REVIN
REVISTA INTERNACIONAL DE PESQUISA EM DIDÁTICA DAS CIÊNCIAS E MATEMÁTICA

REDUCING THE GAP BETWEEN THEORY AND PRACTICE DURING THE PANDEMIC: PLANNING A COMPLEX VIRTUAL ENVIRONMENTAL PROJECT

REDUÇÃO DO GAP ENTRE TEORIA E PRÁTICA DURANTE A PANDÊMICA: PLANEJANDO UM PROJETO AMBIENTAL VIRTUAL COMPLEXO

REDUCIENDO LA BRECHA ENTRE TEORÍA Y PRÁCTICA DURANTE LA PANDEMIA: PLANIFICACIÓN DE UN PROYECTO AMBIENTAL VIRTUAL COMPLEJO

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Abstract: Confinement, due to the pandemic, reveals that teachers are not at all prepared to lead virtual educational processes. The aim is to reduce the gap between theory and practice, presenting an example of how to plan and develop a virtual educational experience using the Complex Environmental Formation Theory. Methodologically planning is based on Complex Environmental Competence and projects. Limitations, contents, as well as possible intercultural processes and virtual learning communities, are discussed. In conclusion, planning is to relate theory and practice, making didactic decisions and teacher professional development.
Keywords: Environmental education. ICT. Competences. Projects. Pandemic.

Resumo: O confinamento devido à pandemia revela que os professores não estão totalmente preparados para liderar os processos educacionais virtuais. O objetivo é reduzir a lacuna entre teoria e prática, apresentando um exemplo de como planejar e desenvolver uma experiência educacional virtual, usando a Teoria da Formação Ambiental Complexa. Metodologicamente, o planejamento é baseado na Competência Ambiental Complexa e nos projetos. São discutidas limitações, conteúdos, bem como possíveis processos interculturais e comunidades virtuais de aprendizagem. Concluindo, o planejamento é um espaço para relacionar teoria e prática, tomar decisões didáticas e desenvolvimento profissional dos professores.
Palavras-chave: Educação ambiental. TIC. Competências. Projetos. Pandemia.

Resumen: El confinamiento por causa de la pandemia devela que el profesorado no está del todo preparado para dirigir procesos educativos virtuales. El objetivo es reducir la brecha entre teoría y práctica, presentando un ejemplo de cómo planificar y desarrollar una experiencia educativa virtual, usando la Teoría de Formación Ambiental Compleja. Metodológicamente, la planificación se fundamenta en la Competencia Ambiental Compleja y los proyectos. Se discuten limitaciones, contenidos, así como posibles procesos interculturales y comunidades virtuales de aprendizaje. En conclusión, la planificación es un espacio para relacionar teoría y práctica, tomar decisiones didácticas y el desarrollo profesional docente.
Palabras-clave: Educación ambiental. TIC. Competencias. Proyectos. Pandemia.

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Introduction

Teachers require education increasingly oriented on how to use educational theories. Confinement due to the pandemic has evidenced that teachers may manage devices, software, platforms, etc., but they do not always know how to plan and develop virtual educational experiences. Direct lessons, homework assigned to students, interactions, and materials are not far from traditional face-to-face education. Part of the solution could be to teach teachers teaching practices derived from theory (Forzani, 2014; Grossman et al., 2009; Windschitl et al., 2012) as well as present them examples of how to design educational processes based on theory. This article aims to reduce the theory-practice gap, illustrating teachers with an example of how to plan and develop a virtual educational experience, using the Complex Environmental Formation Theory (Tovar-Gálvez, 2020). I carry out the aim through the planning process because it is a possibility to bring theory into practice (Franco, 2016) and because it has a transforming potential of educational reality (Almeida & França, 2018).

Guiding teachers on how to use environmental education (EE) theories contributes to solve some problems of practice. It is not the objective reducing educational theories to a set of activities or recipes, neither limiting teachers' educational processes nor their critical and purposeful thought. The goal is to illustrate with specific cases that, for example, EE is not an issue that only natural sciences teachers should undertake (Briggs; Trautmann; Fournier, 2018; Marques; Gonzalez; Xavier, 2017). Likewise, to practically illustrate that EE is not limited to specific content, it has more to do with transformative relationships, processes, and actions (Ardoin; Bowers; Wyman; Holthuis, 2018). And additionally, to display cases that demonstrate that contextualizing educational experiences, designed on a theoretical basis, is also possible (Ríos; Herrera, 2017).

The problem of putting theory into practice in EE has several faces. For example, in different settings, teachers state that they have difficulties in bringing EE theories and policies to the classroom (Marques et al. 2017; Paredes; Viga, 2018; Tian; Wang, 2016). It is perhaps because they do not have a specific education on how to do it, or because they do not know concrete examples of how to do it. Many papers on EE expose results of evaluating students' learning products but do not explain how they promoted such a product, or they make general mentions of methods (see works such as Álvarez-García; Sureda-Negre; Comas-Forgas, 2018; Caraballo, 2011; Coronel; Lozano, 2019; De La Cruz; Ovalle; Cervantes; Villamil; Rivera,

2018; Estrada, 2018; Junyent; Ochoa, 2008; Morkun; Semerikov; Morkun; Hryshchenko; Kiv, 2018; Roczen; Kaiser; Bogner; Wilson, 2014). Thus, teachers have fewer practical support or resources derived from educational research.

Another problem to bring EE theory into practice has to do with reports that display experiences. Some of them do not provide ontological, epistemological, pedagogical, and didactic fundament (see works such as those of Cárdenas; Dextre; García; Santivañez, 2008; Kanevieskir et al., 2009; Pelaez; Hernández, 2019; Ramos; Carvalho; da Silva, 2009; Samaltani; Christidou, 2013). Teachers might take advantage of such cases, because of the successful experiences could be transferable or adaptable to other contexts. However, teachers miss the opportunity of evidencing the connection between theory and practice, which would give them more creative possibilities. Experience is relevant for teachers, but theory additionally offers them the opportunity of a better understanding and direction of educational processes.

To illustrate how to design a virtual experience using the Complex Environmental Formation Theory (CEFT), first I synthesize the theory's ontological, epistemological, pedagogical, and didactic foundations. Subsequently, I present the planning and possible development of a specific case. The example integrates the subject-areas of chemistry, physical education, and Spanish and literature, in addition to indigenous wisdom. However, beyond these specific subjects, the case seeks to illustrate in general how to articulate knowledge from different disciplines and diverse epistemologies in a virtual environmental education project.

Complex Environmental Formation Theory (CEFT)

The CEFT is a proposal that assumes as its starting point the concept of self-eco-organization of systems (Morin, 1996, 1998 and 2004). Thus, Tovar-Gálvez (2020) proposes ontological, epistemological, pedagogical, and didactic foundations for environmental education from complexity. Likewise, Puerto and Tovar-Gálvez (2018) propose a complex system to assess environmental education processes. The CEFT has a meta-theoretical or ontological/epistemological level (Colom, 2005) and another theoretical or pedagogical/didactic (Biesta, 2013; Wüst, 2011), founded in the self-eco-organization.

Ontological foundation: environment and the being

The environment is an emergent phenomenon from the self-eco-organization between the social and biophysical systems; therefore it is a human construction, based on decisions (Tovar-Gálvez, 2020). Being is a self-eco-organized system that is interdependent with others, conforming societies that exist in particular ways in biophysical contexts. Self-organization means that systems have an internal organization (relationships between their components), and eco-organization means that systems connect with others. Thereby, the social and biophysical systems affect each other. However, culture as a human production implies different alternatives for living, relating, existing, thinking, acting, knowing, organizing, valuing, etc. As a construction, culture results from the decisions made by humans, based on their beliefs, knowledge, emotions, experiences, etc. Thus, from such ways of living in biophysical contexts, which result from human decisions and culture, emerges an environment. Then, transforming the ways of living and building other environments is a subject's decision.

Epistemological foundation: knowledge, its production and ecologization

Knowledge is a human historical and provisional production, which might be ecologized (Tovar-Gálvez, 2020). Knowledge and ways of knowing are part of the cultural construction of societies; therefore, they are diverse, plural, and relative. Nature, structure, norms, values, and dynamics of every epistemology are a reflex of the ontology of each community. Hence, a complex ontology leads to a complex epistemology, in which the various forms of knowledge are related according to the ecologies of the multidisciplinary, interdisciplinary, transdisciplinary and inter-epistemological.

Complex Environmental Pedagogy: the ontological and epistemological in the educational

The education as a product and producer of culture is a process to form citizens who act self-eco-organized. Pedagogy, as a systematic reflection on and intentional educational experience, proposes the profile of a citizen who acts aware of his/her ways of living effects. Subjects' action is the result of their knowledge, values, actions, emotions, experiences, etc., personal and collective, to transform the ways of living and existing (culture) and therefore build other environments. For this, the curriculum as a set of discourses, processes, methods, relationships, values, estates, resources, and infrastructure to conduct the educational process,

is self-eco-organized. Thus, the curricular process emerges from the relationships between subjects who make part of institutions, and in turn, seeks to change the relationship between subjects, that is, culture, aiming the construction of other environmental phenomena.

Complex Environmental Didactics: ontology, epistemology and pedagogy in the classroom

The product of student learning, teaching practice, and assessment are the realization of complex ontology, epistemology, and pedagogy. These aspects –learning, teaching and assessing, that constitute complex environmental didactics is presented below:

Learning through the Complex Environmental Competence

Learning is an individual and collective process, which is assessed through the Complex Environmental Competence (CEC). The CEC is the subjects' self-eco-organized action, intending to construct other environmental contexts (Tovar-Gálvez, 2020). For this action, subjects integrate different components of their being: a) cognitive, which comprises the conceptual, procedural, attitudinal, communicative and epistemological contents of each kind of knowledge; b) metacognitive, which consists of the conscious processes that each subject exercises on their learning in reflective, administrative and evaluative terms; c) social, such as collective learning and cooperative work; d) contextual, since subjects recognize and intervene in their habitat; e) factual, which is the materialization of the context transforming action; and f) identity, which refers to the recognition and ethical commitment as subjects, citizens and professionals.

The CEC, as a learning goal in environmental education processes, can be a guide for the curricular process. The CEC, as the ideal of the citizen profile from the self-eco-organization of systems perspective, might be expressed as a progression, with different complexity for each educational level. Likewise, teachers or communities define the performances for each of the components of the CEC (see table 1). Teachers might formulate general students' performance for an educational level, and then adapt them for each subject-matter or area. Thus, although the CEC is a theoretical construct defined by a set of components and their relationships, the educational context will ultimately determine what they expect that students or participants do. It is a theoretically guided learning goal but contextualized by communities.

Communities might use a progression of the CEC based on what they expect citizens/students to be able to do, for example –she/he acts self-eco-organized, integrating multiple possibilities of his/her being, for transforming the ways of living, to build other environments in settings such as places for working, learning/studying, habiting, and surroundings. Then, this expected profile is expressed in complexity levels to guide curriculum:

- Primary education: she/he recognizes his/her being and his/her socio-biophysical context, based on school and community knowledge, seeking environmental transformation.
- Secondary education: she/he solves socio-biophysical problems, based on school and community knowledge, seeking environmental transformation.
- Middle/vocational/preparatory education: she/he leads community education processes and management of socio-biophysical processes, based on school and community knowledge, seeking environmental transformation.
- Higher education: she/he leads community education processes and management of socio-biophysical processes, based on professional and community knowledge, seeking environmental transformation.
- Community education: she/he leads processes of community education and management of socio-biophysical processes, based on community and academic knowledge, seeking environmental transformation.

Teaching through the complex environmental project

The project is a process that potentially contributes to the construction of the CEC, based on the self-eco-organization of knowledge, communities, and institutions (Tovar-Gálvez, 2020). The project is a process through which communities organize and manage their knowledge, experiences, resources, relationships, etc., to transform the environment. However, in didactic terms, the project is how teachers or leaders of EE processes make possible the conditions for the construction of students/participants' learning goal; that is to say, the CEC. A complex environmental project consists of a suite of phases and programs:

- Contextualization: it is the recognition of the environmental setting by a community. The participants identify subjects, forms of relationship, values, knowledge, actions,

effects, situations, biophysical elements, and other aspects of the immediate environment.

- Situations definition: it is the identification, delimitation, and prioritization of events or aspects on which the community will work to transform the environment. It is a community agreement, taking the contextualization phase as a starting point.
- Environmental transformation program: it is how communities decide to change their environmental reality. For this, they define a set of activities, integrating knowledge, resources, experiences, values, and other aspects.
- Community education program: it is the group of activities and strategies designed to share learning about environmental transformation with other people in the community or other communities.
- Permanent evaluation program: it consists of recognition, monitoring, regulation, and production of knowledge about environmental education experiences. Evaluation is a participatory process, which involves procedures, activities, instruments, and indicators that led communities to understand the educational process, its scope, opportunities, redirect it, document it and producing knowledge about it.

Assessment through complexity expression scenarios

The complex evaluation of EE experiences consists of the description of the expression of complexity in different scenarios of the process. Puerto & Tovar-Gálvez (2018) identify six complexity expression scenarios in an EE process and describe them through indicators and levels. The six scenarios are –learning (CEC), teaching (project), curriculum, interpretation of reality (disciplinary, multi, inter, trans, and inter-epistemic), community autonomy (self-recognition, self-management, and self-assessment) and impact (transformation of reality). The levels are –self-eco-organized, intermediate, and restricted.

Methodology

Hypothetical educational context

The teachers of chemistry, physical education, and Spanish and literature decide to orient their subject-matters towards the transformation of an environmental context. For this, the teachers will develop a project to self-eco-organize the community's action to transform the

environmental reality. They will engage students in this project using Information and Commutation Technology –ICT.

The teachers have identified that in the context of the pandemic information, expressions of emotions and records of events and actions circulate. These influence how the community understands what is happening and what could happen in the future. They want to take advantage of the situation to motivate students to have a more comprehensive and critical vision of the information they receive, and also to think about how to transform ways of living, to build other environmental realities.

The project will be carried out with tenth-grade students, aged between 13 and 15 years old. The teachers will use direct online lessons with students to jointly lead the project. During direct lessons, the teachers will address the contents of their subjects and the knowledge of an indigenous community of interest, all oriented to the project. Additionally, they will give instructions on the autonomous work activities of the students (supported by guides) and will develop the assessment activities.

Learning goal and project planning

Complex Environmental Competence and performances

The three teachers propose a set of performances that seek to articulate the conceptual, procedural, attitudinal (values), communicative and epistemic knowledge of each of the subject-matters and the selected indigenous knowledge. Assuming the progression of the CEC for the whole curriculum, they choose the level corresponding to secondary education. The students they will work with belong to this educational level.

Table 1. Performances of the Complex Environmental Competence of the case

Complex Environmental Competence for secondary education		
She/he leads processes of community education and management of socio-biophysical processes, based on school and community knowledge, seeking environmental transformation		
Components	Dimension	Performances
Cognitive	Conceptual	She/he describes environmentally non-viable situations, using school (Spanish, chemistry, physical education) and community (indigenous) knowledge
	Procedural	He/she puts into practice ideas and procedures of each form of knowledge, for the purpose of the project
	Attitudinal	She/he critically reflects on the implications of human-rest-of-nature relationships
	Communicative	He/she communicates in writing (blog, reports), audio-visual (videos and voice messages) and verbally (Skype meetings and online lessons) his/her learnings for environmental transformation
	Epistemic	She/he develops management and education strategies, integrating the different kinds of knowledge
Metacognitive	Reflection	He/she recognizes, assesses and regulates his/her learning for environmental transformation
	Administration	
	Evaluation	
Social	Cooperative work	She/he works as a team and develops the community education program for environmental transformation
	Collective learning	
Contextual		He/she addresses non-viable environmental situations in the context of his/her home
Factual		She/he reports evidence of contributions to environmental transformation in the context of her/his home
Identity		He/she expresses his/her commitments as a person, a member of his/her family and as a student

Project by phases/programs, activities and weeks

The three teachers propose a pool of activities (see tables 2 to 6) through which they guide students to the project development. The activities belong to the phases and programs that constitute the project from a complex environmental perspective. Additionally, the activities are designed in order for students to achieve the performances defined for their CEC.

Table 2. Planning of activities –project contextualization phase

Contextualization			
Week	Activities		
1	Individual	A1	Guide: I describe my origin, family, things that I like and do not like, what diseases I have had and have, what I am afraid of, what makes me calm, how I see nature, what my beliefs are, what I know about environmental problems in my context, how I think I might solve such problems from what I have learned so far in the lessons of Spanish and literature, chemistry and physical education, etc.
	Collective	A2	Meeting by Skype: use the guide to describe the similar or common things among the members of the group. Upload A1 and A2 to the group's blog.
	Evaluative	A3	In the class Moodle develop the form to evaluate A1 and A2. Value students and teachers.
2	Individual	A4	Guide: I describe the biophysical elements in which I live, such as animals, plants, bodies of water, green areas, parks, forest reserves, etc.
	Collective	A5	Group WhatsApp: describe the similar or common things among the biophysical contexts of the group members. Make a concluding audio recording. Upload A4 and A5 to the group's blog
	Evaluative	A6	In the class Moodle develop the form to evaluate A4 and A5. Value students and teachers.

Table 3. Planning of activities –project situation definition phase

Situation definition			
Week	Activities		
3	Individual	A7	Guide: I describe what ideas, values, and actions of mine and my family affect our well-being and that of the biophysical context.
	Collective	A8	Meeting by Skype: each one will present a news item, meme, video, link, etc., which has circulated on WhatsApp during the quarantine, in which the relationship between humans and the rest of nature is evident. Discuss the veracity of the content and what ideas, values and actions lead to this negative situation for us and for the rest of nature. With the guide, make a synthesis of what was discussed. Upload A7 and A8 to the group's blog.
	Evaluative	A9	In the class Moodle develop the form to evaluate A7 and A8. Value students and teachers.
4	Individual	A10	Guide: I describe from chemistry (the composition of pollutants), physical education (aesthetic aspects, self-esteem, health), Spanish and literature (communication processes and dissemination of problems, fake news), and indigenous

			knowledge (human-nature relationship), the main environmental problems that we want to transform.
	Collective	A11	Group WhatsApp: Each one should send 2-minute voice audio describing what was done on A10. In the second round, each one makes a 1-minute comment on what was presented by the classmates. Make an audio recording as a synthesis of what was discussed. Upload A10 and A11 (concluding audio) to the group's blog.
	Evaluative	A12	In the class Moodle develop the form to evaluate A9 and A10. Value students and teachers.

Table 4. Planning of activities –project environmental transformation program

Environmental transformation program			
Week	Activities		
5	Individual	A13	Guide: I propose personal, group and community actions to transform the identified environmental problem, based on the knowledge, values and procedures of physical education, Spanish and literature, chemistry and the indigenous community of the region.
	Evaluative	A15	In the class Moodle develop the form to evaluate A13 and A14. Value students and teachers.
6	Individual	A16	Guide: I present a short video evidencing the progress in the individual activities proposed.
	Evaluative	A18	In the class Moodle develop the form to evaluate A16 and A17. Value students and teachers.
7	Individual	A19	Guide: I present a short video evidencing the progress in the individual activities proposed.
	Evaluative	A21	In the class Moodle develop the form to evaluate A19 and A20. Value students and teachers.
8	Individual	A22	Guide: I present a short video evidencing the progress in the individual activities proposed.

Table 5. Planning of activities –transversal programs for environmental transformation

Community education program			
Week	Activities		
5	Collective	A14	Meeting by Skype: propose group and community actions to transform the identified environmental problem, based on the knowledge, values, and procedures of physical education, Spanish and literature, chemistry, and the indigenous community in the region. Upload A13 and A14 to the group blog.
6	Collective	A17	YouTube: Upload individual videos (A16) to the group's channel, as well as videos evidencing group and community activities. All group participants should watch all videos and make constructive comments. Embed your YouTube videos to the group's blog.
7	Collective	A20	YouTube: Upload individual videos (A19) to the group's channel, as well as videos evidencing group and community activities. All group participants should watch all videos and make constructive comments. Embed your YouTube videos to the group's blog.
8	Collective	A23	YouTube: Upload individual videos (A22) to the group's channel, as well as videos evidencing group and community activities. All group participants should watch all videos and make constructive comments. Embed your YouTube videos to the group's blog.
Permanent evaluation program			
1 to 7	A3, A6, A9, A12, A15, A18 y A21.		
8	Evaluative	A24	Global evaluation of the whole process: Revisit the history of evaluation forms. Everyone values the achievement of individual, group, and community goals. Identify persistent problems. Assess the contribution of each member of the group. Upload the result of the global evaluation to the group's blog.

Some supporting materials

The so far proposed dynamic involves the construction of various work guides by the teachers. Below is a proposal on how to guide the design of activities for the environmental transformation and community education programs. In italics, in the column on the right, is the hypothetical response of a student.

Table 6. Tool to guide students in the design and reporting of activities

Report of transformative activities of the environment	
Activity	*Make a mini-orchard at home*
Type of activity	*Community (family)*
Aim	*Produce some vegetables for self-consumption, free of pesticides and other pollutants*
Requirements	*A place, soil, compost, seeds, gardening material, etc.*
Communication	*Through a video that I will upload to YouTube*
Knowledge of Spanish and literature	*The information that circulates through the network can influence the way we live, so we must be critical of what reaches us. Communicating is an act for which we must be responsible.*
Knowledge of physical education	*Taking care of our body depends on several factors, such as physical activity and diet. The combination of these aspects allows us to feel better about ourselves.*
Knowledge of chemistry	*Crops have different nutrients (for example, inorganic salts) and materials to control the acidity of the soil (for example, calcium hydroxide). It is possible to supply such substances naturally.*
Indigenous knowledge	*The orchard is a reflection of the spiritual state of the family. There it is possible to see our values and harmony.*
Advances	*We already have the first seedlings, and we promised not to come to the orchard with bad attitudes.*
Difficulties	*The process is very slow and requires a lot of care.*
What else should I learn	*I don't really understand the concepts of pH and aesthetics. It is difficult for me to edit the videos.*
How will I learn that	*Watch YouTube video editing tutorials and ask my teachers.*

Possible development of activities by direct online lesson

The teachers might plan direct-lessons and extra-lessons activities (Tovar-Gálvez; Cárdenas, 2012). In the example, the direct-lessons are for developing activities to address the contents through which they expect to transform the environmental situation. Another part of the lesson is to explain the students' extra-lessons activities, as well as for implementing the evaluation activities.

Table 7. Direct-online lessons planning.

Week	Lesson	Modality	Lesson description
1	1	Lesson	Conceptual, procedural, attitudinal, communicative and epistemic dimensions of each form of knowledge (indigenous, chemistry, Spanish, physical education).
		Extra- Lesson	Description of activities A1 and A2 to be carried out.
	2	Lesson	Elements of each form of knowledge
	3	Lesson	Elements of each form of knowledge

		Evaluation	Development of A3
2	4	Lesson	Elements of each form of knowledge
		Extra- Lesson	Description of activities A4 and A5 to be carried out.
	5	Lesson	Elements of each form of knowledge
	6	Lesson	Elements of each form of knowledge
		Evaluation	Development of A6
3	7 a 9	The same	The same, but involving to A7, A8 and A9
4	10 a 12	The same	The same, but involving to A10, A11 and A12
5	13 a 15	The same	The same, but involving to A13, A14 and A15
6	16 a 18	The same	The same, but involving to A16, A17 and A18
7	19 a 21	The same	The same, but involving to A19, A20 and A21
8	22	Lesson	Elements of each form of knowledge
		Extra- Lesson	Description of activities A22 and A23 to be carried out
	23	Lesson	Elements of each form of knowledge
	24	Lesson	Elements of each form of knowledge
		Evaluation	Development of A24

Assessment of Complex Environmental Competence

The complex assessment system of Puerto and Tovar-Gálvez (2018) proposes a set of indicators. With these, teachers can identify the level of complexity that students achieved in their performance during the project. Techers would determine if students' learning goal (CEC) is in:

- Self-eco-organization level: learning is characterized because it is a) the integration of multiple knowledge (cognitive: conceptual, procedural, attitudinal, communicative and epistemic) towards a goal, b) self-managed (metacognitive), c) collectively constructed (social), d) located in specific settings (contextual), e) put into practice (factual), f) aimed at determining their own being (identity).
- Intermediate level: learning is partly accomplished, because –a) a part of multiple knowledge is not addressed, b) multiple knowledge is not articulated to a goal, c) the metacognitive, or social, or contextual, or factual, or the identity is not promoted.
- Restricted level: learning is limited because –a) multiple kinds of knowledge are not promoted, b) knowledge is not articulated to a goal, c) metacognitive, social, contextual, factual, and identity dimensions are not promoted.

Discussion

The complex environmental project in a virtual setting has some limitations. The first limitation has to do with the fact that only one person formulates the planning; which is reductionist. The second limitation has to do with the time it takes to bring such a complex project to reality and obtain products. As alternatives to the issue of time, perhaps teachers can propose to students a suite of activities to choose from, ensuring viability according to the possibilities and time. Another aspect that teachers might consider is to organize the contents in problem nuclei (Marín; Tamayo, 2006; Torres, 2013) or in structuring concepts (Galfrascoli, 2017; Martínez; Barri, 2017), and perhaps integrating contents of the types of chosen knowledge.

There are several challenges for teachers when implementing a complex virtual environmental project. To design work guides for students and extra material such as videos or online information sources is a challenge. Likewise, the large volume of products elaborated by students is demanding. An alternative perhaps is for teachers to design materials that articulate different components of the CEC. Integrating elements is a natural feature of a proposal formulated from complexity. As a case, the guide in table 6 for complex environmental activities has an evaluative character, since students must describe progress. Additionally, it establishes relations among the ideas that each type of knowledge contributes to the activity design. Complementarily, the guide promotes metacognitive processes by asking students about their learning and ways to improve such processes. Finally, the form contributes to the development of performance in written communication.

In the proposal, the intercultural dimension draws attention. Its complex epistemological basis recognizes plurality in knowledge and ways of knowing, as well as their possible ecologies. The first ecologization order is in the integration of physical education, Spanish and literature and chemistry. Epistemological diversity and its contribution to achieving environmental transformation are recognized. The second ecologization order is in the inclusion of indigenous knowledge. Although there is indeed epistemological specificity between chemistry, physical education and Spanish and literature, they are all disciplines from the same cultural tradition of modern European origin. Indigenous knowledge has a greater epistemological and ontological distinction because its cultural tradition is different from the European. This is an epistemological inclusion relationship because of the community

recognize the non-western knowledge and ways of knowing as valid content (Mpofu; Otulaja; Mushayikwa, 2014).

This intercultural dimension and the virtual setting are conducive to configure virtual intercultural learning communities (Leiva, 2013). Building learning is different –it takes place in another space, with other actors, sources, resources, ways of approaching knowledge, and with new relationships and rhythms. Proposing the integration of varied kinds of knowledge helps to open up to recognize diverse cultures and understandings of life, to validate other life projects, and perhaps to transform the own way of existing. Likewise, a virtual setting contributes to understand and use alternative languages, dynamics and information. However, during a virtual and intercultural educational process, learning communities have the challenge of respecting other cultures (Martires; Sousa; Bosa, 2014) and other forms of communication and interaction (Uzun, 2014). Working on the attitudinal dimension of the cognitive component, and on the social and identity components of the CEC, enhances these processes of recognition, validation and respect.

The transferable and generalizable in this article

In addition to contributing to reducing the gap between theory and practice, through the planning of a virtual complex environmental project, this paper provides other elements that may be transferable to other contexts or generalizable:

- The ontological and epistemological foundation: the complex vision of being, the environment and knowledge in the framework, contribute to the diversity of positions to guide environmental education. Tovar-Gálvez (2013) reports that it is increasingly common to find proposals and studies on environmental education with a relational or complex vision of the environment and subjects' action. This vision proposes the environment as a human construction and therefore raises a new subject-nature relationship. Leaders of educational processes and educational policies might take such a relationship as a reference for their experiences.
- The curricularization of the ontological and epistemological foundation: the problem of bringing theories, positions and policies on environment and environmental education to the classroom is widely recognized (Dannenberg; Grapentin, 2016; Erdoğan; Kostova; Marcinkowski, 2009; Eschenhagen, 2011; Fuentes; González, 2016;

Gutiérrez; González, 2005; Burmeister; Eilks, 2013a; Khademi-Vidra, 2017; Stevenson, 2007; Winter; Cotton, 2012). Regarding such a problem, the framework contributes to the advancement in the curriculum curricularization or greening in two ways. First, the framework exposes how to go from ontology to the epistemology, and from there, to the pedagogy and didactics. Leaders of educational processes might use this path to take their ideologies on the environment to classroom practice. Second, the framework develops a curricular path for the complex environmental view. With this, educational communities adhering to the complex approach count on a tool.

- Planning based on the CEC and the project: presenting the virtual complex environmental project planning contributes to highlighting the relationship between theory and practice. The curricular path illustrates how the CEC and the complex environmental project structures condense the ontological, epistemological, pedagogical and didactic basis. However, these structures are flexible, since communities are who define the CEC performances and the project activities. In this way, leaders of environmental educational processes have a practical expression of the learning vision (CEC) and teaching (project) as flexible criteria for planning.
- The system of indicators and levels to assess the CEC: understanding environmental education as a set of transformative relationships, processes and actions (Ardoin; Bowers; Wyman; Holthuis, 2018), a complex referent to assess the learning product is necessary. Regarding this issue, leaders of environmental educational processes have a system of indicators and levels that allows them to describe the construction of the students' CEC.
- The student support tool based on the framework: supporting tools help guide learning when their structure promotes content, relationships between content and students' reflection on their learning (Sandoval, 2013). Following this model, the tool to guide students to design activities includes items related to the multiple contents, the use of such contents to solve/transform the problem, and assessment and metacognitive processes. The tool is not limited to the example, so educational experiences leaders have a tool that could be adapted.

Conclusions

The planning of educational experiences is an opportunity to reduce the gap between theory and practice. In the displayed case, the planned activities aim at the CEC construction and assessment through a virtual project's structure and dynamics. Moreover, it is possible to identify the connection among such activities and the didactic, pedagogical, epistemological and ontological basis of the Complex Environmental Formation Theory. Regarding this, Franco (2016) analyses the relationship between pedagogical practices and pedagogical foundations. The author argues that the planning practice supports teachers bringing theories into the classroom.

Planning educational experiences is crucial for making didactic decisions. In the case presented, the activities are the result of a) deciding what content to teach (multiple kinds of knowledge –physical education, Spanish, chemistry, and indigenous wisdom), b) how and why to relate such contents (based on transforming an environmental reality), c) the context in which contents are used (family). For Rosselló (2010), planning is a decision-making process that goes beyond administrative matters, since teachers reflect on and discuss the curriculum, the contents, the reality of the students and the teaching strategies, to define what comes into play or not in the educational process.

Planning educational experiences is a process for teacher professionalization. In the case, the planning of activities motivates teachers to think about the knowledge of the disciplines and how this represents multiple learnings for students. Additionally, the proposal illustrates teachers on how to ecologize such knowledge and the students' though. Making complex the contents to teach and, consequently, the students' learning is a door to making complex the teachers' knowledge. For Tovar-Gálvez (2018) a systematic reflection on educational processes, guided by theory and supported by evidence, is the starting point for classroom research and teacher professionalization.

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