hegemony, History, Homogenization, Community gardens, Home garden, School garden, Collective identities, Intercultural, Participatory action research, Community justice, Social and political movement, Social movements, Organic, Social organization, Emerging paradigm, Participation, Pluralism, Power, Politics, Praxis

Micro Curriculum Blended learning	Accessibility, ICT health isolation, technological literacy, distance learning, open learning, active learning, asynchronous learning, self-regulated learning, blended learning, mixed learning, face-to-face learning, meaningful learning, synchronous learning, flipped classroom, self-learning, self-efficacy, self-esteem, autonomy, traditional sociocultural knowledge, social constructivism, macroscopic dimension, symbolic dimension, submicroscopic dimension, methodological design, distance education, flexible education, hybrid education, digital era, scalability, learning styles, EVA virtual learning environments, gamification, ICT skills, technological innovation, sociocultural interaction, virtual laboratory, mobile learning, motivation, critical thinking, augmented reality, virtual reality, digital learning resource, learning outcomes, feedbac, ICT and crisis.
Micro-curriculum - Environmental education	Access to food, Scientific literacy, Curricular Ambientalization, Ecological illiteracy, Autonomy, Biodiversity, Good living, Environmental change, Post-normal science, Science and technology, Community, Relevance clusters, Scientific knowledge, Didactic content knowledge, Historical context, Environmental crisis, Culture, School culture, Decreasing, Democracy, Development, Integral development, Didactics, Curriculum design, Cultural diversity, Ecology, Ecosystem, Science education, Education for sustainability, Emancipation, Empowerment, Teaching ecology, Ethics, Globalization, Healthy habits, Transition hypothesis, Environmental history, Home gardening, Community gardens, School gardens, Identity, Uncertainty, Innovation, Curricular integration, Interculturality, Participatory action research, Social and environmental justice, Metacognitive, Narrative, Constructivist paradigm, Participation, Community pedagogy, Critical socio-environmental pedagogy, Latin American environmental thinking, Complex thinking, Critical thinking, Educational policy, Educational process, Food production, Scientific racism, Traditional knowledge, Food security, Food sovereignty, Socio-environmental, Socio-cultural, Socio-economic, Socio-educational, Sustainability, ICT, Transformation, Didactical transposition, Life
Micro-curriculum	Remote education, flexibilization of actors/roles, flexibilization of curriculum, flexibilization of learning, flexibilization of content, flexibilization of context, flexibilization of learning goals/purposes, flexibilization of processes, flexibilization of products, flexibilization of indicators/achievements, curriculum integration and pedagogical transformation.
Micro-curriculum curriculum	Constructive alignment, epistemological content analysis, historical content analysis, dynamic change, complex causality, linear mechanical causality, mythical causality, simple causality, co-evaluation, complexity of teaching knowledge, complexity of school knowledge, school knowledge, constructivism, intermediate constructs, curriculum, curriculum development, curriculum design, environmental education, evolution of students' ideas, didactic tool, progression hypothesis, transition hypothesis, didactic research, didactic itineraries, macrocosm, Mass media, mesocosm, microcosm, levels of formulation, complexity paradigm, critical thinking, expected learning outcome, conceptual frameworks
ALFAM micro-	Attitudes and emotions, environmental literacy, artifacts in context, techno-political artifacts, behaviors, knowledge and skills, digital culture, degrowth, environmental dimensions, questionnaire design, social ecologism, ecological school garden, didactic research methodology, technical mutation, permaculture, power and authority, resistance, political change and questionnaire validation.

With respect to the methodology implemented for the analysis of the state of the art, it is convenient to generate a systematization process carried out for each of the categories, for which the Networks resulting from the processing of the information in the Atlas.ti software will be presented.

Food safety

According to the Food and Agriculture Organization (FAO) (2012), “food and nutritional security exists when all people at all times have physical, social and economic access to food that is safe and consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, services and health care, enabling a healthy and active life” (p. 17). When food security is one of the premises of society to ensure its survival in the face of climate change and increasing population density, it is essential for urban communities to innovate in planting and harvesting practices. Of course, education plays a fundamental role in this process, particularly with the implementation of the home garden as an experimentation laboratory for the new generations, associating science with nature, reconnecting with it, and generating alternative responsible consumption habits in the face of the linear developmentalist context. It also promotes education for disaster risk reduction, while contributing to food sovereignty, sustainable solidarity and the dialogue of knowledge based on the

collective construction of awareness and participation in the care of the environment. Thus, according to Santamaría (2018), education focused on training in values and the creation of global citizens is one of the issues that should be given special priority from educational centers, favoring a cross-cutting approach so that students are able to understand the world in which they live and can change it towards a more just and supportive one.

Now, it is important to highlight that, as a result of the analysis of the selected research against the described categories, the frequency of the nodes is shown in the first number, within the parentheses, the times in which these concepts appear in the documents, and an analysis of the node as follows:

Poverty (13): It is one of the most reiterative nodes, only presenting relations with health. In the documents, food security was aligned with scarcity of economic resources and focused on regions considered third world.
Home gardens (13): It is focused from two perspectives, one related to the capitalist processes of production and consumption for sustainable development, but in other documents it was considered as a fundamental element to promote degrowth and community processes.
Participation (12): This is related to educational processes and the communities' concern for environmental management and care.
Production (11): It projects the need for agricultural growth to meet the dietary and nutritional needs of the population, which is linked to consumption, the socio-environmental crisis, hunger and ecosystem management.
Health (10): This is related to food sanitation, anthropometric and nutritional processes of people, leaving aside the impact of the carbon footprint produced by agriculture.
Urban agriculture (10), community garden (10) and school garden (7): These are linked to community experiences and the democratic participation of social actors.
Quality of life: It is framed from a consumerist and linear production perspective, as it is considered as the unlimited access of people to goods, without thinking about its impact on other forms of life.

It can be deduced, then, that the above nodes are considered trends in food security. However, with regard to educational processes, few nodes are related to the inclusion of the curriculum and science education, and on the contrary, they cover topics related to health sciences and socioeconomic processes. Thus, the relevance of the research work on food security in school spaces is evident, within the micro-curricular elements of the pedagogical practice, as an emerging alternative to the need for degrowth.

Huerta

For Maya (1992), it is necessary to point out that “perhaps more than ever in history, contemporary society is forced to undergo radical transformations if it wants to avoid the annihilation of living systems” (p.48). The implementation of vegetable gardens is currently considered an emerging practice, which historically has made possible the access and use of land and therefore food, the creation of social fabrics and the renaturalization of cities for good living.

For the development of the orchard category, 39 documents were analyzed. The following is the relational analysis between the different nodes systematized in the documents found with the orchard category. Thus:

Food security (37): This seeks to break the paradigms rooted in monoculture and the generation of intelligent crops, through the automation of horticulture, thus causing greater food production and consumption, which for experts is an indicator of health.
Health (32), Nutrition (16): The literature raises links between nutrition as an indicator of health, which is achieved through food security processes for sustainable development, which in its order of importance, gives prevalence to the anthropocentric vision, even, in times of crisis.
Food production (30), Food consumption (22): Mention is made of the need to generate domestic consumption habits, limited by access to land and, therefore, to food.
Home garden (26), Community agriculture (18), Vertical home garden (7), School garden (3): Community agriculture has promoted different ways of building scenarios of food sovereignty and sustainability, through the production of conscious gardens that contribute to pro-environmental behavior and ecological awareness.
Times of crisis (26), biodiversity (12): Refers to the need to produce thoughts and actions based on sustainability, in emerging scenarios that require the conservation of ecosystems, biodiversity and agro-diversity, in the face of excessive consumption and the culture of waste that generates pollution.

Sustainability (24): It is related to environmental processes, due to global and national public policies and the emergency to act in the face of climate change and other threats to ecosystems. However, it is based on an anthropocentric view, as it does not generate searches for degrowth and stop with capitalist consumption and the culture of mercantilist immediacy.
Culture (22), Socio-community interactions (20), Traditional knowledge (21): The orchards consist of spaces where food, dialogues and customs converge in relation to cultivation practices, which implies the development of the indigenous and peasant worldview of "Good living" in terms of coexistence with the other, thought not only from human relations, but also with nature. This generates coexistence processes focused on the well-being of the communities, their cultural relations and the interactions between traditions.
Environmental education (15), Greening (20): Vegetable gardens, are considered a pedagogical strategy of environmental education, where the concern for the knowledge of nature and its preservation, generate the possibility of responding to the current environmental crisis, such is the case of the use of sustainable development in educational processes; however, it is also necessary, to relocate ancestral knowledge as an emerging element before the processes of knowledge construction.

Poverty (14) and Welfare (10): These two antagonistic categories show the tendency of the notion of poverty within the literature consulted in different categories. However, poverty is mentioned as a social structure, without inquiring about its causes and what is understood by poverty for each of the documents consulted, thus, the garden strategy is proposed as an element that contributes to reduce, at least in the food issue, the consequences of this "social structure".

Now, the tendencies of the orchards in relation to the nodes, poverty, orchards, health and quality of life, as constant nodes regarding the contribution of the orchards with the tensions created in times of crisis, are evident. Also the linkage of gardens in multifunctional architectural constructions in both food security and the greening of cities.

However, there are bibliographic gaps regarding the curricular adjustments in terms of gardens for the development of school contents, as well as the justification of the garden as an element that contributes to food sovereignty and its interference in school processes, and even in community or popular processes.

Community education and dialogue of knowledge

The reflections raised by Boaventura de Souza (2018), regarding the profile of the emerging paradigm, prudent knowledge for decent life, which invites to redefine the relationship assigned to the dyads: natural scientist/social scientist; local/total; knowledge/self-knowledge; scientific knowledge/common sense, as properties of the transformation of knowledge for the emancipation of the hegemonic domination of the enlightenment and to advance on grounds of transdisciplinarity, pluriculturality and epistemologies of the South.

Education in times of crisis must not only act accordingly in the face of the strange context that presents itself, it must also be a wake-up call to rethink education as a means of preparing for catastrophe scenarios. In the world of exploitation, production, trade, advertising and linear consumption, food security is perceived to depend on monopolies and there is an urgent need to relocate, redistribute, restructure and reconceptualize the dynamic human interaction with nature. There are relevant Ibero-American educational experiences, which should be taken into account, for their purpose of creating citizenship through inclusive proposals that affirm that an inclusive citizenship is formed from education and its implications in the reduction of social inequality, evidencing the importance of cooperative work, dialogue of knowledge and food security (Ramírez 2016).

Disengaging from the homogeneous, global, capitalist, colonialist, scientific, technical, patriarchal, self-determined as superior, that does not learn from the South and does not translate alternative realities different from its own, but on the contrary, that generates new relations of recognition of subalternity or ideologically and territorially displaced, offering perspectives linked to the heterogeneous, challenging centrality, rescuing the experience and knowledge, recognizing the diversity of the world, summoning alternative theories, disputing the field of struggle of the oppressed, conceptualizing the global south, returning to the recognition of the diversity of knowledge, investigating the struggle within groups and social movements, in short, establishing cognitive justice, which as Boaventura de Souza mentions "founds and contaminates the other injustices".

In this context, 30 documents were reviewed and the following articulations between the emerging categories and the nodes are evident:

Dialogue of knowledge (16), ancestral knowledge (16) and community education (13): consider a paradigm shift in the face of colonial and hegemonic elements, based on patriarchy, capitalism, consumerism, racism, among others. It uses community

research methods such as research-action-participation, where history, culture and community give way to new consciousness and actions. In terms of science education and the use of gardens, the bibliography emphasizes the development of environmental and food literacy processes.

Participation (14), community (13), social conscience (14): These nodes are related to the previous section, as they raise elements of the epistemologies of the South as transformative theories based on emancipation, through loops of social conscience that link communities, through interactions between collective identities and their ancestral knowledge, which allow transcending and generating social changes towards otherness.

Collective identities (12), Sociocultural (10) and Territory (10): Collective identities refer to social, political, cultural, economic and spiritual praxis where elements such as pluralism, ethics and community generate transformations thought from the territories.

Sustainability (11), Food Security (11), Health (10), Food Consumption (9) Globalization (7): They are articulated with the hegemonic processes in the face of emerging capitalisms, where the anthropocentric view focuses on food production, generating homogenization processes in relation to the subjectivities of people and their links with nature in socio-environmental issues such as hunger, food and nutrition, which although they are important social tensions, they are not thought to be the product of capitalism that justifies them, even in times of crisis.

Sustainability (10), Otherness (9), Good Living (7), Transformation (10): These are the pillars of community education and the dialogue of knowledge and raise the epistemologies of the South, as an emerging paradigm, focused on reflective action that seeks an emancipation that transforms social, environmental, economic and cultural dynamics, based on social organization for the constitution of counter-hegemonic political movements that seek community justice and social elements that transcend towards a worldview of good living.

In relation to the trends in the category, it is possible to establish bridges between the processes of retaking the epistemologies of the south as a transforming element in times of crisis. This would imply in educational research, rethinking the social relations of the school community and its links with ecosystems, consumption and the environment, therefore, the gardens are an appropriate strategy to reflect together, emancipatory elements against the practices and habits of capitalist consumption.

On the other hand, limits and gaps are evident in the construction of curricula based on the epistemologies of the South and their impact on pedagogical practices in a concrete way, since utopias are mentioned in relation to the retaking of ancestral knowledge, but they do not materialize in relation to the micro, meso and macro curricula. When dealing with the processes of food sovereignty and indigenous and peasant cosmovisions displaced to the cities, ethno-education processes are developed in garden cultivation practices, in order to collect those traditions and functionalities of the agro-diversity of the plants cultivated in the gardens. Also, there is not much evidence of research related to specific didactics for the consolidation of dialogues of knowledge and the use of technologies as a means of resignification of digital interactions in the service of globalizing processes, which can also be consolidated as an intergenerational strategy to share ancestral and traditional links.

Microcurriculum

This category is developed with the categories blended learning, environmental education, environmental literacy, transitions and curriculum, as concepts that configure it. Regarding the research “Strategy microcurricular environmental for food security in secondary education: an educational experience “blended learning” around the vertical home vegetable garden”. Figure 10 shows the bibliography analyzed in relation to the categories mentioned.

Education and environmental epistemology

Leff (2007) invites to environmental rationality in educational processes, which is forged in a reencounter of the real and the symbolic, in the resignification of the world and nature, in a framework of relationships of otherness between beings and a dialogue of knowledge, where the being is reconfigured, their identities are reconstituted, and new social actors are forged in a policy of difference guided by a desire for knowledge and justice, in the social reappropriation of the world and nature. To explore alternative conceptions to scientific knowledge, a situation that has become visible, through environmental rationality mediated by the dialogue of knowledge and pluralistic epistemologies in several scientific practices around serious problems such as climate change, environmental disasters, population growth, extractivism, ecosystem degradation, hyperconsumption, among others, product of human intervention and its ecological footprint.

The environmental impact of the project is framed in the fulfillment of the SDGs, such as food sovereignty, quality education, responsible production and consumption and climate action, while promoting actions based on generating in the educational community reflection on ecological ethics, sustainable solidarity and innovation in the creation of home gardens as an indispensable element for urban renaturalization and science learning. It also aims to encourage citizens to recognize four of the most important processes of Latouche's (2009) virtuous circle of serene degrowth: "Restructuring, redistribution, reconceptualization and relocation". Assuming the complexity of socio-environmental issues in interdependence between scientific knowledge produced by Eurocentric modernity and other traditional knowledge.

The field of the research project assumes problem solving that is located in the perspective of post-normal science, taking into account that the degree of uncertainty increases as it approaches communal relations, alluding to "the problem does not concern the discovery of a particular fact but the understanding or management of an inherently complex reality", but also, and not least, with "what is at stake in the decisions, we encompass all the various costs, benefits and value commitments that the problem involves through the various people who take positions in the game and risk something in it" (Funtowicz and Ravetz, 2000, 37). In this context, the pedagogical path must recognize the disruptive pluricultural characteristic in the traditional paradigms of education, through the dialogue of knowledge, creative and propositive, towards new ways of approaching the development of processes tending to the pedagogical transformation for the XXI century, in which life, in all its manifestations is the center. Now, in relation to the environmental education category, the relationships between the nodes elucidated in the 35 documents analyzed in the Atlas.ti software V.6 are presented below.

Participation (19), Democracy (14): Environmental education suggests generating participatory and democratic processes related to community pedagogy.
ICT (19), Critical thinking (15), Sustainability (15), Complex Thinking (14): Science and technology during the last decades have been anchored to learning and teaching processes in environmental education, as they generate processes of autonomy, innovation, social transformation and development, which explains that critical thinking and complex thinking, elucidated in the transition hypotheses, are strengthened in school contexts.
Sustainability (16), Social And Environmental Justice (16), Transformation (16): environmental education emphasizes the reading of the historical context that is thought of as empowerment from a cultural diversity perspective and invites communities to generate food sovereignty practices for good living, through reflection on environmental epistemologies practiced from community, school and home gardens.
Socioeconomic (16), Development (17): The economy is one of the social engines that shapes life and social practices, following the processes of globalization and environmental crises, the theory of sustainable development and the generation of healthy habits has been developed; however, there is still the tension of growth based on production and consumption.
Socio-environmental (17), ecology (15): Critical socio-environmental pedagogy is proposed, where elements of critical pedagogy and the theories and concepts of environmental processes and sciences converge, as well as elements of ecology teaching.
Culture (24), Cultural Diversity (18), Interculturality (14), Sociocultural (14): Tensions are evident regarding the role of culture in generating processes of vindication and rescue of traditional knowledge, but it seeks the globalization of life and acculturation practices, which homogenizes worldviews, which can mean the loss of traditional knowledge.
Science education (25), Critical Socio-Environmental Pedagogy (17), Curricular Integration (14), Didactics (14), Community Pedagogy (10): This group of nodes is quite nourished, due to the relationships between environmental education and pedagogical processes. There is evidence of relationships configured from the curricular design, the didactic knowledge of content and the educational policy where the normative and hidden elements of the specific pedagogical practice converge. From a second aspect, there is evidence of Latin American environmental thinking, complex thinking and participation, which are related to the epistemologies of the South and critical pedagogies. And finally, from a third aspect, the purely environmental and scientific knowledge is configured, where ecological illiteracy, the teaching of ecology, education for sustainability and knowledge related to vegetable gardens are articulated.

In relation to the trends, it is evident that environmental education is based on the foundations of critical pedagogies and their relationship with sustainability and the epistemologies of the South, claiming elements of food sovereignty, democracy and socio-cultural processes, in order to seek transformations in the face of the current crisis scenario and produce decadent alternatives to the culture of consumption and production, expressing the importance of reflecting on assuming the role of citizenship in the face of environmental changes, through the generation of actions, political movements, community interactions aimed at the care and conservation of the other and the environment. Another trend is related to the curricular and didactic

perspective, where interesting elements such as the use of Information and Communication Technologies, curricular integration and the development of critical and complex thinking are shown.

In view of the gaps found, it is important to go deeper into home gardens and specifically home or school gardens in vertical terms, due to the difficulties that communities and educational contexts have in accessing land. Unlike the previous categories analyzed, environmental education does not delve into the nodes of food security and sovereignty, fundamental elements for food literacy for sustainability. Finally, one of the limitations is the lack of studies that work with secondary education populations, since during the reading, it is evident the work with communities, infant students, professional teacher education, and even with women, immigrants and indigenous communities, but there is no evidence of studies with adolescent schoolchildren.

Blended Learning

Escobar (2010) points out an ineluctable obligation "with the local/locality; with the marginalized; with the public sphere, with a constant critical self-examination". In addition, he puts in scene the new information and communication technologies, which allows approaches from critical perspectives: There is a political ecology of cyberspace that suggests that the "cultures" developed from the networks supported by NICTs (New Information and Communication Technologies) need to be aware of the dual nature of the struggle, with respect to the nature of cyberspace and NICTs on the one hand, and to the actual restructuring effected by transnational capitalism guided by NICTs on the other. This means that its objective is to create subaltern intelligent communities, which need to be ecological and ethnic in the broad sense of both terms (Escobar, 2010). The links between blended learning and the recurrent nodes in the consulted research are expressed below, which are also described according to the order of frequency and are grouped according to their theoretical articulations.

Traditional socio-cultural knowledge (3), Convergence (9): The connection between scientific knowledge and traditional knowledge is identified, linking the face-to-face and the virtual.
Technological literacy (4), Hybrid Education (3), Johnstone Triangle (2), Scalability (7): They articulate technology and pedagogical processes, evidencing the possibility of ubiquity of education with the use of ICTs, following methodological designs aimed at meaningful learning, autonomy and learning outcomes. These links are present in the hybrid models of distance education and flexible education.
Digital Didactic Resource (7), Methodological Designs (5), Inverted Classroom (6), LMS (5), Autonomy (9), Critical Thinking (6): Refers to the implementation of pedagogy in technological and digital artifacts present in the digital era, where technological innovation and space-time scalability predominate, contributing to educational interactions, together with their methodological designs and social configuration, which enables the integral development of subjects in both, their autonomy for the pursuit of their learning and constant feedback according to learning styles.
Technological innovation (18), digital era (15), times of crisis (7): After the health difficulties of the Covid pandemic - 19 and currently with the tensions of environmental changes, including climate, technology has great challenges to respond to this context, thus, making use of the relationship between technology and pedagogy, didactic resources are proposed, such as the inverted classroom, virtual learning environments, gamification and virtual laboratories, enabling the shortening of distances and the democratization of knowledge, tending to the convergence and expansion of the virtual and the presence in a continuum of constant learning.

The trends of the blended learning node consist of the incidence of the Covid Pandemic - 19 and the times of crisis, as a scenario for the rise of technological innovation in pedagogical and educational processes, as well as the importance of promoting ICT-based skills, which allow to promote scenarios of autonomy in students. Now, the studies project the production of digital didactic resources, which contribute to maintain the motivation of learners, as a fundamental element to connect the subjects with knowledge and information and its ease, scalability and ubiquity of technological artifacts, which allows quick access to information and interaction with others.

Even so, there are limits to the application of the blended learning methodology for environmental literacy processes, the contribution to vindicate the place of food security and sovereignty in the reflective processes of society in relation to sustainability and its relevance in the current crisis scenarios. Additionally, there are works developed mostly with university students, but limited in high school contexts, the applicability of blended learning in contexts without connectivity or technological artifacts, processes that accentuate both cognitive and social injustice.

Transitions - Environmental Literacy - Curriculum

Another of the categories developed in the research and related to micro-curriculum, consist of transitions, environmental literacy (ALFAM) and curriculum, which are shown in Figure 15.

Rodriguez, Fernández, and García (2014) propose "transition hypotheses as a didactic tool that helps solving the problem of giving meaning, in terms of the one who teaches, to the process of knowledge construction. It would be a useful instrument for programming educational intervention and for guiding the exploration and understanding of the difficulties that students find in the process of knowledge construction" (p. 104), which configures the student's learning process during the teaching-learning processes.

Now, according to Roth (1992), an environmentally literate subject is one who uses various interdependent competencies and is aware of the interrelationships established between human beings (society) and the biosphere, being, in turn, able to reflect on their consequences and to make decisions and intervene in a way adjusted to the limits of the planet (Roth, 1992, cited by Fernández, Marín, Lozano, and Ramírez, 2022), proposing an emerging vision of the relationships between human beings and natural resources and insinuating a posture of degrowth with respect to consumption processes, in addition to the subject's abilities to reflect and make decisions regarding their daily practices.

Environmental Literacy

Degrowth (2), digital culture (2) and techno-political artifacts (3): Environmental literacy allows the production of knowledge and reflections on environmental care, taking a position on consumption habits, the incidence of assuming behaviors, attitudes and emotions that act together with pedagogical practices and school discourses related to the times of crisis and the care of ecosystems and biodiversity.

Transitions

Didactic tool (4), complexity paradigm (2), constructive alignment (2), transition hypothesis (2) and progression hypothesis (2): It is related to the construction of complex knowledge, during the learning process and is configured by the sequential transformations of knowledge construction, starting from learning planning.

Curriculum

Curricular development (2), school knowledge (2) and flexibilization (9): It is based on curricular flexibilization according to seven components focused on the needs of the student and the reading of the historical and cultural context for educational transformation, within the framework of the use of information and communication technologies.

According to the categories developed in the Microcurriculum, the implementation of methodologies supported by digital learning, programming and experimentation platforms, with simulation elements at different levels, articulating the macroscopic, microscopic and symbolic aspects of science learning, is evidenced as a trend. Another trend is the delimitation of the learning process of each student, through the development of transition hypotheses, based on the expected learning. Finally, interactions are projected between the processes of environmental literacy and the use of information and communication technologies.

Regarding the gaps and limits of the micro-curriculum, there is a lack of research at the level of the categories proposed from the micro-curriculum, applied in secondary and middle school education. The development of participatory micro-curricula that allow the democratization of education, for the participation of students and the entire educational community in the processes of consolidation of environmental literacy.

By way of conclusion

According to the analysis of the trends, gaps and limits of the research in the Inter-institutional Doctorate in Education (DIE-UD) "Environmental micro-curricular strategy for food security in secondary education: a "blended learning" educational experience around the vertical home garden", the following conclusions can be drawn.

Limits: The absence of transitions, progressions and regressions in the application of vegetable gardens in middle school students, no clear relationships between micro-curricular contents and vegetable gardens, the home vegetable garden as a learning strategy, deepening between school vegetable garden and environmental literacy and the development of research with middle

school students, in relation to food security, the development of vertical home vegetable gardens and the blended learning methodology.

Trends: Urban gardens in the school context and for sustainability or sustainable development, the vegetable garden as a strategy for community interaction and learning, urban gardens and sustainable development, cultivation practices in vegetable gardens - Horticulture, permaculture, agroecology and vertical agriculture, health and school gardens and the relationships between sustainability, health, poverty and public policy, while the category of sustainability framed within the line of degrowth and southern epistemologies.

Gaps: Micro-curricular environmentalization in emergency contexts through gardens, vertical gardens applied through mixed didactics, the relationship between the vertical home garden as a strategy that impacts food security, the articulation with the garden as a learning scenario both at school and at home.

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