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The ecology of resilience learning in ubiquitous environments to adverse situations

La ecología del aprendizaje resiliente en ambientes ubicuos ante situaciones adversas

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ABSTRACT

Basic Education in Mexico faces growing challenges arising from the use of Information and Communication Technologies (ICTs). However, formal education requires a critical and contextualized awareness that rescues the experiences of students to resignify adverse situations, while emphasizing resilience from learning ecologies. The objective of this document is to account for the ubiquitous learning acquired by nine distance education, secondary students in a rural context of Hidalgo, Mexico and the benefits of raising awareness of their own learning ecology. Emphasis is placed on the resignifying process that emerged through the different communication channels. The study presents results of a case approached with a mixed methodology, by means of a phenomenological, multisource, quantitative and qualitative information triangulation with hermeneutic analysis, organized in three stages, by means of a questionnaire, semi-structured interviews, focal groups and the use of Google Classroom. The hermeneutic analysis of autobiographies and the use of technological resources boosted the personal analysis of experiences generating learning that may be invisible in formal education, but which might empower the students' critical thinking, collaboration and autonomy to become aware of their own learning and the scope of their social contribution throughout their lives.

RESUMEN

La Educación Básica en México contempla desafíos crecientes a los que se enfrenta mediante el uso de Tecnologías de la Información y la Comunicación (TIC). Sin embargo, en la educación formal se requiere detonar una toma de conciencia crítica y contextualizada que rescate las experiencias del estudiantado para resignificar situaciones adversas, así como dar importancia a la resiliencia a partir de las ecologías del aprendizaje. El objetivo de este documento es dar cuenta de los aprendizajes ubicuos que adquirieron nueve estudiantes de telesecundaria en un contexto rural de Hidalgo y los beneficios de la concienciación de la propia ecología del aprendizaje. Se hace énfasis en el proceso de resignificación que emergió a través de las diferentes aristas de comunicación. El estudio presenta resultados de un caso abordado con una metodología mixta por medio de una triangulación de información multifuente, cuantitativa y cualitativa fenomenológica con análisis hermenéutico, organizada en tres etapas, mediante un cuestionario, entrevistas semiestructuradas, grupos focales y uso de la plataforma Google Classroom. El análisis hermenéutico de las autobiografías y el uso de recursos tecnológicos potenció el análisis personal de experiencias generadoras de aprendizajes quizá invisibles en la educación formal, pero que pueden empoderar el pensamiento crítico, la colaboración y autonomía del estudiantado para la toma de conciencia de sus propios aprendizajes y el alcance de su aportación social a lo largo de su vida.

KEYWORDS | PALABRAS CLAVE

Resilience, learning ecologies, ubiquitous learning, lifelong learning, students, awareness, resignifying, adverse situations.
Resiliencia, ecologías del aprendizaje, aprendizaje ubicuo, aprendizaje a lo largo de la vida, estudiantes, concienciación, resignificar, situaciones adversas.

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1. Introduction

Within the framework for action under the 2030 Agenda, the United Nations (UN) has endorsed the need for children and young people to adopt flexible skills and competencies that will be useful throughout their lives, considering a world in need of greater sustainability and interdependence based on knowledge and ICTs (Delors, 1996; Beltrán, 2015; UNESCO, 2016). This implies the need to research and listen to people's possibilities and experiences, assuming the style and control of individual learning processes derived from a variety of formal and informal contexts, as well as the different elements that make up learning ecologies, understood as the basis for future educational models according to the context and characteristics of current knowledge: chaotic, interdisciplinary and emerging (Siemens, 2007; González-Sanmamed, Sangrá, Souto-Seijo, & Estévez, 2018).

In this context, new paths are required that elucidate different approaches to communicate with students in contexts with diffuse horizons, characterized by economic and social disadvantages. It is therefore important to promote awareness of the ecologies of resilient learning in order for adolescents to clarify their potential and strengthen the construction of their identity (Barron, 2006).

Resilience, interwoven with ICTs, can become a means and a capability that people develop to cope with adversity in hostile environments, as well as a mechanism for integration with technological progress that triggers options for adaptation and restoration of past experiences.

There has been little research on the link between resilience and ICTs (Mark, Al-Ani, & Semaan, 2009). While the first resilience studies focused on the characteristics of people, protective factors, resilient tutors and community resilience (Werner & Smith, 1992; Rutter, 1993; Munist, Suárez, Krauskopf, & Silber, 2007; Vanistendael & Lecomte, 2002; Forés & Grané, 2012; Simpson, 2014; Henderson & Milstein, 2003; Truebridge, 2016; Clará, 2017), it is now necessary for the student body to become aware of the "process by which the developing person acquires a broader conception of the ecological environment" (Bronfenbrenner, 1977: 523) to configure their own ecology of resilient learning in adverse situations.

In this sense, Barron (2006: 196) defines learning ecologies as "the set of contexts found in physical or virtual spaces that provide learning opportunities. Each context comprises a unique configuration of activities, material resources, personal relationships and the interactions that arise from them. The case study analysis provides evidence of the potential benefits of students' awareness of their own learning ecology.

In this way, new ubiquitous dynamics are generated through the connectivity achieved through the Google Classroom platform as a bridge for integration in the use of ICTs and for the socialization of adverse and important situations for students, which transcend the school context and often go unnoticed in formal education (Buckingham, 2007; Burbules, 2014a). The concept of resilient learning ecologies, articulated with the ubiquity provided by the Google Classroom platform, was a catalyst between the social context and resilient learning in distance secondary education (Barron, 2006; Santos-Caamaño, González-Sanmamed, & Muñoz, 2018).

The case study is conducted within a rural community in the municipality of Zapotlán de Juárez, Hidalgo, with a wide cultural diversity and little attention to disadvantaged youth. The population is transient, as entire families migrate to the United States or Mexico City. In rural contexts, there are institutions known as "telesecundarias", characterized by classrooms equipped with televisions, computer equipment and video-projectors; however, few have Internet. The educational model is integrated by the teacher, television classes and support materials.

Due to the environment where they operate, they face other types of problems, such as the scarce support for life projects, the recovery of values and the needs of adolescents. In spite of the social and school conditions of this context, there are students who, without economic and family support, successfully finish their studies, which led to the research question: how can the development of resilience be analyzed from the ecologies of learning in "telesecundaria" students?

2. Materials and methods

Due to the complexity of the studied variables, this research was approached from a mixed multi-reference analysis, as suggested by Ardoino (1991: 173) "from different angles, apparently different,

not reducible to each other", although complementary in terms of achieving the objectives. The phenomenological design focused on the individual subjective experience of participants in order to explore the meaning, structure and essence of an experience lived by the student body in relation to the development of their resilient learning ecology, from a perspective that argues the specific character of human reality, while making it irreducible to the categories of physical reality analysis (Taylor & Bogdan, 2000). As an alternative for analysis, the phenomenological approach proposes the categories of subject, subjectivity and significance. This research focused on the voice of the student body reflected in different moments from its inner self and experience.

Table 1. Mixed multi-referential methodological approach

Approach	Objective	Variables
Phenomenological	To research the individual subjective experience of the participants	Learning ecology
Exploratory	To identify third year students in "telesecundaria" who experienced adverse situations.	Resilience
Hermeneutic	To raise awareness of the ecology of resilient learning itself	Ubiquitous environments

According to Álvarez-Gayou (2003) and Hernández, Fernández and Baptista (2006), phenomenology is based on the following premises: the aim is to describe and understand phenomena from the point of view of each participant and from the perspective built collectively. It is based on the analysis of specific discourse and themes, as well as on the search for their possible meanings. Consequently, an exploratory analysis was necessary to identify students who lived adverse situations, by first identifying perceptions and actions that they considered pertinent and significant to confront them, facilitating the direction of research efforts based on that reality.

Table 2. Research stages

Stages	Objective	Technique, instrument, resource	Sample	M	F
1. Exploratory	To identify students with adverse experiences interested in analyzing them	65-item questionnaire, Likert scale	111	64	47
2. Intervention	To research individual subjective experiences of participants	Google Classroom platform Focus group	18	11	7
3. Closing	To understand the configuration of resilient learning ecologies	In-depth semi-structured interviews Oral and written autobiographies	9	3	6
Validation	Information cross-checking	Methodological triangulation	111	64	47

Table 1 contemplates the integration of hermeneutics to enhance insights into the diversity of conditions and lifestyles from a perspective of present and past. Studies by Sandoval (2002) and Taylor and Bogdan (2000) point out that this perspective seeks a personal understanding of the motives and beliefs behind people's actions, as well as an understanding of facts through descriptive data and the analysis of spoken or written words.

The hermeneutic method was implemented during the process of analysis and narration of the stories, in order to identify critical phases or adverse situations as core elements for the awareness of resilient learning ecologies (Bolívar, Domingo, & Fernández, 2001).

2.1. Stages of research

The research stages were organized around the complexity of identifying students with resilient characteristics and the subjectivity of the variables. The sample was taken from third year groups of a

rural "telesecundaria". The first phase began with 111 students, the second one with 18 and the last one closed with nine students (Table 1). Each phase of the study was a sieve that allowed an approach to personal realities in the configuration of resilient learning ecologies for the last nine students.

As shown on Table 2, the challenge during the exploratory stage was to identify third-year "telesecundaria" students with adverse experiences who were willing to analyze them and share them confidentially in order to begin the study of the resilience variable. The intervention stage began with the use of the Google Classroom platform, which integrated written materials, videos and images related to resilience variables and learning ecologies. The Focus Group (FG) technique was applied in person. The closing stage was developed in two scenarios: formal and informal, to raise awareness of the ecology of resilient learning for the student, considering the ubiquitous environment variable. In the formal stage, semi-structured in-depth oral interviews were applied. In the informal setting, Google Classroom was used as a bridge between spoken and written language for the students' analysis and reflection process while writing their autobiographical stories.

Finally, a phenomenological validation was performed through a methodological triangulation, to ascertain the participants' sociocultural reality from the perspective of the social actors in their life trajectory (Bronfembrenner, 1976).

2.2. Instruments and procedures

In order to identify students with resilient characteristics, a 65-item questionnaire incorporating the following factors was applied: impulse control, frustration tolerance, assertiveness, self-esteem, empathy, expressing emotions, prospective attitude, self-awareness and responsibility (Melillo, 2001). A four-point Likert scale was used: 1) it is the responsibility of others; 2) it is not my responsibility; 3) I am responsible; 4) I can solve it.

In the second stage, and in order to initiate an exchange of opinions regarding "what can be done in the face of adversity?", the use of the Google Classroom platform tools, as well as messages and document submissions made it possible to socialize videos with narratives of characters such as Rita Levi Montalcini and Mario Capecchi to connect with stories of people who lived through adversity, faced it and learned from it by becoming aware of their own potential.

The FG technique was also used to exchange experiences of adverse situations and their different ways of dealing with them. The reading and question guide for the FG were written on the basis of contributions from Grotberg (2006), Melillo (2001), Barron (2006), and González-Sanmamed, Sangrà, Souto-Seijo and Estévez (2018). The technique began with an introductory reading of learning ecologies and resilience, followed by the trigger question "what can be done in the face of adversity?" The full cycle of the FG consisted of an opening, climax and closing. During the opening, informed consent information and presentation dynamics among the participants were important; at the climax, the most useful information for the study was identified; and during the closing, consensual conclusions were formulated.

Finally, in the third stage, semi-structured interviews were conducted, starting orally and ending in writing through Google Classroom, to identify critical incidents as adverse situations, as well as the learning obtained through them (Bolívar, Domingo, & Fernández, 2001). The autobiography is a means of inventing the self and what the life of the person will be (Bolívar, 1999), in which hermeneutics and storytelling enable the understanding of the psychological complexity comprising individuals' conflicts and dilemmas in their lives (Bolívar, 2002).

3. Results

Resilient learning ecologies were identified on the basis of the ubiquitous environment, which promoted networked learning through the Google Classroom platform, which denotes the importance of the use of ICTs in education as a means for students to identify what, how, where and why they should learn (González-Sanmamed, Sangrá, Souto-Seijo, & Estévez, 2018).

In the exploratory study, during the first stage of the study, the sample consisted of 111 "telesecundaria" students with an age range between 13 and 14 years, out of whom 18 students with resilient characteristics

were identified to further research the variables in the next stage. The application of the questionnaire, validated with a Cronbach Alpha of 0.91, enabled the exploration of particularities of the rural context, profiling risks and resilient characteristics.

Table 3. Results of the Exploratory Stage

Categories	Indicators	Results
Risk factors	Personal problems Family problems School-related problems	"I get distracted a lot" (37.4%) "lack of money" (20.3%) "relationships in school" (12.7%)
Resilient traits	Responsibility Assertivity Expression of emotions Self-awareness Impulse control	55% 41% 35% 32% 25%
Sources of resilience	"I respect myself and others" "I am someone who empathizes with others" "I am responsible for my own actions and for accepting the consequences"	
Learning mediators	Television / Internet / computer / people	

In terms of their parents' education level, it went from secondary to baccalaureate, with fathers working in different trades and mothers as homemakers. The number of members per family ranges from four to five. Students reported having personal, family and school-related problems (Table 3). On the other hand, preliminary indicators were found on the ecology of learning that denote fundamental capacities for life, such as factors of responsibility, assertiveness, expression of emotions, self-awareness and impulse control, characteristic of resilient people.

Table 3 presents the most relevant results that outlined the context in which the 111 "telesecundaria" students generate learning. It should be noted that one of the main risk factors they face is personal risk, such as distraction (37.4%). On the other hand, one of the most frequent protective factors was responsibility (55%).

Table 4. Results of the Research stage

Categories	Indicators	Adverse situations
Risk factors	Family problems	"Frequent fights and arguing" "Financial problems" "Parental separation" "Abandonment by a parent" "Illness of a family member" "Beatings among relatives" "Bad communication between loved ones" "Death of a relative" "Infidelity of a parent" "Family lack of understanding"
Resilient characteristics	"It is possible to face difficult situations" "Having the support of someone who loves you: like dad, mom, family or a friend" "The importance of talking about the problem with the person that you trust the most" "Analyze the situation, be aware of it" "Everything has a solution"	
Sources of resilience	"I have one or more people within my family circle who I can trust and who loves me unconditionally" "I respect myself and others" "I can be someone who empathizes with others"	
Learning mediators	"When I feel bad, I try to distract myself" "I go out to the street, I play soccer" "I talk to friends or family" "Chat with friends on Facebook or Whatsapp" "I communicate through the Classroom"	

Likewise, the interactive sources of resilience proposed by Grotberg (2006) supported the analysis and systematization of the diverse factors indicated as constituting external supports ("I have") that promote resilient learning; the internal force ("I am") that develops over time and sustains those who find themselves facing adversity; and finally the interpersonal factors ("I can"), understood as the capacity to solve problems that lead the person to face adversity. The most important source of resilience was being a person who respects himself and others. Mediators who support the learning of participants in problem situations are television, the Internet, the computer, and people.

In the second stage of research, the use of the Google Classroom platform strengthened the interaction between students through shared messages and documents. The 18 participating students experienced adverse situations that they faced using their own resources, thus confirming that resilience, beyond just enduring a traumatic situation, consists of rebuilding and committing to a new life dynamic.

Vanistendael and Lecomte (2006) assert that the notion of meaning in life is very important, to the point of being a vital need for people. The bond and meaning are basic foundations of resilience that emerged within the ecology of "telesecundaria" students' learning, by working collaboratively in the analysis of their adverse situations in a barrier-free space, which went from the formal to the informal.

Table 4 presents extracts from the statements selected through axial coding in which categories and indicators were identified to find a meaning that ultimately reflected a certain trend and was verified through the consensual participation of students (Álvarez-Gayou, 2003). In both Google Classroom and FG, risk factors, resilient characteristics, sources of resilience, learning mediators and the identification of nine students emerged to deepen the hermeneutic analysis.

Table 4 also presents a selection of relevant responses shared by 18 students through Google Classroom and face-to-face during FG to the question "what can be done about adversity?" In their analysis, they realized that they were experiencing similar family problems, perceived in a particular way according to each person's experience. As mentioned above, the population is transient and mostly tends to migrate, which causes imbalances and dysfunctions in family dynamics, thereby affecting "telesecundaria" students' learning.

The use of Google Classroom enabled significant online learning, as students felt at ease, barrier-free and with time to express their thoughts and emotions in writing. This ICT system established peer-to-peer trust and empowerment by validating their potential and identifying sources of resilience and learning who supported the process of resignifying an adverse situation as a learning opportunity.

As for FG, interaction between students was generated in an atmosphere of trust and respect, where Rita Levi's and Mario Capecchi's life stories, the sources of resilience and the learning mediators led to reflection and awareness of the elements that supported the resignification of an adverse situation into a learning opportunity.

The language used in both formal and informal environments demonstrated the importance of interacting with people through different media such as television, Google Classroom, Facebook and WhatsApp, used as affective bonds between students to generate resilient learning in a dynamic process between student and media.

The results obtained in the exploration and intervention stages laid the groundwork for a close-up approach to the subjectivity of the nine "telesecundaria" students, who shared their autobiographies orally, through semi-structured interviews, and in writing using Google Classroom. Thus, a ubiquitous environment was configured where barriers were broken down between the formal space of the "telesecundaria" and the informal realm of the student's personal and family space.

The hermeneutics analysis framework (Table 5) allowed a "hermeneutic encounter" where dialogue was possible between the horizon of understanding and life experience, transcending space and time benchmarks (Sandoval, 2002). The autobiographical analysis was performed through a participatory interpretation of the student, which allowed each of the nine participants to configure their own ecologies of resilient learning in a context tempered by problematic economic situations, parents with low levels of schooling and employment and, for the most part, with little stability. There was also a double perspective of present and past hermeneutic analysis.

Table 5. Results of the Closing stage	
Categories	**Extracts of autobiographies**
Risk factors Family problems	"I got sick with epilepsy and my mom didn't have money for medicine, thank God we made it." "My dad has never looked out for me." "I didn't live with my parents, my mother abandoned me: that day I wasn't at home, only my older sister was there, when I heard the news I was very sad, I spent weeks crying, but with the help of my family I got through it and now I see my mother and feel sorry for how she lives." "When I found out that my mother had an abortion, I felt that she didn't want any more children and that's why she got together with another man." "My family has no money." "My father doesn't live with me, he is a manager in the United States and when he left, I was 5 months old and I don't know him, well, only from pictures and when he calls me on the phone. He already has another wife, he has 2 children, one with his wife and me."
Resilient traits	"I'm a good, intelligent, courageous person, I finish everything I start, my word counts." "I am bold, my goals and aspirations are to continue studying, to give it all, to work, to help my mother and aunt so they don't need to work, to buy them a house and to continue as a united family."
Sources of resilience	"I have one or more people within my family group that I can trust and who love me unconditionally." "I am someone who empathizes with others." "I am responsible for my own actions and accept their consequences."
Learning mediators	"It is helpful to go to the Internet café / play video games on the computer / close relationships with people."
Messages shared in Google Classroom	"I suggest young people who have problems to trust God, to have faith, he will solve it, talk to him, tell him, he loves you, and he will listen to you." "Don't lower your head, you're very important, work hard, the problems don't last a hundred years, in the end, the only thing you're going to complain about is that you didn't have time to be well, so start now, enjoy everything, food, friends, and especially yourself, you're worth a lot and you shouldn't underestimate yourself."

Given this, Table 5 shows that the main risk factors reported by high school students arose in the family, such as infidelity, alcoholism, illness, abuse and economic hardships. The acceptability of the selected extracts had to meet two conditions: 1) that the student explain all available relevant information (if any important significance was excluded or diffusely reconstructed, the interpretation was not considered); 2) that the interpretation proposed was the most plausible to explain the events experienced (Sandoval, 2002).

The use of Google Classroom allowed the students to narrate their autobiography in the first person, which led to a complex process of self-analysis and reflection where they were involved in a critical way. The process of construction of the autobiographies was conducted through successive online and face-to-face approaches, with the aim of accompanying the process in a meaningful way. They highlighted the changes or turns undergone by the subjects. These changes are called "critical incidents" according to Bolívar (1999). It can be argued that one of the features that identify autobiographical narratives or stories is their experiential character. The students recounted situations that they remembered and interpreted, regularly related to other actors in different spaces, which shaped their own ecology of resilient learning.

The validation of the information was carried out through a methodological triangulation aimed at documenting and contrasting multisource information (Denzin, 1989). The filters used to identify resilient students contained socio-demographic data, risk factors and resilient characteristics that were consistent throughout the three research stages. Subsequently, the sample was modified.

4. Discussion and conclusions

In the study, the results show the complexity of the social fabric in which a group of "telesecundaria" students develop, which generates a challenge for education. The result analysis reflects the importance of considering the personal experience of the student body, with the objective of consolidating learning that strengthens their sense of life and autonomy. This implies a paradigm shift in the development of

communicative strategies to create spaces and conditions where students become aware of the importance of their own learning ecology, empower their resilient experience in which they were able to face adversity, and express their thoughts and emotions (Sangrá, 2005; Maina & González, 2016; Rodríguez, González, García, Arias, & Arias, 2016; Burbules, 2012; 2014a; Rodríguez, Cabrera, Zorrilla, & Yot, 2018).

The periphery of the research was the reality described from the students' subjectivity, reflecting their own awareness of the ecology of resilient learning in a ubiquitous environment. Proof of this are the extracts of their interactions in the Google Classroom platform: "I realize that the greatest achievement so far, is to be writing this, because I have a hard time talking about myself, and it is because of my little brother that I want to improve and it is because of him that I do everything". This inner voice realizes that oral and written stories in ubiquitous environments stimulate narrative reflection and resignification through a collaborative interaction that proved to be a tool that enhances the accompaniment of students to express their voice, not yet legitimized in some school environments, which leads to an empowerment of the hybridization between the subjective and the social (Phillippi & Avendaño, 2011).

The bridge generated between the formal and the informal made it possible to connect and exchange emotions, feelings, knowledge and experiences, in such a way that the relationship with others was gradually inked with confidence, security and awareness of the ecology of resilient learning in order to develop fundamental life skills that facilitate social and critical knowledge (Gutiérrez, 2012; Duke, Harper, & Johnston, 2013; Fernández & Anguita, 2015; Díez-Gutierrez & Díaz-Nafría, 2018).

Life projects as products of critical thinking in the student body emerged as fundamental pillars in the configuration of the ecology of resilient learning: "buying a house to live with my family, helping my grandmother and aunt with expenses, continuing to study for my loved ones and learning more". Aspects that are not regularly addressed in school contexts. The ability to organize words with clear meaning and meaning through verbal representations allows for the sharing of experienced images and emotions, in order to give them a meaning that can be communicated to make students feel like unique and valuable people. Learning to value the whys and wherefores of problematic situations gives firm support to the awareness of resilient learning ecologies (Maina & González, 2016; Herrera, 2013; Jiménez-Cortés, 2015; Peters & Romero, 2019).

The conclusion is that the Learning Ecologies framework supports the configuration of resilient learning. Jackson's (2013) proposal for shaping learning ecologies from an individual setting is considered, highlighting the personal context and the relationship with one' s environment in both virtual and physical settings, and integrating both process and purpose. In this sense, by understanding the support they have, such as the sources of resilience and the resources (Burbules, 2014b) on which they can rely for the acquisition of knowledge, people feel greater autonomy and security in the configuration of their own learning ecology.

In the discourse by the students, adverse situations were identified, which they perceived as a constant effect of abandonment and separation from their parents. This implies that learning, as a social construct in which internal elements and external factors converge in a dynamic process, can be triggered by the use of ICT to promote ubiquitous learning (Ladino, Santana, Martínez, Bejarano, & Cabrera, 2016; González-Sanmamed, Muñoz-Carril, & Santos-Caamaño, 2019).

The affective style acquired, and the sense attributed to the experienced situations constitute the mental capital that the student uses to face problems. Most of the participating adolescents displayed sensitivity to the contexts where they asserted their judgments and clarified the parameters within which their assertions were framed. Proof of this were their suggestions for other young people living in adverse situations: "don't lower your head, you're very important, work hard, problems don't last a hundred years". The comments reflect a continuous resignification process that fostered critical thinking, configuring their ecology of resilient learning in ubiquitous environments.

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