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Disruptive Learning Ecosystems: Transformative Peace Tools in Post-Conflict Rural Contexts

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SUMMARY

This study explored the potential of hybrid learning ecosystems as an educational innovation to foster peacebuilding in rural post-conflict communities. By facilitating intercultural dialogue and the construction of shared narratives, this educational intervention contributed to transforming perceptions of the armed conflict and strengthening students' life projects. The results, based on the theory of the knowledge space, showed significant improvements in socio-emotional competencies and greater social cohesion. These findings position hybrid ecosystems as a key tool to promote resilience and contribute to sustainable peacebuilding in post-conflict rural contexts

KEYWORDS: Education for peace, intercultural dialogue, shared narratives, rural communities, hybrid ecosystems.

Introduction

The armed conflict in Colombia has left deep scars on rural communities, affecting both the social fabric and educational institutions. Rural schools face the challenge of forming citizens capable of contributing to peace, despite the aftermath of the conflict. Between 1986 and 2021, 881 cases of direct violence against educational communities were documented (Commission for the Clarification of the Truth, 2021), altering school dynamics, hindering life projects, and perpetuating intergenerational inequalities. Education, recognized as a driver of social change, has a fundamental role in the construction of an equitable and peaceful society. In this sense, the General

Education Law (Law 115 of 1994) establishes as a central objective the comprehensive training of students, promoting initiatives such as the Chair of Peace and citizen coexistence programs. However, these efforts are not always adapted to the particularities of the rural contexts most affected by the armed conflict (Rivas et al., 2019; Márquez et al., 2014).

In this context, it is crucial to understand how the armed conflict impacts students' socio-emotional aspirations and competencies. Authors such as Herrera and Lozano (2019) state that transforming the perception of conflict and strengthening life projects can empower young people as agents of change in their communities. In rural areas, where educational opportunities are limited, these projects are closely linked to overcoming barriers such as poverty and social exclusion. Based on the theory of the knowledge space, which emphasizes the importance of creating flexible learning environments adapted to individual needs, this research proposes that hybrid learning ecosystems can transform traditional pedagogical practices and offer new opportunities for the integral development of students. By combining digital and analogue tools, these ecosystems make it possible to overcome the geographical and socio-economic barriers that limit access to quality education in rural areas.

Unlike previous studies that have focused on one-off interventions, this study seeks to assess the long-term impact of hybrid learning ecosystems on peacebuilding. Specifically, this research seeks to answer the following questions: How do hybrid learning ecosystems influence students' perception of armed conflict? To what extent do these ecosystems strengthen the socio-emotional competencies necessary for the construction of life projects? How do hybrid learning ecosystems contribute to fostering community engagement and sustainable peacebuilding?

This study focuses on exploring the potential of hybrid learning ecosystems as an innovative strategy to strengthen students' socio-emotional competencies and promote peacebuilding in rural post-conflict communities. In particular, it examines the ways in which these ecosystems, by integrating digital and analogue tools, can overcome geographical and socio-economic barriers that limit access to quality education. In addition, it addresses how these ecosystems transform perceptions about armed conflict, empowering students to act as agents of change in their communities.

This study, conducted in Pradera, Valle del Cauca, a region severely affected by armed conflict, provides empirical evidence on the effectiveness of hybrid learning ecosystems as a tool to promote social transformation and the construction of lasting peace

Theoretical Framework

Theory of the Knowledge Space

The theory of the knowledge space, proposed by Doignon and Falmagne (1985), states that learning is a progressive process in which students acquire fundamental concepts in a sequential manner in order to solve specific tasks. This approach allows for the dynamic assessment of knowledge states, adapting educational experiences to the individual needs of students (Falmagne et al., 2013). In rural contexts affected by the

armed conflict, this theory is crucial to identify and strengthen specific competencies that facilitate the overcoming of educational and social barriers, adapt teaching to the individual needs of students, favoring the personalization of learning and the inclusion of those who face socioeconomic disadvantages.

Learning Competencies

The development of key competencies in rural contexts is essential for students to be able to face the socio-emotional and cognitive challenges arising from the armed conflict. According to Heller et al. (2006), skills such as critical thinking, resilience, and decision-making are critical to training students in problem-solving within their social environment. Hybrid learning ecosystems not only seek to improve academic performance, but also to facilitate the development of socio-emotional competencies, such as resilience and decision-making, which are crucial to face the challenges arising from armed conflict (Stefanutti & Chiusole, 2017).

Life Project

The concept of life project refers to the personal, academic, and professional goals that guide the integral development of individuals. Lomelí et al. (2016) identify four key dimensions to build a life project: self-esteem, motivation, planning, and management. Within the framework of this research, the importance of these dimensions in the post-conflict rural context is underlined, where students face challenges such as poverty, social exclusion and lack of educational opportunities. Self-esteem is associated with positive self-perception, which is crucial for coping with obstacles; motivation drives the effort to achieve goals, and planning and management allow long-term objectives to be established and achieved. These dimensions are fundamental in the formation of educational strategies that integrate both the academic and emotional aspects of students. In a post-conflict environment, building a life project can be especially challenging due to social and economic barriers. Hybrid learning ecosystems, by integrating digital tools and interactive activities, can be key to revitalizing students' aspirations, helping them overcome the aftermath of conflict.

Mental Models and Conceptual Models

Mental models are internal representations of reality that people construct to interpret their environment and make decisions (Novoa, 2012). In the educational context, mental models evolve into conceptual models when students reorganize their ideas and concepts, transforming them into more complex structures aligned with scientific knowledge. This process, according to Becerra and Benítez (2019), is essential for meaningful learning, as it facilitates the integration of abstract concepts and the application of knowledge in real contexts. In this study, learning ecosystems are used as a tool to promote this transition, favoring a comprehensive development, both cognitive and socio-emotional, of students. Hybrid learning ecosystems serve as a means to help students transform their mental models into more complex conceptual structures, facilitating the understanding of armed conflict and its effects, and promoting a deeper and more critical interpretation of the social reality that surrounds them.

Learning Ecosystems

Learning ecosystems are dynamic environments that integrate technological resources, pedagogical activities and social interaction to promote adaptive learning. Donnelly and Maguire (2020) and Li et al. (2022) highlight that these ecosystems offer personalized education that meets the individual needs of students, promoting key competencies that are fundamental for their integral development. In rural post-conflict contexts, learning ecosystems are presented as a powerful tool to overcome traditional educational limitations and improve both academic performance and socio-emotional development of students (Gallego, 2022; Benítez, 2023). The combination of digital and analogue tools in these ecosystems makes it possible to transform pedagogical practices, creating learning environments that empower students to face the challenges of their context. Hybrid learning ecosystems in rural contexts combine digital technologies (such as educational platforms) with traditional resources (such as printed materials or face-to-face activities), making it possible to overcome geographical and technological barriers that limit access to quality education.

Integration of Theoretical Approaches

The interrelationship between knowledge space theory, learning competencies, life project, and mental and conceptual models offers a robust framework for addressing educational challenges in rural communities affected by armed conflict. This approach not only enhances academic learning, but also strengthens the emotional and social capacities necessary for sustainable peacebuilding. In this context, learning ecosystems represent an innovative strategy that, by integrating academic knowledge and emotional development, fosters the empowerment of students as agents of change in their communities by improving students' communication skills, allowing them to express their opinions, listen to others, and build consensus. This is fundamental for the peaceful resolution of conflicts and the construction of a culture of peace.

Hybrid learning ecosystems, by facilitating intercultural dialogue and the construction of shared narratives, promote effective communication and peaceful conflict resolution. According to agenda setting theory, these ecosystems can influence students' agendas by encouraging active participation and dialogue, they can influence students' agendas and the construction of shared meanings about the armed conflict, directing their attention towards issues related to peace, reconciliation and coexistence. In addition, by encouraging students' active participation in building their own knowledge, these ecosystems contribute to strengthening their resilience and developing critical thinking skills needed to face the challenges of a post-conflict context. Resilience is a key concept in the context of armed conflict; Learning ecosystems can strengthen students' psychosocial resilience, enabling them to cope with adverse situations and build a brighter future.

Knowledge space theory provides a conceptual framework for understanding how students construct and organize their knowledge. By adapting content and activities to students' previous knowledge levels, learning ecosystems can facilitate the construction of more complex and sophisticated mental models about armed conflict and its consequences. This transformation of mental models is essential to promote changes in students' attitudes and behaviors, facilitate intercultural communication, and build virtual learning communities to foster a culture of peace.

Methodology

Research Approach and Design

This study adopted a mixed approach (quantitative and qualitative) to investigate how hybrid learning ecosystems influence the perception of armed conflict and the strengthening of life projects in rural students. The mixed approach allows for a more comprehensive understanding of the effects of educational intervention, combining quantitative analysis of outcomes with qualitative interpretation of students' experiences during the process. This facilitates a richer view of the evolution of perceptions and competencies over time. Through a quasi-experimental design, the effects of the educational intervention without randomization of the groups were evaluated, due to the specific characteristics of the educational environment in which the research was carried out. The quasi-experimental design allowed us to observe the impact of the intervention on students over time and in a controlled context, which facilitated the understanding of how mental models and perceptions of the armed conflict evolve.

Study Context

The research was carried out in the municipality of Pradera, Valle del Cauca, Colombia, a region strongly affected by the armed conflict. The participants were students from rural elementary, secondary and middle schools. The study focused on evaluating how learning ecosystems, which integrate digital and analog tools, allow the evolution of the life project and the change in perception of the armed conflict. A learning ecosystem was designed through the Moodle platform, which offered the digital classroom "journey through the life project", with content adapted to the needs of students based on the key dimensions of the life project and the armed conflict.

Population and Sample

The population was composed of 108 elementary, secondary and middle school students from two selected rural institutions. Non-probability sampling was used by inclusion criteria, ensuring that participants met the specific requirements for the study. With a margin of error of 5% and a confidence level of 95%, the sample size was determined to be adequate for the purposes of the study.

Instruments for Information Collection

All instruments were validated by experts in the area of rural education and armed conflict to ensure their relevance and reliability in the context of conflict-affected communities. In addition, they were culturally adapted to ensure their applicability in the rural and post-conflict context.

Space of Competencies for Life Project Learning: This instrument was based on the theory of the knowledge space as an ontological structure. Structuring concepts were identified, each associated with an action that students should be able to perform. The concepts were organized into five levels of competence: Elementary, Basic, Reconstructive, Prospective and Inclusive.

Monitoring for the monitoring of the evolution of the life project: This instrument consisted of 30 multiple-choice questions, designed based on the matrix of

competencies of the life project, with the aim of measuring the evolution of the students' mental models over time.

Instrument for the Perception of the Armed Conflict: This instrument sought to identify three dimensions: understanding of reconciliation and peace, resilience in the face of the adversities of the conflict, and reflection on its causes and consequences.

Data Collection Procedure

Data were collected at various stages of the intervention process. The questionnaires were administered before, during, and after the educational intervention, allowing a longitudinal follow-up of the evolution of students' perceptions and competencies. The interpretative approach adopted in this study allowed us to obtain an in-depth vision of the processes experienced by the students, without pretending to generalize the results to broader populations. The triangulation of qualitative data (open responses in forums and interviews) and quantitative data (results of questionnaires collected through the digital classroom and printed questionnaires) allowed a richer interpretation of the effects of the learning ecosystem. This approach combined the objectivity of numerical data with the depth of student experiences.

Data Analysis

The data obtained were analyzed using descriptive and inferential statistical tools, which allowed identifying patterns in the evolution of mental models and students' perceptions. A mixed analysis approach was used that combined the qualitative interpretation of the open-ended responses collected in the forum participation with the quantitative results of the multiple-choice questions, which provided a more complete view of the effects of the educational intervention. The qualitative data were analyzed using thematic coding, which made it possible to identify recurring patterns in the students' responses and to establish relationships with the quantitative variables obtained in the questionnaires.

Limitations of the Study

It is important to note that, due to the characteristics of the educational environment and logistical and institutional constraints, it was not possible to carry out a strict control of the intervention conditions, which may have influenced the accuracy of the results. However, the longitudinal methodology allowed for a detailed analysis of changes over time, which contributed to a more robust assessment of the effects of the learning ecosystem.

This study focuses on the description of the learning environment as it occurs in the educational ecosystem, with the aim of capturing the dynamics of the processes within it. The collection, organization and analysis of the data was carried out through various strategies, seeking an interpretation that, under a constructivist epistemological stance, allows a deep understanding of the observed phenomena. This interpretation is not limited to the simple description of the facts, but is based on the experience of the

researcher, which makes it possible to develop emergent designs applicable in similar contexts (Cerda, 1991).

A quasi-experimental design was chosen, in which the subjects of the experimental groups were not randomly selected. The purpose of the study was to analyze how the evolution of the mental model of the life project influences the perception of the armed conflict in young students of elementary, secondary and middle school in two rural educational institutions located in the municipality of Pradera, Valle del Cauca. Each of the groups constituted an independent experimental group.

It is relevant to note that a randomization process and rigorous control over intervention time were not applied due to the organizational and institutional constraints of the educational environment. Throughout the experimental intervention, data were recorded at various times of the process, which allowed a detailed monitoring of the variables involved in the study. According to Bono Cabre (2012), this methodology, which involves taking multiple records over time of the same subject, improves the accuracy of the results and allows a more complete evaluation of the changes experienced.

The temporal scope of the study classifies this research as longitudinal, since it focused on the study of the evolution of individuals' mental models during a given period, observing both the processes of change and their possible causes. In addition, the research is categorized as exploratory and descriptive, given its focus on the observation of phenomena within a specific context without attempting to generalize the results to broader populations (Bono Cabre et al., 2015). In epistemological terms, the study was configured from an interpretative paradigm, which implies that the reports prepared have an interpretative character, seeking to understand the complexity of the processes without generalizing the findings (Meneses et al., 2004).

Descriptive and inferential statistical tools were used for data analysis, after properly organizing and filtering the data obtained through the interactions of the subjects within the educational ecosystem (Mason & Lind, 1998).

Design of the Educational Ecosystem

The educational ecosystem was developed using the Moodle platform, under the domain kstcolombia.org. Through this platform, a "journey through the life project" was designed, made up of 30 lessons that addressed the previously established concepts and levels of knowledge. The navigation flowchart designed allowed students to interact with the contents, including educational resources such as videos, readings and audios, which facilitated the deepening of the topics.

The automatic feedback system within the platform provided personalized messages based on the student's performance, which stimulated reflection and autonomous learning. Students could progress through the lessons, and by selecting incorrect answers, they were redirected to additional materials to reinforce their knowledge.

Analysis and Discussion of Results

In the descriptive analysis of the results, the general behaviors observed in the dependent variables are presented: number of interactions, attempts made, time spent and the responses obtained in relation to the states of knowledge. The changes in the

mental models of the students and how they influenced their perception of the armed conflict are discussed, based on the interactions and feedback received through the educational ecosystem.

Average Assessment and Levels of the Mental Model

This assessment considers the space of learning competencies for a life project, which addresses the conceptual model (composed of the seven states of knowledge, each with its respective concepts), the actions necessary to solve a problem situation, and the twenty-eight multiple-choice questions distributed in the different states of knowledge. The levels of the mental model previously defined are: *Inclusive*, *Prospective*, *Reconstructive*, *Basic* and *Elementary*.

Next, the relationship between the average assessment of the answers to the twenty-eight questions and the levels of the mental model for the group of participants in each of the proposed states of knowledge is described. In Figure 1, the horizontal axis shows the final average of the score obtained according to the number of questions answered, while the vertical axis indicates the absolute frequency, i.e. the number of students. Considering that the maximum score per question is 100 and that there are a total of 30 questions, the minimum score is 300 and the maximum is 3000.

From the figure it can be said that eight (8) students answer all thirty questions correctly, that is, 12%, 15% answer 27 questions, 13.6% between 24 and 21, 7% between 18 and 15, 25% between 12 and 9 and the remaining 25% between 6 and 3 questions.

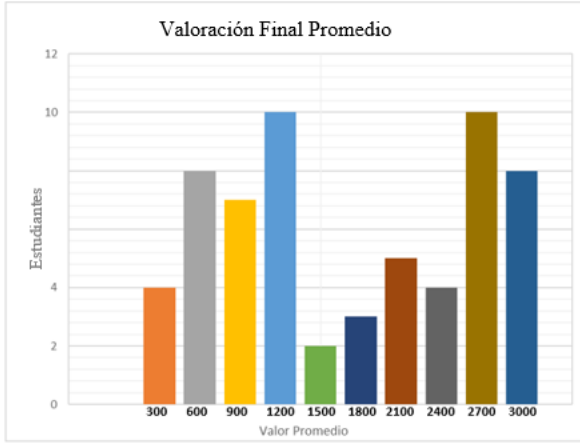

Figure 1 Relationship between number of students (height) and average final rating (bars). In original language: Spanish

From the answers, the levels of the mental model reached are identified. Figure 2 shows that 71.8% reach the Inclusive level and 10.5% the Prospective level; that is, for 82.3% of the students, their mental model is close to the conceptual model proposed in the space of learning competencies and 17.7% do not reach the conceptual model, thus being in the following levels: Reconstructive 5.58%, Basic 6.84% and Elementary 5.25%.

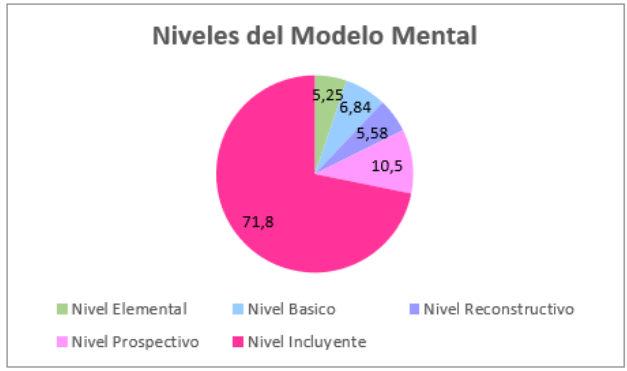

Figure 2 Levels of mental model. In original language: Spanish

When inquiring with some students about the results, they commented: "... For good reading comprehension or the part of the imagination with the exercises, suddenly I have a more skillful logic for that. I have noticed that I am a little more graphic than for texts and formulas to find the logic of the exercises..." [DET1050]; "… one must already have a basis and it is simply necessary to read and contextualize in a coherent way, looking for a contextualization according to the topic that allows us to visualize the correct answers in the best way..." [DET1027] and "... For me the most important thing is reading because everything was in reading, if one reads the readings and experiments well one answers the questions very well..." [DET1062].

The life project and the change in perception of the armed conflict

The instrument for perceiving armed conflict allowed us to observe a slight change in the understanding of reconciliation and peace, recognizing that they are complex and long-term processes that involve multiple actors and perspectives (Benitez, 2024). While it is true that there is a distancing from the conflict, being reluctant to get involved in related activities, they are also clear in stating that it is a personal decision according to their life project. It highlights the importance that students give to social justice as a basis for reconciliation and how it gains relevance in the perceptions of young people, who mostly see it as a great possibility to address inequalities and structural injustices. It was observed that there is a strong commitment to peace and respect for legality on the part of the students.

Young people suggest greater support from state entities to develop a broader set of socio-emotional skills, such as empathy, resilience, and the ability to resolve conflicts, which allow them to face adversity more effectively. As well as, building stronger support networks, both locally and globally, that provide them with the necessary support to overcome traumatic experiences and build a positive future. This suggests that young people want to become agents of change, participating in initiatives to promote peace and social justice and empowering other young people affected by conflict.

When reviewing changes with respect to the structural causes of conflict, such as inequality, discrimination and lack of opportunities, they remain in questioning official narratives about conflict and prefer to construct their own interpretations based on

multiple sources of information, perspectives and make connections between armed conflicts in different parts of the world and recognize the need for collective action to address global challenges. That is, they do not see the problem as something that is local or only theirs, but they link it to the conditions of conflict that is occurring in the world.

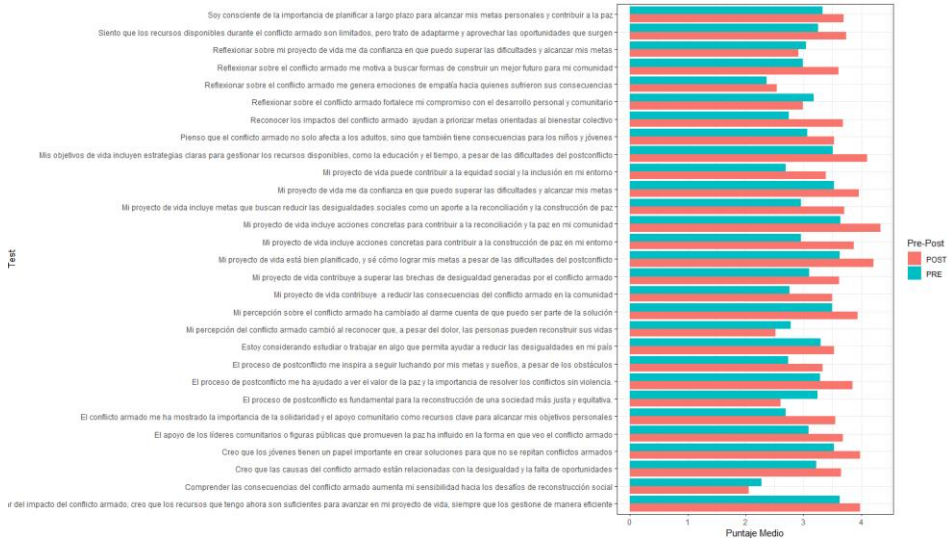

Figure 3 Change of Perception of the Armed Conflict. In original language: Spanish

When observing the change in the perception of the armed conflict in Figure 3 it can be noted that it is a dynamic and complex process that is subject to multiple influences, it is possible that the evolution of the life project is a determining factor, if possible evolutions towards a deeper, more critical and committed understanding of the conflict could be identified. as well as a greater desire to build a more peaceful and just future.

The research carried out reveals that young students from rural institutions in Pradera have demonstrated a remarkable capacity for resilience and adaptation, rebuilding their life projects through education, work and support from their communities. However, challenges such as stigma and lack of access to basic services remain. At the same time, there is a positive change in the perception of the armed conflict, with greater recognition of the victims and a growing commitment to peacebuilding. These findings highlight the importance of public policies that promote comprehensive reparation, transitional justice, and the construction of a shared historical memory.

Pradera students have demonstrated a great ability to adapt to an environment marked by violence and armed conflict. This research can contribute to the development of programs and strategies that promote peacebuilding and social transformation in communities affected by armed conflict. Their life projects reflect this resilience and their desire to build a better future despite adversity.

Interaction with the Ecosystem

Below are the interactions in the ecosystem. Figure 4 shows the interaction between students, devices and actors in the ecosystem, which were selected for this research: teacher, students, experiences with analog and digital elements, questions to monitor the evolution of the mental model, answers selected by students, feedback information and ease of navigation, Figure 46 shows the interactions by actors and devices. The feedback information that the student receives, understood as an action that carries information and returns information, makes both the student and the teacher mutually regulate, that is, the action of one affects the other. The feedback was made through suggestions and dialogues in the chat and forum enabled in the ecosystem. In the dynamics of interaction with the devices, feedback information is always generated that modifies the teacher's actions and affects the effectiveness and efficiency of the ecosystem, achieving greater flexibility and other alternatives in the search for answers to the problem situation posed. The accompaniment of the teacher and the feedback information that was proposed in the ecosystem were fundamental for the scope of the conceptual model as manifested by the students [DET1039] ... "The option of if I have any doubts or concerns, I have a direct chat with a teacher or someone who helps to solve doubts, because there were times when I could not solve some questions, such as in the formulas, moments when I could not understand and carry them out..." and [DET1009] "... In the ecosystem that we work with, one can repeat, reread and watch the videos several times, in the class the teacher arrives, dictates the class, solves the doubts at the moment and you do your job, on the other hand, you can observe several times both the experiences, the videos, the readings, you knew them to understand the subject more and additionally ask the teacher..."

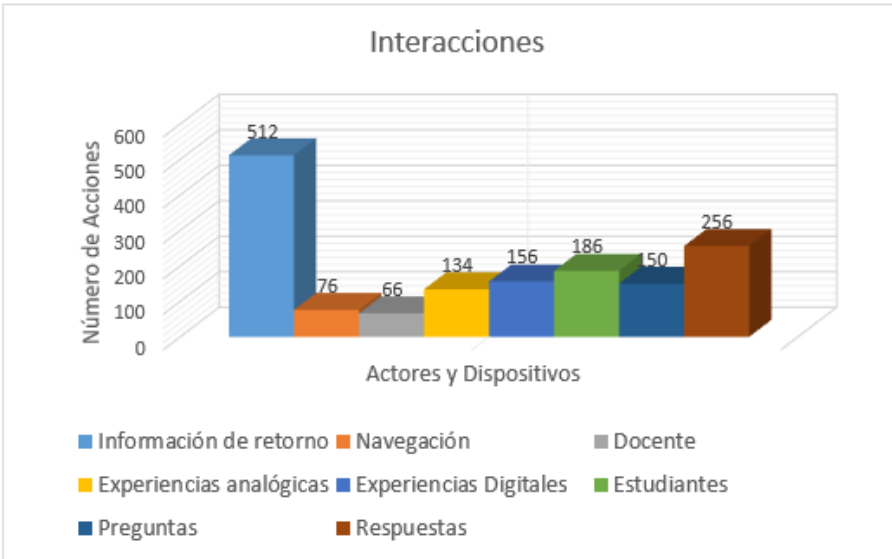

Figure 4 Relationship interactions. In original language: Spanish

In this research it is assumed that the mental model is built by each student, this construction is made from the combination of the different components of the ecosystem raised and described in the conceptual categories of this thesis. The

experiences of each level of the ecosystem affect the interactions we have with resources, devices, other students, and teachers (Ocampo, 2017). The above is reaffirmed by the teacher [DDT1001] "... Learning devices facilitate the evidence of conceptual models in any area of knowledge, some simulations show these conceptual models correctly and others, with errors. When "visualizing" the conceptual model, the interpretation of it is done with the mental model of each student. It may be that this is the contrast between the models and approaches of the mental model to the conceptual one..." and [DDT1002] "... Yes, the student's mental model is affected in the ecosystem, because it is a different way of learning and all the topics in the curriculum are found with many resources with which the student interacts, it is very good to work with and help students transform their way of seeing physical and social phenomena..."

Figure 5 shows the evolution curve of the mental model of the students who managed to complete more than 24 lessons and answer the questions that monitor the evolution of the mental model; There are periods with greater activity and others in which the slope of the curve decreases noticeably. In some cases, when the student fails to overcome the proposed task, assertively solve the question or finish the activities, that is, his model is overwhelmed by the situation to be solved and it is difficult for him to make predictions, a block occurs and most of the time he abandons what he is doing (Orellana & Sánchez, 2006). The foregoing strengthens the quality of the feedback and messages that encourage the student to continue with the process, coinciding with what was expressed by some students and teachers: [DET1010] "... the most difficult questions were the planning ones, then I looked for another one I answered and then I went back, that motivated me to continue with the questions, the teacher also told me how I was doing and called me to order...", [DET1046] "Well, the questions that I left unanswered were because they were very difficult and I left them for later and then I forgot... the important thing was that it was not a grade for any class, otherwise I would have done very badly with the teacher...", [DET1007] "I finished all the questions, then I answered some of them again and watched the simulations with great pleasure was the most beautiful thing, I saw them with my son and five years old and I explained to him that he also liked it..." and the teachers also agree on the importance of making cuts and knowing how the process is going [DDT1002] "... When you sent me the first report, I talked to the students and we asked some questions and watched some videos and then they were motivated to continue. The report is very important for the teacher and the student, knowing how it is going is essential...", [DDT1003] "The reports are important, I didn't know how to download them, but you sent it very complete and that makes the information for the students and even the parents to whom I showed the platform very good... it's a pity that the internet at school is so bad..."

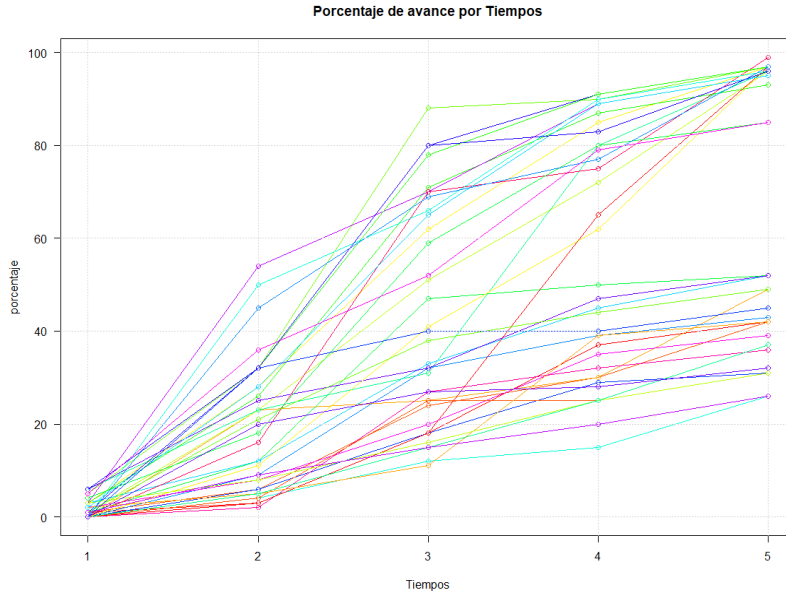

Figure 5 Curve of evolution of the Mental Model over time. In original language: Spanish

The distribution that is presented can be interpreted as a learning curve, in which the evolution of each of the students is observed as a function of time; the slope of the line represents the progress at different times in order to achieve the proposed goal (Restle, 1971). The evolution curve for students who finished the course and achieved the conceptual level according to the state of competencies that include the states of knowledge, actions and the use of devices proposed in the ecosystem. The figure shows that there is more relative learning between the first and second cuts, from the third cut it is observed that the slope increases significantly.

The writing of the life project is revealed as a powerful tool for students to process their experiences, emotions and reflections around violence and armed conflict. By capturing their thoughts and feelings in a text, students can construct alternative narratives that allow them to overcome trauma and build a more hopeful future. When reviewing participation in the forum, a significant evolution in students' perception of violence and armed conflict is observed. Initially, the stories may be marked by feelings of fear, resentment, and hopelessness. However, with the passage of time, there is a trend towards the construction of more positive narratives, focused on resilience, hope and the search for solutions.

Correlation of ecosystem variables

Figure 6 shows the correlation of the variables of the devices enabled in the ecosystem. The Pearson correlation (R) is calculated, which establishes values between [-1,1] where [-1] means a perfect negative correlation between the variables; that is, as the variable on the X axis increases, those on the Y axis decrease until they reach the value

0 where there is no correlation and the value [1] corresponds to a strong positive correlation in which the variables on the X axis increase as well as those on the axis And. It is observed that as the blue color increases, a positive correlation is observed and the red color a negative correlation, so the dots within the table indicate, according to the color and their color intensity, the correlation between the devices. It is observed that feedback information, encouragement to overcome the difficulties that arise in the search for a solution to a problem, responses and teacher-student interaction have a positive correlation.

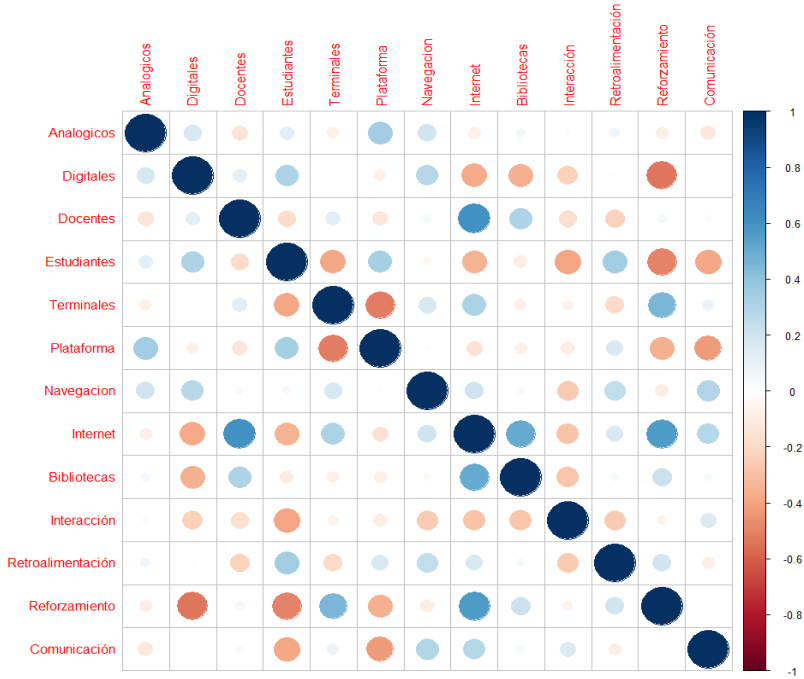

Figure 6 Correlation between ecosystem devices. In original language: Spanish

Linear Regression Model

Finally, a regression model is established in order to estimate the effect on the answers obtained as a dependent variable (the times I try to answer the question) of the independent variables, time used, interactions (the number of times the student entered the ecosystem) and the percentage (refers to the assessment). The regression model is associated with Pearson's coefficient (R) to simultaneously correlate two variables and provides the possibility of predicting the behavior of a variable, in this case the dependent one, in relation to the values taken by the independent variables.

Table 1 presents the multiple linear regression model in which the Pearson coefficient R2 is 0.9708 and adjusted R2 is equal to 0.9704, indicating that the model has a high degree of replicability of the results. At the same time, the P value is less than 5% (< 2.2e-16), which indicates that the model is significant calculated with 6 degrees of freedom of the independent variable and 521 degrees of freedom for the variance of

error. The model shows the estimated coefficient for each of the variables (βi), this value being the one taken in the equation of the regression model. Negative values are inversely proportional to the growth of $\hat{y}$ and estimates with a positive sign are directly proportional.

The standard error column indicates the variation of the estimator according to the calculated mean error. The variation in the model is high, especially due to the size of the estimators and their variation above the size of the estimate. The significance of each variable in the model is calculated from the t-student test to find out if the effect of the variable analyzed is significant (the probability of error in the acceptance of the hypothesis is less than 0.05). Of the variables analyzed, only the attempts were not significant when evaluated with a significance level of 0.05.

The significance of each variable in the regression model is calculated from Student's t-test to observe whether the variable analyzed is significant within the model.

Table 1 Linear regression that includes questions, interactions, and gender as predictors

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REGRESION

lm(formula = RESPUESTAS ~ INTERACCIONES:GENERO + PREGUNTAS: GENERO +
Tiempo + Intentos)

Residuales:
     Min      1Q  Median      3Q     Max
 -4.3501 -0.6137  0.1751  0.4460  8.1659

Coefficients:
                                Estimate Std. Error     t value Pr(>|t|)
(Intercept)                       -1.375e-01  8.905e-02  -1.544  0.123
Tiempo                            -1.560e-04  3.677e-05  -4.244  2.60e-05
Intentos                          -3.575e-02  2.234e-02  -1.600  0.110
INTERACCIONES:GENERO(Femenino)    -3.072e-01  6.422e-02  -4.784  2.24e-06
INTERACCIONES:GENERO(Masculino)   -3.079e-01  2.822e-02 -10.913  < 2e-16
PREGUNTAS:GENERO(Femenino)         1.038e+00  7.080e-02  14.666  < 2e-16
PREGUNTAS:GENERO(Masculino)        1.035e+00  3.305e-02  31.318  < 2e-16

Residual standard error: 1.254 on 521 degrees of freedom
Multiple R-squared:  0.9708, Adjusted R-squared:  0.9704
F-statistic:  2882 on 6 and 521 DF,  p-value: < 2.2e-16
```

Linear regression is observed in the scatter plot in Figure 6, in which the grouping of variables in relation to the linear model is observed.

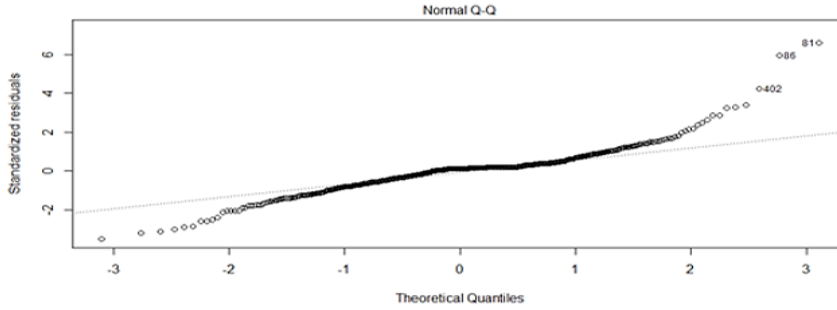

Figure 6 Scatter Plot. In original language: Spanish

When analyzing the model separately in relation to the variables, it is summarized in a correlation coefficient (R) of 0.992, which indicates that the Response variable has a high linear dependence of the variables Interactions, Questions and Time. In the same sense, the coefficients of determination (R2 and adjusted R2) indicate a high replicability of the model, of 98.3%. Finally, the model is evaluated under a significance hypothesis, where it is said that the variables have no differences between them, so the model does not have a contribution or novelty, having that the model does not fit this hypothesis under a significance of 0.05, so a p-value less than 0.01 indicates that the model has significant contributions.

The following analysis takes the average values of the variables questions, interactions, and time as predictors of the average number of responses.

Table 2 Correlations between the averages of the variables taken for the average regression model

Variable		Minteracciones		Mpreguntas		Mrespestas		Mtiempo	
1. Minteracciones	Pearson's r	—							
	p-value	—							
2. Mpreguntas	Pearson's r	0.992		—					
	p-value	< .001		—					
3. Mrespestas	Pearson's r	0.972		0.989		—			
	p-value	< .001		< .001		—			
4. Mtiempo	Pearson's r	0.527		0.565		0.552		—	
	p-value	< .001		< .001		< .001		—	

Table 2 shows that the correlations between the four variables are significant and therefore it is inferred that there is interdependence between them and the values are all positive. The increase in any of them corresponds to increases in the others.

Conclusions and Contributions

The ecosystem view, as an epistemological approach, provides a deep understanding of the relationship between digital technologies and education, in which learning is built through experience. This approach highlights how processes

within the ecosystem activate experience and enable the evolution of the individual, who synchronizes his or her actions with changes in the physical and cultural environment. This evolution is materialized in the student's ability to take control of their environment and self-regulate their own performance, which integrates cognitive, emotional and attitudinal dimensions.

In this context, the hybrid learning ecosystem plays a fundamental role in the evolution of students' life projects, as it allows them not only to acquire knowledge, but also to develop self-regulation and decision-making skills. This process of self-transformation is essential to change the perception that students have about the armed conflict and other social issues, since interaction with the digital ecosystem encourages critical reflection on their experiences and allows them to explore new perspectives. The ecosystem facilitates a safe space to reconfigure their beliefs and values, aiding in reconciliation with personal and collective history.

The results of this research reinforce the importance of a design of learning ecosystems that not only favors the acquisition of conceptual knowledge, but also promotes the development of emotional and social competencies, essential for changing the perception of conflict. Ecosystem devices (such as questions, videos, discussion forums, and feedback tools) are catalysts that allow students to interact with different perspectives, gradually modifying their mental model and helping them integrate their past experiences with new learning.

In this sense, it was evident that the integration of both digital and face-to-face experiences, such as workshops, congresses, forums and word circles, significantly increases student participation. These experiences contribute to reducing social, economic, and intergenerational inequality gaps, providing students with more equitable access to learning opportunities and active participation. In addition, the learning ecosystem becomes a peacebuilding scenario, where communication flows more openly and effectively between students and teachers, and where participants have the opportunity to redefine their perspectives and collaborate on conflict resolution. This environment aligns with the principles of total peace, fostering a culture of peace that transcends the academic realm and extends into social dynamics.

Constant feedback, provided by the devices within the ecosystem, is key to strengthening the student's autonomy and motivation to overcome obstacles. This process not only favors the consolidation of knowledge in areas such as physics, but also has a profound impact on the transformation of their worldview, helping to rethink their understanding of the armed conflict and their own role in peacebuilding. By being exposed to a variety of interactive resources and experiences, students begin to change their representations of the world, and this evolution is reflected in their attitudes toward others and in their social behavior.

Learning within this ecosystem is a gradual, systemic, and adaptive process that goes beyond the simple transmission of knowledge. Students' ability to decide on their own learning path strengthens their sense of autonomy and gives them the control they need to adjust their efforts, both academically and personally. This autonomy is crucial not only to achieve the conceptual model of the life project, but also to reconfigure their identity and their perceptions of their environment.

Approaches that integrate the ecosystemic, neurocognitive and digital perspective in the design of these learning ecosystems are essential to improve educational quality. In addition, they make it possible to effectively address the complexities of learning in rural and post-conflict contexts, offering tools for social and digital inclusion, and promoting a deep reconciliation of students with their social and cultural environment.

Finally, this research shows that the use of digital ecosystems not only improves academic learning, but also facilitates the evolution of students' life projects, contributing to a change in their perception of the armed conflict. Educational institutions, by being configured as learning ecosystems, have the potential to shape social interactions and contribute to the construction of a more inclusive and peaceful future.

Recognition

The article presents components worked on in the project "Changes in the perception of the armed conflict of students in the rural area of Pradera, Valle del Cauca from the evolution of their life projects", prepared within the framework of the Orchids Women for Science Peace Agents Program - call No. 935-2023. Ministry of Science, Technology and Innovation, Contract 112721-277-202

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