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# INTERVENTION IN THE LEARNING PROCESS IN STUDENTS OF PEDAGOGY IN HISTORY AND GEOGRAPHY IN CLASSES MEDIATED BY ICTS; SUBJECT: SPECIAL PROBLEMS AND CLIMATE CHANGE

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## ABSTRACT

This study analyzes the impact of an innovative methodological intervention that integrates Information and Communication Technologies (ICT) and field-based activities on meaningful learning in students of Pedagogy in History and Geography, within the subject "Special Problems and Climate Change." Grounded in a constructivist approach, the research aims to strengthen digital competencies, connect theory with practice, and enhance teacher training. A mixed-methods design was applied, combining quantitative analysis of academic performance with qualitative data from semi-structured interviews. The sample consisted of 44 university students. Data were collected through validated instruments, including the TIC-TAC form and institutional performance reports. The results indicate a significant improvement in students' digital competence and understanding of key concepts related to climate change. Additionally, increased motivation, confidence in ICT use, and stronger engagement with the learning process were observed. The integration of field experiences contributed to reinforcing meaningful learning by linking academic content with real-world contexts. The study concludes that the combined use of ICT and experiential learning strategies is effective in improving academic performance and pedagogical competencies. These findings highlight the importance of integrating innovative methodologies in higher education to address the challenges of 21st-century teacher training.

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**KEYWORDS:** Learning - ICT - TicyST Methodology- Constructivism - Pedagogy in History and Geography.

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## 1. INTRODUCTION

### 1.1. Background to the Problem

The present study focuses on the design and implementation of an innovative methodology mediated by Information and Communication Technologies (ICT) to enhance meaningful learning among students of Pedagogy in History and Geography, within the subject "Special Problems and Climate Change," under a constructivist approach.

This research contributes to the existing literature by examining the relationship between ICT use and meaningful learning in higher education, particularly in teacher training contexts. It proposes the integration of digital tools and field-based activities to connect theory and practice, strengthen pedagogical competencies, and improve educational quality. Methodologically, the study incorporates validated instruments and data triangulation to evaluate the effectiveness of the intervention. Additionally, it offers practical implications through the development of didactic resources and the promotion of collaboration between universities and schools, contributing to both academic and social impact.

#### 1.2 Hypothesis

The methodological intervention has allowed students to achieve more than 65% of ICT use management and significant learning.

Null hypothesis.

The methodological intervention mediated with ICTs has not been able to comply with a significant learning.

### 1.2. Objectives and justification

The research work of this study is aimed at carrying out an intervention with an innovative methodology that includes the use of ICTs applied in the classroom to enhance the significant learning of students of pedagogy in History and Geography in the context of the subject of Spatial Problems and Climate Change under the constructivist model.

#### 1.2.1. General objective

To design and implement a methodological intervention that enhances **meaningful learning** with pedagogical strategies **mediated by ICT** and consequently the development of skills in students of Pedagogy in History and Geography, as a tribute to the graduation profile and pedagogical and disciplinary standards in the context of the subject Special Problems and Climate Change

#### 1.2.2. Specific Objectives

1. Carry out a bibliographic review and analysis on the subject of study.

2. To analyze the profile, perceptions and level of digital literacy and skills of students in the use of ICTs, highlighting the dimensions of the variables.
3. Design methodological strategies and interventions that allow students to learn in a meaningful way by connecting theory and practice through the use of ICTs.
4. Evaluate the impact of interventions through the application of instruments that measure how students transfer what they have learned to real texts.

## 2. CHAPTER 2 METHOD (METHODOLOGY)

### 2.1. Research design

This study follows an experimental design within a mixed-methods approach. The independent variable, Information and Communication Technologies (ICT), was applied through a methodological intervention to evaluate its effect on the dependent variable, meaningful learning.

The research integrates both qualitative and quantitative components to provide a comprehensive understanding of the phenomenon. Quantitative data were used to measure academic performance and learning outcomes, while qualitative data contributed to understanding students' perceptions and experiences.

The study also incorporates a structured literature review as part of the research design, aimed at identifying theoretical foundations, research trends, and existing gaps in the field. This process involved the selection, analysis, and synthesis of relevant academic sources to support the development of the study.

Overall, the design allows for a systematic evaluation of the intervention and its impact on learning, ensuring coherence between theoretical foundations, methodological procedures, and research objectives.

### 2.2. Population and sample

The population under study is made up of university students enrolled in the subject "Special Problems and Climate Change". Out of a total of 49 students, 44 who actively participate in academic activities will be worked on. The sample has been selected through a non-probabilistic sampling for convenience, considering the accessibility and availability of the participants.

To better understand the difference between both terms (population and sample), it is determined; Prhita, (2024) specifies the following: Population; refers to the entire group from which conclusions are to be drawn. It can include elements beyond people,

such as objects, events, organizations, countries, species, etc.

Sample: This is a specific group from which you will collect data. Their size is always smaller than that of the total population. In research, the population is not always limited to people

**2.3. Research instrument**

The instruments are the tools with which the information related to the research work will be collected, among which the questionnaires, focus groups, among others, stand out. (Cochachín, 2024)

Qualitative instrument: An interview was carried out **without replacement** in a group of students to

know their **personal appreciations** about the process of the work developed in the semester with some questions specifically addressed.

**2.3.1. Data collection techniques and instruments**

The data were analyzed qualitatively and quantitatively under the umbrella of the integrative or mixed paradigm, they were used a.- Statistical performance report b.- Analysis of the results of the Google form, c.- Analysis of the focus group responses. Detailed with computer programs in Table 1

*Table 1: Analysis of the data and programs to be used*

Data analysis	Program to use
Data standardization	SPSS Program
Use of statistics	SPSS Program
Use of analysis techniques used within the SPSS program	Atlas Ti 12 CANVA Program

Source: Authors.

The research was carried out using both qualitative and quantitative methods. In the qualitative approach, the Atlas Ti 12 program was used to perform a word cloud analysis, and co-occurrence, which allowed identifying possible patterns in the focus group responses. On the other hand, in quantitative research, several statistical techniques were used. Descriptive statistics allowed the data to be summarized (mean, standard deviation, etc.).

**3. CHAPTER 4 RESULTS. ANALYSIS AND INTERPRETATION OF RESULTS**

**3.1. Diagnosis and results**

According to the fulfillment of the objectives, the following results are detailed

Student profile; the group of students of the Pedagogy in History and Geography career is

*Table 2: Case Processing Summary. In original language Spanish*

**Resumen de procesamiento de casos**

	Casos Válido		Casos Perdido		Total	
	N	%	N	%	N	%
DISEÑO_REC * SEXO_R	77	100.0%	0	0.0%	77	100.0%

**Tabla cruzada DISEÑO\_REC \* SEXO\_R**

DISEÑO_REC	SEXO_R M	SEXO_R F	Total
PRT	21	12	33
POT	28	16	44
<b>Total</b>	49	28	77

relatively homogeneous, with ages ranging from 19 to 22 years old. Of the responses, 42.8% belong to the female gender and 57.1% belong to the male gender. As for the academic performance of secondary education (school), students are mostly concentrated between grades 5.9 and 6.3. This demonstrates the good academic performance of the students. In terms of preference for the career, 81.8% chose the career in first place and 9.1% chose it in second place, which shows the interest in preferring the career of pedagogy in History and Geography. In terms of previous university academic performance, the group in general had an average in university between 4.2 and 6.3 respectively. Below, results of the Tic-Tac form study; answers that summarize the Processing of the cases.

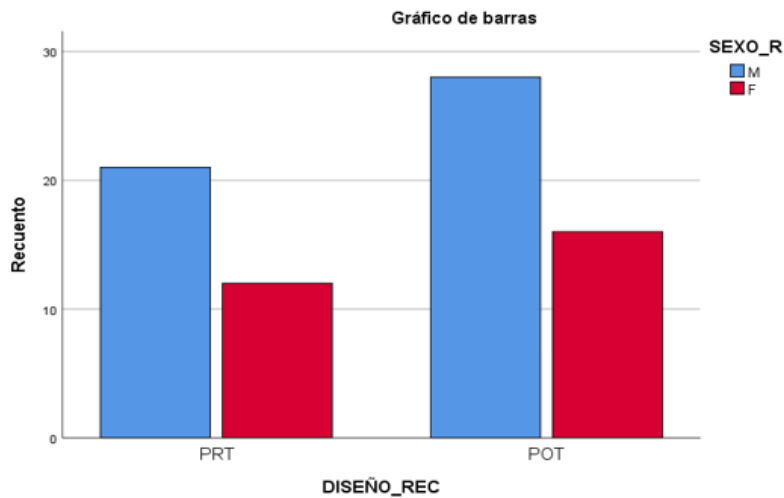


Figure 1: Bar graph pre-test and post-test answers. In original language Spanish

Table 3: Sex Case Processing. In original language Spanish

Resumen de procesamiento de casos

	Casos Válido		Casos Perdido		Total	
	N	%	N	%	N	%
SEXO_R * P1 * DISEÑO_REC	77	100.0%	0	0.0%	77	100.0%

Tabla cruzada SEXO\_R \* P1 \* DISEÑO\_REC

DISEÑO\_REC: Total

SEXO_R	Medida	P1 NO	P1 PO	P1 SI	Total
M	Recuento	3	20	26	49
	% dentro de SEXO_R	6.1%	40.8%	53.1%	100.0%
F	Recuento	3	11	14	28
	% dentro de SEXO_R	10.7%	39.3%	50.0%	100.0%
Total	Recuento	6	31	40	77
	% dentro de SEXO_R	7.8%	40.3%	51.9%	100.0%

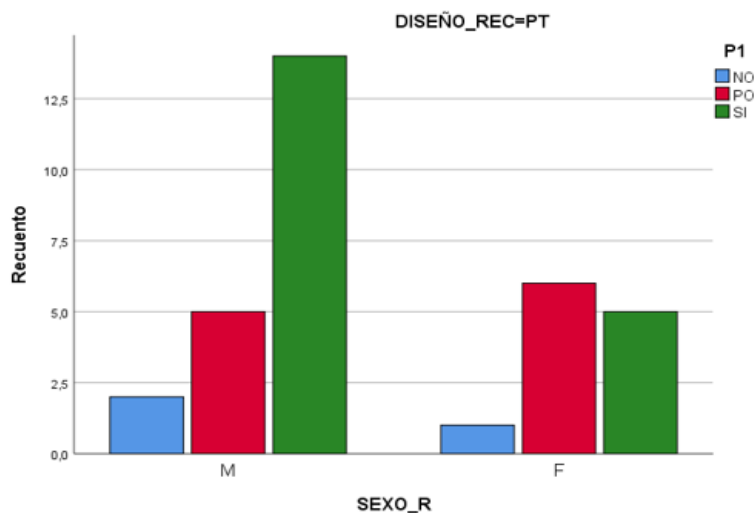


Figure 1: Bar graph with pre-test and post-test count. In original language Spanish

**3.2. Data Analysis**

**3.2.1. Summary of Valid Cases**

Total Cases: There are a total of 77 valid cases, indicating that all participants have answered the

corresponding questions with no lost data (0% data lost).

**3.2.2. Distribution by Design and Sex.**

Cross Table DISEÑO\_REC \* SEXO\_R:

*Table 2: Cross-table in SPSS answers Pretest and posttest*

Design	Sex	Counting
PRET	Men (M)	21
PRET	Women (F)	12
PRET	Total	33
POST	Men (M)	28
POST	Women (F)	16
POST	Total	44
Total by Sex	Men (M)	49
Total by Sex	Women (F)	28
Total by Sex	Total	77

Source: Own elaboration of the SPSS program

Interpretation: There is a higher male participation (49 men) compared to women (28 women).

In the PRT design, (pretest) men also have a higher representation than women (21 vs. 12).

In the POT design, (posttest), the difference remains, with 28 men and 16 women.

**3.3.3. Gender Distribution and Responses to P1**

Total Percentages: 7.8% (NO), 40.3% (PO), 51.9% (SI)

Interpretation: The majority of men (53.1%) answered "Yes" (YES) to P1, indicating a positive trend in the innovative TicyST methodology (design). Women also show a majority in the answer "Yes" (50.0%), although with a slightly lower representation than men.

Overall, 51.9% of all participants answered "Yes," suggesting favorable acceptance or recognition toward the adaptations or designs discussed in question P1.

**3.3.4. Conclusions**

1. a.-Gender Differences: The analysis shows a clear difference in participation between men and women, with a greater male representation in both design categories (PRT and POT). Although

both genders have a positive trend toward acceptance of climate change adaptations, men tend to show a greater inclination to answer "Yes."

2. b.- General acceptance: The general acceptance of climate change adaptations (51.9% "Yes") suggests that participants, as a whole, are open to design strategies that address climate change. This may be indicative of a growing environmental awareness among participants.

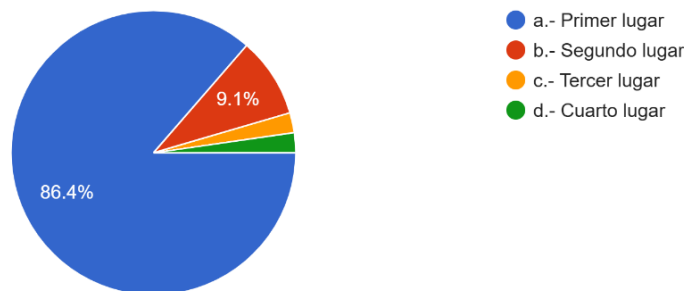
3. c.- Implications for Learning: These results highlight the importance of continuing to promote education on climate change and its adaptations, with a focus on engaging all genders equitably.

4. d.- Strategies could be considered to increase female participation in future studies, as well as to foster an environment that reinforces the acceptance of sustainable solutions.

This analysis provides a clear view of how design, sex, and response variables relate to each other, highlighting potential areas for educational and awareness-raising interventions.

**3.4. Question 3. About the preference of students to study the pp3 career**

3.- La carrera estaba en el rango de sus prioridades en:  
44 respuestas



Figure

Note: In original Spanish language



b.- Detailed Definitions: Many participants offer content-rich descriptions, with concrete examples of tools and applications. This not only shows that they are knowledgeable about technologies, but they also understand how they can be used in their education.

c.- Implications: The knowledge they have acquired allows them to better integrate technology into their learning and teaching. This can make your educational experience more interactive and effective, which is a huge advancement in your training.

Conclusions: Effect of the methodological intervention; The difference between the first measurement and the second measurement clearly highlights the importance of educational intervention. The group without intervention shows a notable lack of understanding, while the same group with the methodological intervention has developed knowledge that will be very useful in their studies and in their daily lives, especially because they must develop the skills of the 21st century, which are framed in the graduation profile. There is a need for Continuing Education; to implement training programmes that help them understand ICT and TAC. This learning will not only give them information, but it will also help them feel more confident when using technology. It is important to

highlight the responses in the group that received the methodological intervention, presents a greater knowledge about ICT and CAT, as observed in the group with intervention, can lead to a more effective use of technology in the classroom. Not only does this improve the way they learn, but it also fosters a more collaborative and interactive environment, which can enrich their overall educational experience. giving them an advantage in future challenges in other subjects as well as in the professional development of each of the students in the group.

**3.7. Instrument Results**

Instrument 1; Focus group interviews. The results were analyzed with the Atlas Ti 25 Program and enriched the results of the research by complementing the different educational areas with the most accurate appraisals of the classes.

**3.7.1. Results of the interviews conducted with the students**

The co-occurrence charts for the interviews are presented below along with an analysis of the results. Annex E

**3.7.2. Interview n° group 1, 2 and 3**

*Table 3: Co-occurrence results on question suggestions.*

Code	Frequency	Co-occurrences
I prefer traditional classes	5	Dictation, No practical activities
Self-esteem and self-confidence	7	Work well, Improve self-esteem
Strategies for learning	6	Learn about other strategies, Improve academic performance
Learning	5	Improved knowledge acquisition
Learnings	6	Reinforce learning

Source: Authors' elaboration in Atlas Ti 25.

Analysis: Students show a clear and minimal preference for traditional classes, suggesting a resistance to the use of ICT. Self-esteem and self-

confidence are important aspects in learning, indicating that the methods used may be influencing students' personal perception.

*Table 4: Co-occurrence results on the subject's significant learning question.*

Code	Frequency	Co-occurrences
Significant	12	Moderately, Deepening, Complementary activities, Not significant
Moderately significant	10	Deepening, Complementary Activities
Deeply significant	5	Complementary activities

Source: Own elaboration in Atlas Ti 25

Analysis: Most of the participants consider that they have achieved significant learning, although some see it as moderately significant.

Complementary activities are positively valued, suggesting that the practical approach improves comprehension.

*Table 5: Co-occurrence results on question self-grading of work done and learning*

Code	Frequency	Co-occurrences
Rating 7.0	19	
Note 6.0	7	
Note 5.0	3	

Source: Own elaboration in Atlas Ti 25

Analysis: The self-rating reveals that most students are satisfied with their performance, giving themselves high grades (7.0). This could

indicate a positive perception of the methodology used in teaching.

Table 6: Results of Co-occurrence on question suggestions for subject.

Code	Frequency	Co-occurrences
Suggestion	12	More texts, Climate change, Practical classes
Greater order	2	Evaluations, Rubrics
More texts	5	Complement the subject

Source: Own elaboration in Atlas Ti 25

**Analysis:** The suggestions point to a need to improve the organization and content of the classes with printed documents and not just a platform since not everyone entered the platform to look for information. A small group of students want a more local focus circumscribed to the Coquimbo region, on relevant issues, such as climate change, suggesting a desire to connect with the local and regional reality.

**General Conclusion:** The co-occurrences in the interviews reflect a combination of preferences for traditional methods and the search for meaningful learning. Students value self-esteem and self-confidence, as well as the need for more relevant strategies and content in their education. Student suggestions indicate specific areas for improvement that could benefit both teaching and learning, particularly for a more regionalist approach.

According to what was analyzed in the interviews, it was determined that, although the innovative TicyST methodology was novel and contributed great significance to the work carried out, one of its opinions considered *a finding was the suggestion not to leave the traditional classes with dictation and without activities, especially students who prefer the discipline of History more than Geography.* The same group did not want guidelines or digital guides but printed on paper; this small group of students were the ones who registered the least amount of income to the Moodle platform and low motivation for digital E-activities.

It should be noted that in the conversation in the focus group, the vast majority (98%) of the students expressed a high level of satisfaction when they visited the two schools in the Elqui Valley, in which they presented the classroom work as a group to a group of 22 elementary and middle school courses; a situation that filled them with fulfillment. In the interviews, a large number of students contributed in their answers that they felt good about the methodology used that allowed them to learn. With the exception of students with a preference for traditional classes and a displeasure in habitually entering the Moodle platform; The rest of the course he expressed a pleasure in learning and maintaining

the work with the platform and using different types of open source programs to continue learning and consolidating the knowledge of the classes. They stated that they had learned thanks to the use of ICTs.

5.2.2.-Instrument 2. Statistical performance document. It is one of the instruments created by the university in order to summarize and archive the results of the subject. For the case study it is called; Statistical compliance report on Special Problems and Climate Change. It condenses statistical results that are interpreted in this study. See Appendix D for more details.

### 3.8. Analysis instrument 2 of Statistical Performance Report.

The report is from the second semester of 2024 on the subject "Space Problems and Climate Change" of the University of La Serena offers a clear vision of student performance. This analysis focuses on understanding both the numbers and the learning experiences, in quantitative terms, which helped to get a more complete picture of the course. Summary Annex F.

### 3.9. Quantitative Data

**a.- Registration and Participation: Initially, there were 50 students enrolled, and by the end of the semester, 49 completed the course.** This indicates good retention, as only one student did not continue.

**b.- Of the 49, 47 took the course at their first opportunity,** which shows a high level of interest and commitment to the content.

**c.- Academic Performance:** c.1.- **Only one student took the exam, and fortunately, passed.** This can be a food for thought, as it suggests that assessment methods might not be aligned with student expectations. c.2.- **The pass rate is 98% of students passing at the end of the semester.** This suggests that most of them were able to understand and apply what they learned.

**d.- Grades:** d.1.- **The average grade was 5.7, with a standard deviation of 0.6,** which means that the grades were quite consistent and that the students performed similarly.

Table 7: Grade Distribution

Rating	Percentage
BAD	0%
DEFICIENT	0%
LESS THAN ENOUGH	2%

ENOUGH	12%
MORE THAN ENOUGH	58%
GOOD	28%

Source: Own elaboration 2025 based on the Statistical Performance report of the subject.

This shows that most of the students performed well, although a small group struggled.

**Usefulness of Statisticians.** Regarding the usefulness of statistics as indicators: these statistics are fundamental to evaluate student performance and the effectiveness of the innovative university methodology based on learning and ICT variables allow us to consider;

a.- Pass and Fail Rate: A high percentage of approval (98%) suggests that the methodology applied is effective and that most students are achieving the learning objectives.

b.- Average Grade and Standard Deviation: The average grade of 5.7 and a low standard deviation (0.6) indicate that most students obtained similar grades, suggesting a consistency in academic performance.

c.- Distribution of Grades: The distribution of grades shows that most students obtained grades of 5 and 6, which reinforces the idea of good overall performance. The absence of very low grades (1 and 2) is also a positive indicator.

d.- Number of Opportunities to Complete the Course: Most students completed the course at their first opportunity, suggesting that the methodology is accessible and understandable to students.

In summary, the statistics presented allow us to detect a good performance in academic performance and suggest that the innovative university methodology based on learning variables and ICT is effective. This data is essential for making continuous adjustments and improvements in educational methodology.

**3.10. Descriptive analysis of the instrument.**

a.- Learning Efficiency: The high pass rate and participation from the beginning reflect a positive learning environment. This could be due to the quality of the course content or the way it was taught.

b.- Perception of the exams: The low number of students who took the exam (only one) is something that deserves attention. This could suggest that students are not comfortable with this type of assessment or that they prefer more continuous, less stressful assessment styles.

c.- Grade Results: Although the majority performed outstandingly, 14% of students who stayed at "sufficient" or "less than sufficient" indicate that there is a small group that could benefit from additional support.

Conclusions of the instrument; the course "Space Problems and Climate Change" presents a positive outlook, with several strengths:

**Table 8: Summary of Success and Challenges by Statistical Report**

Appearance	Description
Successes	High pass rate and good grade point average (grades), reflect good learning.
Challenges	Maintain a good level of learning to prevent students from having to take exams; a situation that in the academic field is a reflection that the expected learning was achieved.

Source: Authors' elaboration based on quantitative results.

**3.11. Recommendations**

1. Review Evaluation Methods: It would be useful to consider alternative evaluation formats that reduce stress and encourage more active participation, especially since the activities have deadlines that are set in stone.
2. Offer Academic Support: Implement tutoring programs or reinforcement sessions to help those students who are on the verge of passing.
3. Use of Technologies: Evaluate how technological tools can improve interaction and learning, as well as facilitate preparation for the delivery of practical work and avoid taking the final exam.

In summary, this analysis provides a clear view of course performance, highlighting achievements and areas where there is room for improvement. With these insights, we can continue to move towards a

more enriching educational experience for all students and guidance for future teachers who teach the subject.

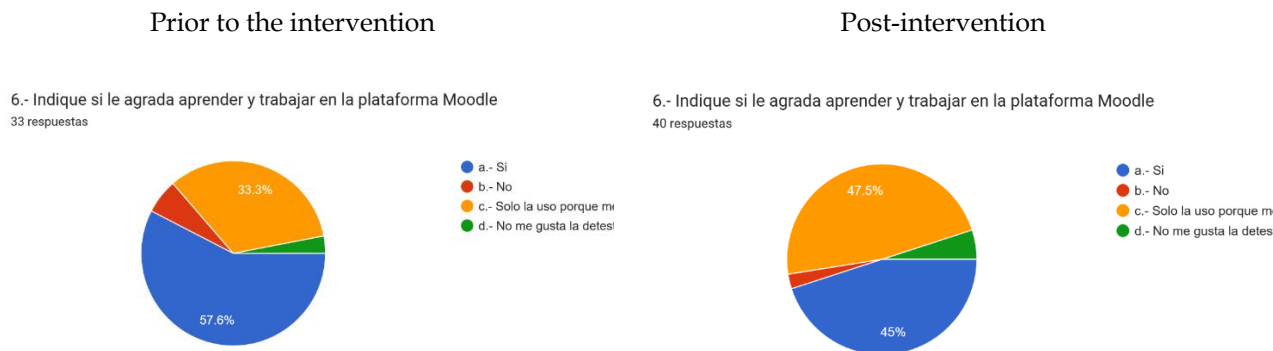
It is crucial that this methodology continues to be evaluated and adjusted to maximize the potential of students and promote meaningful and lasting learning that incorporates contact with educational practice in addition to ICT. In addition, it is important to continue researching the reasons behind success in 2024 in order to replicate and adapt these strategies in future courses. Above all, thinking about projecting the future teaching performance of these students who will face the challenges of the 21st century.

3.- Instrument 3. Tic-Tac Form. The instrument is named to measure knowledge of Information and Communication Technologies and how they are transformed into learning and communication

technologies. The results were analyzed using SPSS and Excel as a user, which allowed us to determine the profile of the sample and provide data of interest that deepened the relationship and prominence of the variables in the aspects consulted. Questions 1,2,3,4,5

allowed the sample profile to be defined, presenting the results in the diagnostic section.

The results of question 6 onwards are presented below.



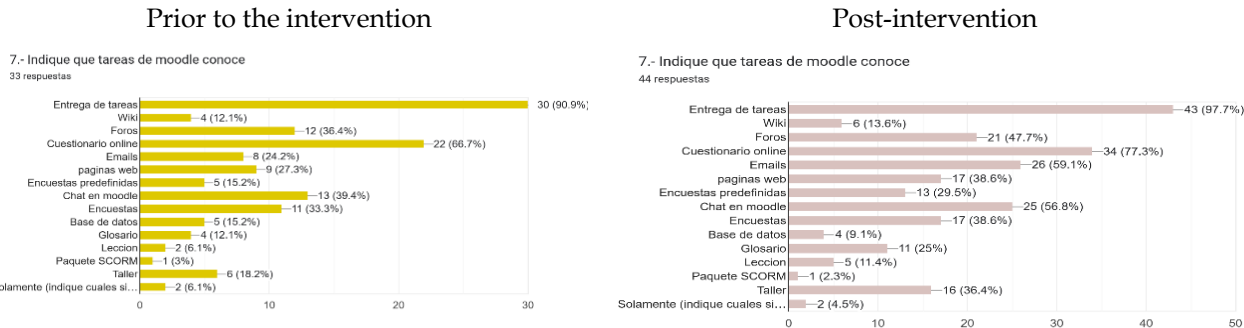
**Figure 2: Result p 6: Do you like learning and working on the Moodle platform?**  
 Source: Tic-Tac 2024 form application. In original language Spanish

Analysis; In the post-intervention the perception of pleasure of working on the Moodle platform decreases slightly, the option c increases only because I am asked to.

Explanation: during the second semester, students feel the lack of time and that the Moodle platform takes away their time, this due to another

strike that occurred as a result of a situation explained above.

It is noteworthy to note that the profile of the student of Pedagogy in History and Geography is oriented to traditional readings and classes, which is reflected in 12% of students who express a preference for this type of classes without the use of ICT



**Figure 3 : Result p 6 Known tasks of the Moodle platform.**  
 Source: Tic-Tac 2024 form application. In original language Spanish

**3.12. Comparative Analysis**

**3.12.1. About the use of Tools**

Hands-off: Many users mentioned that they use "Assignment Delivery," which shows that it's a very important tool for them.

"Online Quizzes" and "Forums" are also highlighted, suggesting that they like to assess their learning and participate in discussions.

There are a good variety of tools they use, such as "Moodle Chat," "Wiki," and "Polls," indicating that they are exploring different ways to interact and learn.

With Intervention: Like the previous group, they also mention "Assignment Delivery" and "Online Questionnaires" a lot. However, here you notice that they use fewer tools, which could mean that they are more focused on specific tasks, or that they do not have as much freedom to choose how to learn.

**3.12.2. Variety of functions**

No Intervention: This group uses a wide range of features, which could make their learning experience based on tools such as "Database" and "Glossary" are also mentioned, suggesting that they are open to exploring further.

With Intervention: Here, the functions they use are more limited. This can be useful if you're looking for a more direct approach, but it could also make the learning experience less dynamic.

3. Focus on Tasks: Users who do not have intervention seem to have more freedom to choose how and which tools to use, which could encourage more collaborative and creative learning. On the other hand, users with intervention may be more directed to fulfill specific tasks, which could be

effective for certain objectives, this is specified in the orientation of the methodology focused on the orientation to the final project.

In summary, the way users interact with Moodle varies depending on whether they have intervention or not, which can influence their experience and learning, but you cannot focus all your learning on working exclusively with this platform.



Figure 4: Result Q 8 Do you know how to store data in your email or workspace?

Source: Tic-Tac 2024 form application. In original language Spanish

On the analysis of these questions, it is determined that with the intervention the number of students who realized that they did not manage the institutional workspace well increased by 2%.

The number of students who learned to use it with their potentialities increased by 2%, teamwork was essential to correct doubts about the management of this virtual environment.

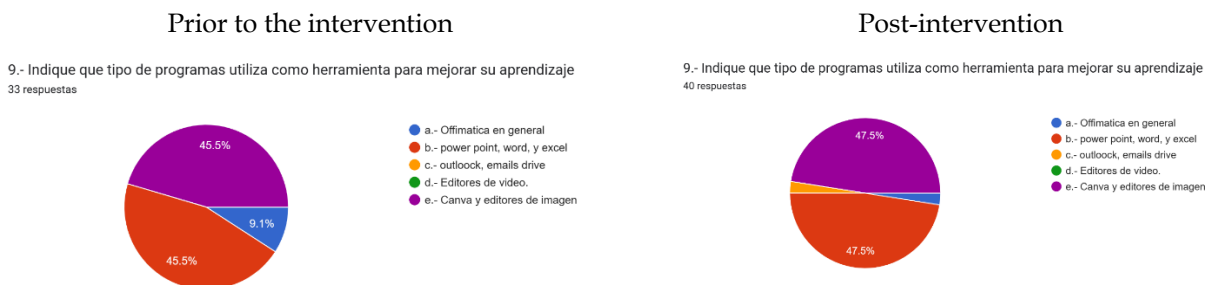


Figure 5: Result p 9 Programs used to improve learning.

Source: Tic-Tac 2024 form application

#### 4. INTERPRETATION AND CONCLUSION

The comparison between the two groups reveals that the same intervention group, despite its more limited use of tools, has experienced significant benefits in its learning and in the use of information and communication technologies (ICT).

A focus has been achieved on essential tools for the profile of pedagogy student. The intervention group focused on key tools such as PowerPoint, Word and Excel. This focus on well-established applications provides them with practical skills that are highly valued in academic and professional settings. Learning to use these tools effectively can

facilitate their performance in future tasks, both in education and in the future workplace.

The intervention has allowed for a more defined structure in learning. By directing students to specific tools, they have been helped to deepen their knowledge and competence in these applications, which can be more difficult to achieve in a more dispersed environment.

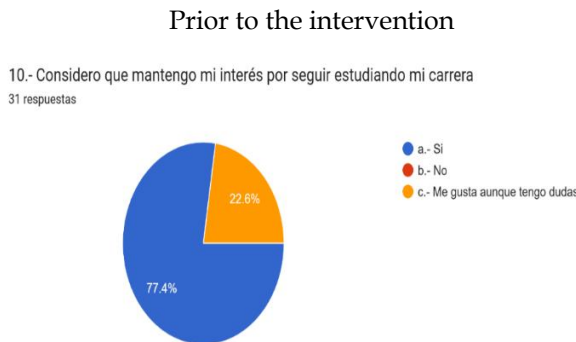
On the benefits in their productivity; By focusing on a limited set of tools, students can develop greater dexterity and efficiency. This not only improves their ability to complete tasks, but also prepares them to use these tools in future contexts, increasing their productivity and effectiveness

considering that they will be teachers of students in the educational system.

Integration of ICT in Learning: the intervention has ensured that students use ICT in a more intentional and focused way. This can result in a better understanding of how to integrate technology into your learning process, fostering digital skills that are essential in today's age.

In summary, the intervention group has benefited in terms of learning by receiving clear

direction towards practical and useful tools. Although their use of ICT may seem more limited in variety, this concentration has allowed them to gain valuable skills and develop a more structured approach to their educational process. In the long term, these competencies are crucial for their academic and professional success, highlighting the importance of intervention in effective learning and in the use of technologies in accordance with pedagogical standards.

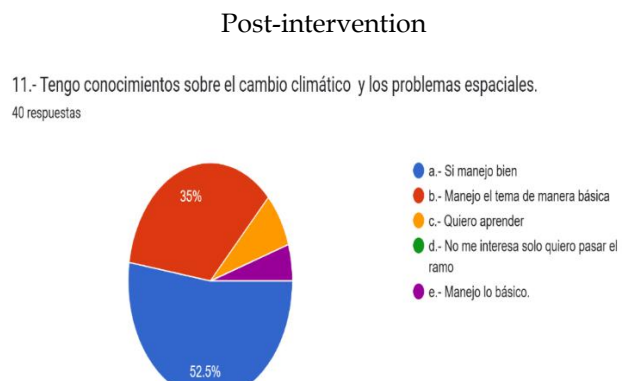
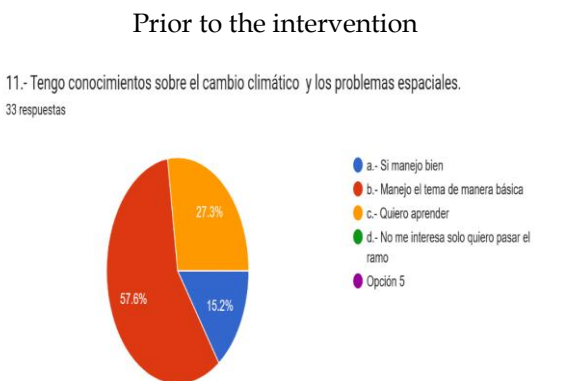


**Figure 6: Result p 10 Consider that I maintain my interest in studying.**

*Source: Tic-Tac 2024 form application. In original language Spanish*

It is interesting to note that in this question the intervention did not have a significant impact or be decisive. When reviewing the result, the student whose answer was negative was identified. In the interview, it was discovered that his interest lay in

studying a career in administration and not pedagogy. This decision is multifactorial and the intervention methodology had no connection with this student's response.



**Figure 7: Result p 11I have knowledge about Climate Change**

*Source: Tic-Tac 2024 form application. In original language Spanish*

Interpretation of the Results: Non-intervention group, demonstrated a.- Interest in Learning: a significant part of the participants express their desire to learn more about climate change and space problems, indicating an active interest in deepening their knowledge. This is reflected in multiple responses that mention "I want to learn."

Basic Knowledge: Many also state that they handle the subject in a basic way. This suggests that although they have some initial knowledge, they

recognize that there is still a long way to go to fully understand the topic. They stated b.-Variable Confidence: There are some responses that affirm that some participants handle the issue well. However, these responses are less frequent compared to those that indicate basic handling or a desire to learn, suggesting that most feel less confident about their current knowledge.

Group With Intervention is summarized as follows:

a.- Greater Confidence in Knowledge: In the intervention group, there is a remarkable number of responses that indicate that the participants handle the topic well. This may reflect more structured teaching or greater exposure to educational resources on climate change and space issues.

b.- Interest in Learning: Like the non-intervention group, some participants express their desire to learn more. However, the number of affirmative responses indicating an adequate handling of the topic is considerably higher, suggesting a higher level of confidence in their knowledge.

c.- Balance between Knowledge and Desire to Learn: although many in this group claim that they handle the subject well, there is also a recognition that there is more to learn. This suggests a positive

balance between confidence in their knowledge and the motivation to keep learning.

Conclusions: Differences were recorded in Trust and Knowledge; The main difference between the two groups lies in confidence and level of knowledge. The intervention group shows greater confidence in their understanding of climate change and spatial problems, while the non-intervention group tends to have a more basic handling and a more evident desire to learn.

*Impact of the Intervention on Learning: The intervention appears to have provided an environment that fosters effective learning, resulting in improved mastery of the subject. This suggests that educational structure and support can be key to increasing confidence and competence on complex issues such as climate change.*

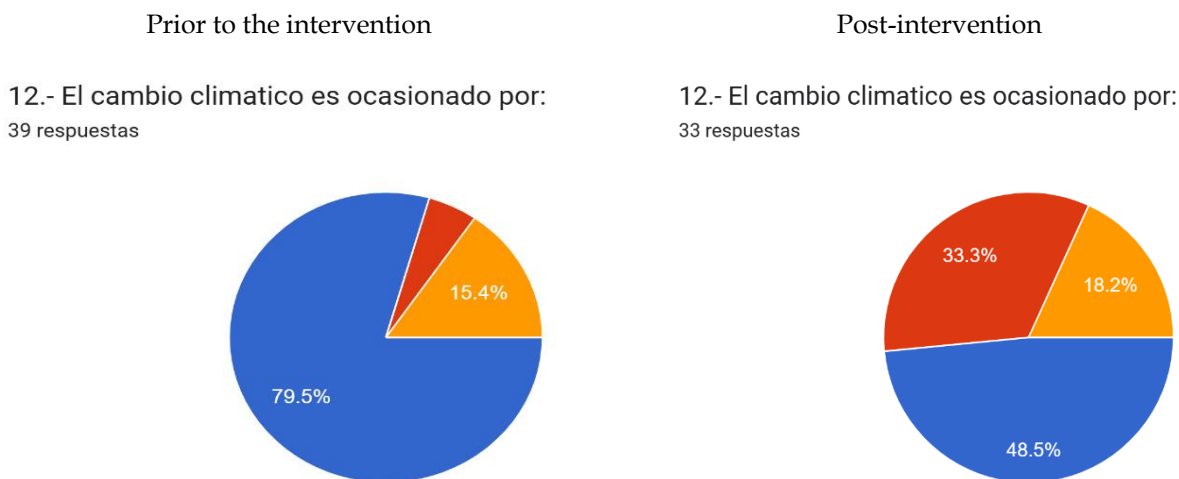


Figure 8: Result p 12 Climate change is caused by Source: Tic-Tac 2024 form application. In original language Spanish

4.1. Comparative Learning Analysis

Knowledge about the Causes of Climate Change: Non-Intervention Group: as can be seen in the graph, there is a predominance of the Anthropic Effect: Most of the participants identify the anthropic effect as the main cause of climate change, which demonstrates a good level of awareness about the human impact on the environment. There are also responses that mention the natural effect and the perception that climate change is a natural cycle. This suggests a broader understanding, albeit with some confusion in the

interrelationship between natural and human causes.

With Intervention: a.- Consistent Knowledge of the Anthropic Effect: This group also shows a strong recognition of the anthropic effect, with a majority of responses supporting it. However, the degree of confidence in their knowledge seems to be higher, as few participants mention alternative perspectives. b.- They deliver a lower Diversity of Responses: The answers are more homogeneous, indicating that the intervention could have provided a clearer and more unified understanding of the topic.

Non-Intervention Group: a.- They manifest a strong desire to Learn; Many participants express an interest in learning more about the topic, indicating an active motivation to deepen their knowledge. However, this also suggests that they feel that their current understanding is limited. b.- Variable Trust: Although some handle the subject well, most feel at a basic level, which may reflect the lack of structured educational resources.

On self-confidence and desire to learn the group with Intervention: This group shows a good level of confidence in their knowledge, with many affirmative answers about their understanding of the topic. However, there are also participants who want to continue learning, which indicates an openness to continuous knowledge.

*Less Need to Learn Basically: The intervention appears to have strengthened their self-confidence, reducing the number of participants who feel only at a basic level of knowledge.*

**4.2. Impact of the Intervention on Learning**

Non-intervention group: spontaneous learning; Their knowledge of climate change seems to be the result of personal or informal initiatives, which can

lead to a fragmented understanding. Need for Educational Resources: The variability in their responses suggests that they would benefit from a more structured educational approach to consolidate their knowledge.

Group with Intervention: The Directed Learning and Structured Intervention has provided a framework that helps them acquire knowledge more effectively. This translates into a better command of the topic and greater confidence in your answers.

Knowledge Consolidation: By having access to more guided teaching, students can better understand the complexity of climate change and its causes.

Conclusions: Differences in self-confidence and Understanding: The intervention group shows greater confidence and a clearer understanding of climate change, while the non-intervention group has a more basic and dispersed knowledge.

*Benefits of the Intervention: The educational structure seems to have been key to improving the understanding of the topic in the intervention group, suggesting that a more formal and targeted approach may be beneficial for learning.*



**Figure 9: Result p 13 Variables associated with climate change**  
 Source: Tic-Tac 2024 form application. In original language Spanish

Data Interpretation. From the Group without Intervention; The predominance of the "All Previous Alternatives" Response, d: The majority of participants in the non-intervention group consistently select the option "all of the above alternatives". This indicates that they have a general understanding that the variables associated with climate change are multiple and cover various dimensions, which is a positive understanding.

Recognition of Diversity of Variables: The fact that many participants opt for this answer suggests that they are aware of the complexity of climate change and that the variables involved are not limited to a single aspect (economic, environmental, social, etc.). This reflects a holistic vision that is crucial to address the phenomenon of

climate change effectively in the subject. Lower frequency of Specific Responses is recorded; Although some participants mention more specific answers such as "environmental and social" or "economic", these are less frequent. This could indicate that, although there is recognition of these variables, the lack of intervention has limited their ability to deepen the specific knowledge about each category. A need for Clarification and Education is detected; The high proportion of responses choosing "all of the above alternatives" may also suggest that participants are unsure how to classify variables associated with climate change. This indicates a need for educational resources that help clarify and specify knowledge about the different dimensions of climate change.

Comparison with Intervention: a.- Consistency in Responses: The intervention group also shows strong support for the option "all of the above alternatives", but the number of specific responses (such as "economic" or "environmental and social") is higher compared to the group without intervention. This suggests that the intervention has helped participants to better identify and classify variables.

b.- Greater Depth of Knowledge; The intervention appears to have provided a framework that allows students to not only recognize the diversity of variables, but also to understand how these dimensions interact. This can result in a deeper and more nuanced understanding of climate change.

c.- Self-confidence and Clarity; Participants in the intervention group show greater self-confidence in

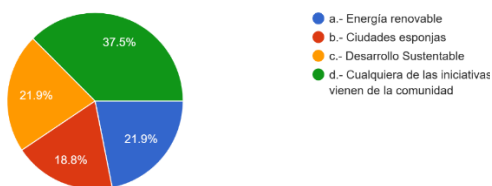
their knowledge and ability to discuss the variables associated with climate change, which is indicative of the positive effect of the educational intervention.

Conclusion: The non-intervention group shows a general recognition of the complexity of the variables associated with climate change, but its capacity to specify and classify these variables is limited. This highlights the importance of providing educational resources that strengthen their understanding. **In contrast, the intervention group demonstrates clearer and more structured knowledge, indicating that the methodological and educational intervention is effective in improving the understanding of complex issues such as climate change, the learning variable stands out in the responses.**

Prior to the intervention

Post-intervention

14.- Conoce entre las adaptaciones al cambio climático lo siguiente  
32 respuestas



14.- Conoce entre las adaptaciones al cambio climático lo siguiente  
40 respuestas

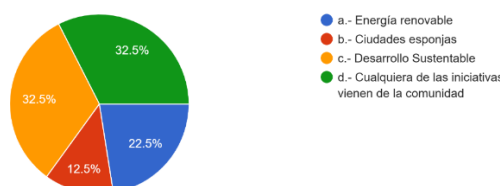


Figure 10: Result p 14. Learn about adaptations to climate change  
Source: Tic-Tac 2024 form application. In original language Spanish

Interpretation of the Data: In the same group without intervention there is a predominance of recognized options: Most of the participants mention "renewable energy" as an adaptation to climate change, which indicates a good level of awareness about sustainable solutions possibly knowledge from previous courses. Responses related to "sustainable development" and "sponge cities" are also highlighted, although to a lesser extent. This suggests that although they have basic knowledge, their understanding may be limited in terms of the variety of adaptations. This group has a lower Diversity of Responses:

The option "any of the initiatives that come from the community" is frequently chosen, indicating that participants recognize the importance of local initiatives, but may reflect a lack of familiarity with more specific or technical adaptations. The repetition of certain responses suggests that participants may not be exposed to a wider range of adaptations to climate change, underscoring the need for additional education in this area.

Intervention Group, regarding self-confidence and variety of responses: This group also shows strong recognition of "renewable energy" and "sustainable development," but with a more balanced variety among responses. This suggests that they have gained a broader understanding of climate change adaptations.

The inclusion of "sponge cities" and "community initiatives" also appears, indicating that they have been exposed to multiple approaches to addressing climate change. They stand out for a.- greater consistency in the answers; The responses are more consistent and varied, suggesting that the intervention has been effective in teaching them not just about one type of adaptation, but about multiple strategies and their importance. b.- Strengthening of Knowledge; The intervention appears to have provided an educational framework that allows them to better understand the different adaptations and how they can be implemented in their communities.

## 5. CHAPTER 5 DISCUSSION AND CONCLUSIONS

The findings of this study confirm that ICT-mediated interventions significantly enhance meaningful learning and digital competence in higher education. Students exposed to the TicyST methodology demonstrated improved understanding of key concepts, greater confidence in their digital skills, and higher engagement with the learning process.

These results are consistent with previous research highlighting the positive impact of ICT integration on academic performance and student motivation (Arriagada et al., 2020; Awoyemi et al., 2020; Ardelean et al., 2023). The findings reinforce the role of ICT as a key component in contemporary education, particularly in teacher training contexts, where digital competencies are essential for future professional practice.

However, unlike many studies that focus primarily on the use of digital tools, this research

incorporates a practical dimension through field-based learning. This integration of ICT with real-world application represents a significant contribution, as it strengthens the connection between theory and practice and promotes deeper, more meaningful learning experiences.

An important finding is that, although the majority of students positively valued the methodology, a small group showed preference for traditional teaching approaches. This suggests that educational strategies should consider diverse learning profiles, maintaining a balance between innovative and traditional methods.

Overall, the results demonstrate that the combined use of ICT and experiential learning strategies not only improves academic outcomes but also reinforces students' motivation and professional identity. This supports the need for continuous innovation in pedagogical practices to address the challenges of 21st-century education.

## BIBLIOGRAPHY

- UNESCO International Institute for Educational Planning. (March 22, 2023). <https://learningportal.iiep.unesco.org/es>. Retrieved from <https://learningportal.iiep.unesco.org/es/fichas-praticas/mejorar-el-aprendizaje/tecnologias-de-la-informacion-y-la-comunicacion-tics-en-la>
- Montiel, H., & Gomez-Zermeño, M. (2022). Rock the Boat Shaken by the COVID-19 Crisis; A Review on Teachers, Competencies in ICT. *Frontier in Education*, 1-11.
- Salica, A. (2021). Analytics of Meaningful D-Learning Applied in the Teaching of Physics in Secondary Education. *RIED. Ibero-American Journal of Distance Education*. v. 24, n. 2, February; p. 265-284.
- Solans-Domenech1, M., MV Pons, J., Adam, P., Grau, J., & Aymerich, M. (2019). Development and validation of a questionnaire to measure research impact. *Research Evaluation*, 28(3), 253-262.
- Taherdoost, H. (2016). Validity and Reliability of the Research Instrument; how to test the validation of a Questionnaire/survey in a research. *International Journal of Academic Research in Management*, 28-36.
- University of La Serena. (2020). *Strategic Development Plan 2020 - 2023*. La Serena: Universidad de La Serena (Editorial).
- Wati D, D., Dewi, R., Lasmana, O., Lufri, O., & Asriz, L. (2024). Application and impact of constructivism on learning: a tertiary study. . *Al Qalam: Jurnal Ilmiah Keagamaan dan Kemasyarakatan*. <https://doi.org/10.35931/aq.v18i5.3585>, 1.
- Acevedo Mena, K., & Amador Jiménez, D. (2021). Stress, coping strategies and academic experience in university students in times of the covid-19 pandemic. The experience of Nicaragua and Chile. *Torreón University Magazine*, 1-14.
- Alfredo Guzmán, Lira Valencia, Carlos Puerta Gil. (2022). *New realities of economic and administrative Social Sciences*. Asturias: Asturias Corporation.
- Ampuero Villareal, G., & Cortés Huerta, H. (2012). *Regional History*. Santiago: Grijalbo.
- Ardelean, A., Toma, F., & Gradinaru, C. (2023). Effects of ICT Integration in Teaching Using Learning Activities. *Sustainability*, 1-2.
- Arenas, S., Guerra, M., & Valenzuela, F. (2020). Colossi of the Green North. *Editorial del Norte*, 123.
- Arriagada, W., Bautista Gonzales, J., & Montenegro Camacho, L. (2020). ICTs and their support in university education in times of pandemic; a facto-theoretical foundation. *REvista Conrado* 17(78), 201-206.
- Udes International Association. (May 08, 2023). <https://www.iau-aiu.net/technology>. Retrieved from <https://www.iau-aiu.net/technology>
- Aucejo, E., Frances, J., Ugalde, M. P., & Zafar, B. (2020). The impact of COVID-19 on students' experiences and

- expectations is evidence from a survey. *Journal Public Economics*, 1-15.
- Aucejo, E., French, J., Ugalde, M., & Zafat, B. (2020). The impact of COVID-19 on student experiences and expectations: Evidence from a survey. *Journal of public Economics*, 19, 2-15.
- Ausubel, D. (1963). *The psychology of Meaningful Verbal Learning*. New York: Grune-Stratton.
- Ausubel, D. (1968). *Educational Psychology: A Cognitive View*. New York: Holt, Rinehart & Winston.
- Awoyemi, R., & Awoyemi, R. (2020). Awoyemi, R., & Awoyemi, R. (2020). Perspectives and implementation of ICT in teacher training. *IGI Global Scientific publication*, 321-333. <https://doi.org/10.4018/978-1-7998-1461-0.ch018>.
- Awoyemi, R., Keengwe, I., & Onchwari (Eds.), O. (2020). Perspectives and Implementation of ICT in Teacher Education. In R. A. Awoyemi, *Handbook of Research on Literacy and Digital Technology Integration in Teacher Education IGI Global Sci* (pp. 321-333). S/I: IGI Global Scientific Publishing. <https://doi.org/10.4018/978-1-7998-1461-0.ch018>.
- Ayarza Malqui, J. (July 07, 2021). <http://repositorio.untumbes.edu.pe>. Retrieved from <http://repositorio.untumbes.edu.pe>: <http://repositorio.untumbes.edu.pe/bitstream/handle/20.500.12874/1389/JORGE%20EUSEBIO%20AYARZA%20MALQUI.pdf?sequence=1&isAllowed=y>
- Balladares-Burgos, J., & Valverde-Berrocoso, J. (2022). Caribbean Journal of Educational Research, 2022, 6(1), 63-72 <https://doi.org/10.32541/recie.2022.v6i1.pp63-72> THE TPACK TECHNOPEDEAGOGICAL MODEL AND ITS IMPACT ON TEACHER TRAINING: A REVIEW OF THE LITERATURE. *Caribbean Journal of Educational Research* 6, 63-72.
- Banoy Suárez, W. (2019). The pedagogical use of information and communication technologies ICTs and their influence on the significant learning of technical students in Zipaquirá, Colombia. *Academia and virtuality magazine*. Vol 12 (2), 23-46.
- Bermúdez Mendieta, J. (2021). Problem-Based Learning to Improve Critical Thinking: A Systematic Review. *INNOVA Research Journal*, ISSN 2477-9024, 77-89.
- Blancafort, C., Gonzalez, J., & Sisti, O. (2019, May 25). *Menaningful learning in the digital Technological age*. Retrieved from <https://www.researchgate.net>: [https://www.researchgate.net/profile/Pablo-Rivera-Vargas-2/publication/333093162\\_EL\\_APRENDIZAJE\\_SIGNIFICATIVO\\_EN\\_LA\\_ERA\\_DE\\_LAS\\_TECNOLOGIAS\\_DIGITALES/links/5cdb3680a6fdccc9ddae3bb6/EL-APRENDIZAJE-SIGNIFICATIVO-EN-LA-ERA-DE-LAS-TECNOLOGIAS-DIGITALES.pdf](https://www.researchgate.net/profile/Pablo-Rivera-Vargas-2/publication/333093162_EL_APRENDIZAJE_SIGNIFICATIVO_EN_LA_ERA_DE_LAS_TECNOLOGIAS_DIGITALES/links/5cdb3680a6fdccc9ddae3bb6/EL-APRENDIZAJE-SIGNIFICATIVO-EN-LA-ERA-DE-LAS-TECNOLOGIAS-DIGITALES.pdf)
- Brau, B. (2020). Constructivism. *United Nations peace operations and International Relations theory*. <https://doi.org/10.4135/9781483375519.n148>, 1.
- BTM, W., KC, L., & MJ, L. (2024). Blender learning in education ICBL. *An Analysis of learning Analytic Approaches for course evaluation* (pp. 229-237). Singapore: Springer.
- Cajamarca-Correa, M., & Cangas-Cadena, A. (2024). New trends in the use of resources and tools of Educational Technology for University Education. *Journal of Economic and Social Science*, 127-150.
- Campuseducation. (December 15, 2024). <https://www.campuseducacion.com>. Retrieved from <https://www.campuseducacion.com>: <https://www.campuseducacion.com/blog/revista-digital-docente/aprendizaje-significativo-constructivismo/?srsltid=AfmBOoMK68oaBGLVnhlvfkRnQRDo-zRgTRF7SHt5nXiqp0qhmFjm7Qc>
- Canales, R. (2021). Education as a right; Chile in times of pandemic. *Linhas Florianópolis Magazine*, 106-121.
- Cantú Martínez, P., & Santoyo Stephano, M. (2019). Evaluation of the academic performance in Biostatistics and the disciplinary competence of mathematical thinking in university students. *Educación vol.28 no.54 Lima Mar*, 45-60.
- Training, A. T. (Producer), Lima, D. R. (Writer), & Lima, D. R. (Director). (2021). *How to do the pleasing of the problem in a successful thesis [Film]*. Retrieved January 05, 2023, from [https://www.youtube.com/watch?v=\\_bnAIA\\_kRqE&list=RDLV34Tvo86kZ78&index=2](https://www.youtube.com/watch?v=_bnAIA_kRqE&list=RDLV34Tvo86kZ78&index=2)
- Carretero, M. (2021). *Constructivism and Education*. Zaragoza: Tilde editora.
- Carrión Candel, E., Agustín Elen, M., & De Ory, E. (2021). ICT and gamification experiences with CLIL methodology as innovative resources for the development of competencies in compulsory secondary education.2021. *Digital Education Review*. <https://doi.org/10.1344/der>, 238-256.
- Castro Gil, R., & Correa, D. (2021). Previous literature reviews on blended learning in higher education. *Education and information Technologies Vol 26*, 3399-3426.

- Cazanueva Aldo. (June 20, 2022). *www.museoprecolombino.cl*. Retrieved from [www.museoprecolombino.cl/page/museo%67](http://www.museoprecolombino.cl/page/museo%67)
- Cerda, H. (2008). The elements of the investigation; how to recognize them, design them, build them 3 Edition. In C. Humberto, *The Elements of Research; How to Recognize, Design and Construct Them* (pp. 10-60). Bogotá : El Búho.
- Cerda, H. (2008). *The Elements of Research; How to Recognize, Design, and Construct Them (3 ed.)*. Bogotá: El Buho.
- Cerna, F. (2019). Well-managed resources. *Financiero*, 23-45.
- Ceron , A. (2025). The family and AI. *Elqui al día*, 14.
- Cervantes-Vergara, M. (2023). Implementation of a training plan for the use of ICT within the teaching-learning process for teachers of the U.E. *YUYAY: Estrategias metodologías, amp: Didácticas educativas.*, 73-87.
- Chen, W., Pi, Z., Tan, J., & Lyu, Q. (2022). Preparing pre-service teachers for instructional innovation with ICT via co-design practice. *Australasian Journal of Educational Technology*. <https://doi.org/10.14742/ajet.7743>., 133-145.
- Cigognini, M., & Di Stasio, M. (2021). Formative Assessment. From pandemic practices to sustainable perspective through active learning approaches. *Open Journal per la formazione in rete*, 91-110.
- Cochachín, C. (June 25, 2024). <https://clientify.com>. Retrieved from <https://clientify.com/blog/marketing/recoleccion-de-datos-metodos-tecnicas-e-instrumentos>
- Codina, L. (2020). Systematized reviews in human and social sciences.2 Search and evaluation. *Medoto Yearbook of Research in Social Communication*, 61-77.
- Codina, L. (2020). How to do traditional or systematic bibliographic reviews using academic databases. *ENT Magazine. Salamanca*, 139-153.
- Codina, L. (October 19, 2020). <https://repositori.upf.edu>. Retrieved from <https://repositori.upf.edu/handle/10230/45509>
- Codina, L. (2021, May 13). <https://repositori.upf.edu>. Retrieved from [https://repositori.upf.edu/bitstream/handle/10230/47100/Codina\\_SEO\\_Contenidos21.pdf?sequence=1&isAllowed=y](https://repositori.upf.edu/bitstream/handle/10230/47100/Codina_SEO_Contenidos21.pdf?sequence=1&isAllowed=y)
- Codina, L. (March 30, 2023). <https://repositori.upf.edu/handle/10230/34497>. Retrieved from <https://repositori.upf.edu/handle/10230/34497>: <https://repositori.upf.edu/handle/10230/34497>
- Coman , C., Tiru, G., & Bularca, M. (2020). Online teaching and learning in higher education during the coronavirus pandemic: the students' perspective. *Swiss Sustainability Magazine* , 75-85.
- Contreras, L., Fuentes, H., & Rodríguez, J. (2020). Prediction of academic performance as an indicator of . *Form. Univ. vol.13 no.5 La Serena oct.*, 233-246.
- Contreras, R. (2021). *Accounting for administrators*. LS: Compas y Cia.
- Cordero, E. (May 30, 2024). *www.fundacionarrebol.cl*. Retrieved from [www.fundacionarrebol.cl](http://www.fundacionarrebol.cl)
- Cossío Ponce de León M, , M., & Quiñones Domínguez O, Coss, O. (2021 ). Pedagogical continuity in higher education in times of pandemic. . *Revista Publiando 2022*, 67-73.
- Creswell, J. (2019). Design of qualitative and quantitative research and mixed-methods approaches (4th edition). *Canadian Centre for Science and Education. Vol 12 N° 5*, 40-41.
- Cruz, M., Pozo Vinueza, M., Aushay Yupangui, H., & Arias Parra, A. (2020). Information and Communication Technologies ICTs as a research and interdisciplinary form with an intercultural approach for the student training process. <https://www.redalyc.org/journal/4768/476862662003/html/>, 1-4.
- Del Carmen Canto López, , M., Porras, M., & Charlo, J. (2022). Description of the main innovative and alternative methodologies for mathematical learning of written algorithms in Primary Education. *Frontiers in psychology. Vol 13*, 1-14.
- Dewey, J. (1938). *Experience and Education*. New York: Macmillan Company.
- Díaz-Barriga Arceo, F., & Hernández Rojas, G. (2002). Constructivism and meaningful learning. In D.-B. A. Gerardo, *Constructivism and Meaningful Learning* (pp. 23-60). Mexico: Mc Graw Hill.
- Dijve-Droogers, V., Drijvers, M., & Bakker A, P. (2024). Effects of a learning trajectory for statistical inference on the statistical afabetization of 9th grade students. *Journal of Research in Mathematics Education*, 26-48.
- Strategic Development and Quality Management. (2021). *Characterization Survey 2021. Office of Institutional Analysis*. La Serena: Universidad de La Serena.

- Domenech-Esquerdo, S., Segarra-Saavedra, J., & Hidalgo-Mari, T. (2024). Systematized review of the academic and scientific production on the livestreaming platform. *International Visual cultural Review*. Vol 16 N°3, 167-184.
- E., V. (June 21, 2011). Design, implementation and evaluation of a virtual training environment for the teaching of mathematics in secondary school, based on learning styles (Postgraduate thesis). National University of Distance Education of Spain, Madrid. *Postgraduate thesis*. Madrid, Spain: S/E.
- Española, R. A. (June 23, 2021). *www.rae.es*. Retrieved from <https://dle.rae.es>: <https://dle.rae.es/aprendizaje>
- Euroinnova International Online Education. (January 05, 2023). <https://www.euroinnova.edu.es/blog/que-son-los-procesos-de-aprendizaje>. Retrieved from <https://www.euroinnova.edu.es/blog/que-son-los-procesos-de-aprendizaje>: <https://www.euroinnova.edu.es/blog/que-son-los-procesos-de-aprendizaje>
- Eyzaguirre, S., Le Foulon, C., & Salvatierra, V. (2020). Education in times of PAndemia Background and recommendations for discussion in Chile. *studios Públicos* 159 (2020), 111-180.
- Fernandez, F. (2019, September 19). The Theory of MEANINGFUL LEARNING 【By David Ausubel】 ~ What it is and Ideas for Applying It. Spain.
- Figaredo, D., Reich, D., Ruiperez-Valiente, J., & A., J. (2020). Gardening analytics and data-driven education; An expanding field. *Ibero-American Journal of Distance Education*. Vol 23 number 2, 32-39.
- Flores Ferro, E., Gutiérrez, N., & Maureria Cid, F. (2021). Satisfaction of online classes of Physical Education students at a university in Chile in times of Pandemic. *Digital Review of Physical Education* , 10-19.
- Gagné. (1965). The Conditions of Learning. . In *The Conditions of Learning*. (p. 5). New York: Rinehart & Winston.
- Gagné, R. (1965). *The condition of learning*. S/I: Rinehart and Winston.
- Gampala, M. (2023). Innovative approaches to teaching and learning. *Shanlax International Journal of English*. <https://doi.org/10.34293/rtdh.v12is1-dec.86.>, 138-145.
- Giannini, S. (2020). *Covid-19 and higher education: From the immediate effects to the day after*. S/I: UNESCO.
- Gil Flores, J. (2007). The evaluation of labor competencies. *Educación XXI* N10, 83-106.
- Golondrino, C., & Pinedo, M. (December 19, 2021). <https://www.semanticscholar.org/paper/Emociones-y-sentimientos-en-docentes-universitarios-Golondrino-Pinedo/6ea48c5dfe4a7351be51ab25d7696c81d095a646>. Retrieved from <https://www.semanticscholar.org/paper/Emociones-y-sentimientos-en-docentes-universitarios-Golondrino-Pinedo/6ea48c5dfe4a7351be51ab25d7696c81d095a646>: <https://www.semanticscholar.org/paper/Emociones-y-sentimientos-en-docentes-universitarios-Golondrino-Pinedo/6ea48c5dfe4a7351be51ab25d7696c81d095a646>
- Guaña-Moya, J., Arteaga-Alcívar, J., & Chiluisa-Chil, Y. (2022). Evolution of information and communication technologies in education. . *Third International Conference on Information Systems and Technology* (pp. 138-144). Ecuador: S/I.
- Guerra, M., Arenas, C., & Cortés, P. (2020). Communications at INGADEM. In M. Guerra, C. Arenas, & P. Cortés, *Las comunicaciones en INGADEM* (p. 23). Coquimbo: Melgarejo.
- Guzmán-Valenzuela, C., Tagle, Brazo, A., & Lorca-Vyhmeister, A. (2021 May). Learning Analytics in Higher Education: Preponderance of Analytics but Too Little Learning? *INTERNATIONAL JOURNAL OF EDUCATIONAL TECHNOLOGY IN HIGHER EDUCATION*, S/I.
- Hernandez Sampieri, R., Fernández Collaro, C., & Baptista Luco, P. (2024). *Research methodology*. Mexico: McGraw Hill 6th edition.
- Hernández-Sellez, N. (2022). Self-directed learning in work processes. *Educar* 2022 Vol 58/2, 389-403.
- Hernández-Selles. (2022). Self-directed learning in collaborative work processes in higher education. *Educar* Vol 58/2 , 389-403.
- Hilgard, E. ((1979).). Introduction to Psychology. In *Introduction to Psychology* (p. (S/I)). S/I: Harcourt Brace Jovanovich.
- Hilgard, R. (1979). *Learning theories*. S/I: Trillas.
- <https://learningportal.iiep.unesco.org/es>. (March 9, 2022). Retrieved from <https://learningportal.iiep.unesco.org/es>: <https://learningportal.iiep.unesco.org/es/fichas-praticas/mejorar-el-aprendizaje/tecnologias-de-la-informacion-y-la-comunicacion-tics-en-la>
- <https://repositori.upf.edu>. (November 21, 2020). Retrieved from <https://repositori.upf.edu>: <https://repositori.upf.edu/handle/10230/45509>
- <https://teoriasdelaprendizaje.com.ar>. (May 15, 2024). Retrieved from <https://teoriasdelaprendizaje.com.ar>: <https://teoriasdelaprendizaje.com.ar/aprendizaje-significativo-concepto-y-aplicacion-en-la-educacion/>

- Hu, Yun, , H., Ning, L., & Chenyang, L. (2020). Quality Evaluation of Practical Training of Innovative and Entrepreneurial Talents in Universities Based on Statistical Learning Theory after COVID-19 Epidemic'. . *Special section: Artificial Intelligence driven Big Data Analytics for COVID-19*, 9045 – 9051.
- Huanca- Arohuanca, J., Supo-Condoris, F., Sucari, L., & Supo, Q. L. (22). The Social Problem of Virtual University Education in Times of Pandemic, Peru. *Educational Innovations* 22, 1-18.
- I, S.-E. (2019). Foundations for meaningful learning of biodiversity based on constructivism and active methodologies. *Journal of Innovation and Good Teaching Practices*, 90-101.
- ICIELC. (2020). *COVID-19 and Higher Education: From the Immediate Effects to the Day After. Impact analysis, responses and recommendations*. S/I.: Organization for Culture, Science and Education.
- IESALC. (2020). *COVID-19 and Higher Education. From the immediate effects to the day after*. S/I: UN .
- Jaramillo Mujica, J. A., Linares Luque, K., & Morales Avella, L. F. (2018). Design and implementation of an instructional pedagogical assistant. *Trends and claallenger in Higher Education in atin America*, 236-224. Retrieved from <https://www.adayapress.com>: <https://www.adayapress.com/wp-content/uploads/2018/04/24.pdf>
- Jaramillo Mujica, J., & Diaz, M. V. (2020, April 29). <https://es.scribd.com/document/45897235>. Retrieved from <https://es.scribd.com/document/45897235>: <https://es.scribd.com/document/458972350/Semana-6-Teorias-de-aprendizaje#:~:text=Jorge%20A.%20Jaramillo%20Mujica%20f%20Teor%C3%ADas%20de%20aprendizaje,hasta%20que%20estos%20se%20realizan%20de%20manera%20autom%C3%A1tica>.
- Johnson R. B. R.B. Onwuegbuzie, A. J. ((2004)). *Mixed methods research: A research paradigm whose time has come.,* n.d.: Educational Researcher 33(7), 14-26.
- Labraña, J., & Vanderstraeten, R. (2021). Functional differentiation and university expansion Chile. *HSE Social and Education History*, 25.
- Leiva, Y. (2020). The Competence Profile Assessment . *ULS Memories*, 2-5.
- Leiva Nuñez, J., Ugalde Meza, L., & Lorende-Cejudo, C. (2018). The Tpack model in initial teacher training; model University of Olaya Ancaha (UPLA) Chile. *Revista de medios y Educación* 53, 165-177.
- Leiva, Y., & Riveros, K. (2021). The use of ICTs in the classroom. *Journal of Education*, 45-48.
- León-Perez, F., Bas, M.-C., & Escudero-Nahón, A. (2020). Self-perception of emerging digital skills in Higher Education students. *Comunicar*, 92-101.
- Llanos Bardales, J., Machuca Cabrera, Y., & Guzman Cáceres, M. (2022). Emotional intelligence and significant learning in students of the Faculty of Education of the National University of Cajamarca. *Ciencia Latina, multidisciplinary journal*, 1-17.
- Longas Flores, Y. (2021). Learning methodologies and tools used in remote classes at Unisangil. In F. R. Garay, *Experiences of success in the transition from face-to-face to remote in higher education*. (pp. 1-21). Medellín: Editorial Universidad Católica de Colombia.
- López-Sánchez, J., Patiño-Venegas, J., Valencia-Arias, A., & Valencia, J. (2023). Use and adoption of ICTs oriented to university student learning: Systematic review using PRISMA methodology. *Cogent Education*, 10. <https://doi.org/10.1080/2331186X.2023.228>, S/I.
- M, O. (2024). Methods of using technologies in the educational process. *International Journal of Pedagogy*. <https://doi.org/10.37547/ijp/volume04issue06-32>, 174-177.
- Mancha Pineda, E., Casa- Coila, M., Yana Salluca, M., Mamani Jilaja, D., & Mamami Vilca, P. (2021). Digital competencies and learning achievement satisfaction of. *Communication Journal of Communication and Development*, 106-116.
- Mariaca Garrón, M., Zagala Sánchez, M., Campoy Aranda, T., & Gonzalez Gonzales de Mesa, C. (2022). Bibliographic Review on the Use of ICTs in Education. *International Journal of Social Science Research*, 23-40.
- Martínez Lara, S., Rodríguez Melchor, E., & Leyva Cordero, O. (2020). Academic exchange in the face of the COVID-19 pandemic: specific case of Higher Education students of the Autonomous University of Nueva León. *Justicia just*.26.39.4801, 79-90.
- Martínez-Márquez, M. (2021). ICT uses in education. Theoretical framework proposal for its characterization and analysis. *Journal of Systems and Educational Management*. <https://doi.org/10.35429/jsem.2021.22.8.16.23>, 13.
- Matienzo, R. (2020). Evolution of the theory of meaningful learning and application in higher education. *Dialektika of Philosophy and Social Theory Research* 3., 17-26.

- Maureira, M. (2020). Meaningful Learning; the classical view, other view and interest. *Projections. Digital Journal Institute of Research and Accounting Studies*, 22-30.
- Marzipan Ltda. (November 02, 2023). *www.creativos.com*. Retrieved from [www.creativos.com/maquetas/profesor](http://www.creativos.com/maquetas/profesor)
- MINEDUC. (December 19, 2022). <https://www.bcn.cl/leychile/navegar?idNorma=1118991&idParte=9917404>. Retrieved from <https://www.bcn.cl/leychile/navegar?idNorma=1118991&idParte=9917404>
- MINEDUC. (June 16, 2022). <https://www.bcn.cl/leychile/navegar?idNorma=255323&idVersion=2020-01-01&idParte=>. Retrieved from <https://www.bcn.cl/leychile/navegar?idNorma=255323&idVersion=2020-01-01&idParte=>
- MINEDUC. (January 30, 2025). <https://estandaresdocentes.mineduc.cl/estandares-carreras-pedagogia/>. Retrieved from <https://estandaresdocentes.mineduc.cl/>
- ICT Ministry; (May 15, 2021). <https://mintic.gov.co/portal/inicio/Glosario/>. Retrieved from <https://mintic.gov.co/portal/inicio/Glosario/>
- Mohite, A. (2020). Covid 19 use of ICT in education. *Educational Resurgence Journal*, 1-3.
- Moliner Miravet, A., Sanahuja Ribés, L., & Alegre, A. (2020). Inclusive Education and ICT: An Analysis of Teaching Perceptions and Practices. *Journal of Pedagogy*, 72 <https://doi.org/10.13042/Bordon.2020.69852>, 123-138.
- Monte, T. R. (2021). Design of a Pedagogical Model of Education for Environmental Citizenship in Primary Education. *Sustainability Vol 13*, 6051.
- Mori Escobar, F. (May 25, 2020). <https://alicia.concytec.gob.pe/vufind/>. Retrieved from <https://alicia.concytec.gob.pe/vufind/>
- Nejad, B., & Karami, F. (2020). Comparing the effect of ICT-based education with traditional education on students' academic enthusiasm. *Education, Computer Science*, 33.
- Nin, M., & Acosta, M. (2020). Evaluative practices in the teaching of geography in secondary education. *Boletín geográfico Año XLII N 42*, 83-102.
- Nivela Cornejo, A., Echeverría- Desiderio, S., & Santos Méndez, M. (2021). Higher Education with new information and communication technologies in times of pandemic. *Revista horizontes.org Vol 5 N 19*, 813-825.
- Nóbile, C. G. (2022). Dimensions and instruments to measure digital competence in university students: a systematic review. *Edutec, Electronic Journal of Educational Technology*, (81), 88-104.
- Nóbile, C., & Gutiérrez Porlan, I. (2022). DIMENSIONS AND INSTRUMENTS TO MEASURE DIGITAL COMPETENCE IN UNIVERSITY STUDENTS: A SYSTEMATIC REVIEW. *EDUTEC Revista de Educación y Tecnología N° 81*, 88-104.
- ISO 21001:2018 standards. (October 15, 2022). <https://www.studocu.com/latam/document/universidad>. Retrieved from <https://www.studocu.com/latam/document/universidad>
- Novak, J., & Gowin, D. (1984). *Learning How to Learn*. New York: Cambridge University Press.
- WHO. (May 23, 2023). <https://www.elmundo.es/ciencia-y-salud>. Retrieved from <https://www.elmundo.es/ciencia-y-salud/salud/2023/05/23/646c6b42e4d4d8ff7c8b45d2.html>
- Orrego, G. (2018). Descriptive statistics. In G. Orrego, *Descriptive Statistics* (p. 250). La Serena: ULS.
- Passo Utria, Y., & Castro García, P. (June 30, 2019). *www.repositorio.cuc.edu*. Retrieved from <https://repositorio.cuc.edu.co/bitstream/handle/11323/5688/Estrategias%20didácticas%20multimediales%20offline%20para%20el%20fortalecimiento%20de%20los%20procesos%20lecto-escritores%20de%20los%20estudiantes%20del%20nivel%20básica%20primaria.%20.pdf?sequence>

- Pedró, F. (January 10, 2021). <https://www.iesalc.unesco.org>. Retrieved from <https://www.iesalc.unesco.org/2020/08/25/informe-cepal-y-unesco-la-educacion-en-tiempos-de-la-pandemia-de-covid-19/>
- Peiró, R. (2021, May 2021). <https://economipedia.com/definiciones/teorias-del-aprendizaje.html>. Retrieved from <https://economipedia.com/definiciones/teorias-del-aprendizaje.html>: <https://economipedia.com/definiciones/teorias-del-aprendizaje.html>
- Pereira, Z. (2011 January-June ). *Mixed-method designs in education research: a concrete experience*. Spain: Revista Electrónica Educare, XV 15-29.
- Pérez Gómez, A. (1988). *Understand and transform teaching*. Madrid: Morata.
- Pérez Gómez, Á. I. (1985). Teaching: its theory and practice. In Á. I. Pérez Gómez, *La enseñanza: su teoría y su práctica (Teaching: its theory and practice)*. (p. 322). Madrid: Akal.
- Piaget, J. (2019). *Psychology and Pedagogy. How to bring learning theory to teaching practice*. Argentina: XXV Century.
- Prhita, B. (2024, May 21). <https://www.scribbr.com>. Retrieved from <https://www.scribbr.com/methodology/population-vs-sample/>
- RAE. (July 31, 2022). <https://dle.rae.es>. Retrieved from <https://dle.rae.es>: <https://dle.rae.es/evaluar>
- Rambay Tobar, M., & De la Cruz Lozano, J. (2020). DEVELOPMENT OF THE DIGITAL COMPETENCES IN THE UNIVERSITY TEACHERS IN PANDEMIC TIME: SYSTEMATIC REVIEW. *In Cresscendo* 11 (4), 511-527.
- Education Magazine. (2007). LABOR AND EMPLOYABILITY COMPETENCIES. *REVISTA CALIDAD EN EDUCACIÓN*, 36-51.
- Ríos, C. (June 19, 2023). [www.cronicas.cl](http://www.cronicas.cl). Retrieved from [www.cronicas.cl/region/norte.htm](http://www.cronicas.cl/region/norte.htm)
- Rivas, N. (2022, September 26). <https://www.ejemplos.co>. Retrieved from <https://www.ejemplos.co/verbos-para-objetivos-generales-y-especificos/>
- Rodríguez Estrella, E., & Gamboa Guerrero, D. (2024). The Empowerment of Attention in Students with ADHD through Active and Inclusive Methodologies. *„ Sapiens International Multidisciplinary Journal*, 1(1)<https://revistasapiensec.co>, 43-60. h.
- Romero, R., Tejada Navarro, C. A., & Olga, N. (2020). Attitudes towards ICTs. *Pontificia Universidad Católica de Valparaíso. Journal of Education*, 99-120.
- Ruz-Fuenzalida, C. (2021). Virtual education and emergency remote teaching in the context of technical-vocational higher education: possibilities and barriers. *Revista Saberes educativos* Number 6 ISSN 2452-5014, 128-143.
- SA, S. (2022, December 28). <https://www.significados.com/>. Retrieved from <https://www.significados.com/fortalezas-y-debilidades/>
- Sáez, M. R. (2019). Constructivist education in the digital age. *Technology, Science and Education*, 11-127. Retrieved from [www.tecnologia-ciencia-educación.com](http://www.tecnologia-ciencia-educación.com)
- Sanches Días, L., Sanchez- García, J., Aplomino Alvarado, G., & Verges, I. (2021). Challenges of university education in the face of virtuality in times of pandemic. *Journal of Social Sciences (RCS)*, 32-48.
- Santos, L., Proença, S., & Riveiro, S. (2023). Co-creation methodology to promote 21st century competencies in the classroom context. *European Conference on Innovation and Entrepreneurship*. (p. <https://doi.org/10.34190/ecie.18.1.1750>). Coimbra: Instituto Plitécnico de Coimbra.
- Santos-Ellakura, I. (2019). Foundations for meaningful learning of biodiversity based on constructivism and active methodologies. *Journal of Innovation and Good Teaching Practices* , 90-101.
- Sayaf, A., A. Alamri, A., Alqahtani, M., & Al-Rahmi, M. &. (2021). Information and Communications Technology Used in Higher Education: An Empirical Study on Digital Learning as Sustainability. *Sustainability. Sustainability.*, 2-19.
- Serena, U. d., & ULS, P. d. (20, 2022, Aug. 20). [www.userena.cl](http://www.userena.cl). Retrieved from [www.userena.cl](http://www.userena.cl): [www.userena.cl](http://www.userena.cl)
- Sevillano-Monje, V., Martín-Gutiérrez, A., & Hervás-Gómez, C. (2022). The flipped classroom and the development of competencies: an experience of teaching innovation in higher education. *Educational Sciences*. <https://doi.org/10.3390/educsci12040248>, 1-16.
- Shibani, A., Knight, S., & Buckingham, S. ((2020). Educator perspectives on learning analytics in classroom practice. *The Internet and Higher Education*, 46, 2-14.

- Significados.com/constructivismo/. (August 25, 2022). <https://www.significados.com/constructivismo/>. Retrieved from <https://www.significados.com/constructivismo/>
- Silva Córdova, R., & López Donoso, E. (2019). Infagatory teaching methodology for the promotion of meaningful learning in the foundations of quantum theory. *Brazilian Journals Development Vol 5, N°1*, [www.brazilianjournals.com](http://www.brazilianjournals.com).
- SIMCE, M. (2020, December 20). <http://archivos.agenciaseduacion.cl/metodologia-de-construccion-de-gruposocioeconomicos> SIMCE-2012. Retrieved from <http://archivos.agenciaseduacion.cl/metodologia-de-construccion-de-gruposocioeconomicos> SIMCE-2012: <http://archivos.agenciaseduacion.cl/metodologia-de-construccion-de-gruposocioeconomicos> SIMCE-2012
- Srivastava, M, M., Khare, A., & Kumar, R. (2020). Utilizing Information and Communication Technology (ICT) Based Learning over Traditional Learning. . *International Journal of Recent Technology and Engineering*. <https://doi.org/10.35940/ijrte.e6442.018520>, 1.
- Thesaurus. (December 15, 2019). <http://vocabularies.unesco.org/thesaurus/concept1514>. Retrieved from <http://vocabularies.unesco.org/thesaurus/concept1514>: <http://vocabularies.unesco.org/thesaurus/concept1514>
- UGIP La Serena. (2019). *Pedagogical Research in Initial Teacher Training*. La Serena: Universidad de La Serena.
- UMD. (October 15, 2023). [www.umd.cl](http://www.umd.cl). Retrieved from [www.umd.cl](http://www.umd.cl): [www.umd.cl/capacitacion/clasesonline.cl](http://www.umd.cl/capacitacion/clasesonline.cl)
- University of Navarra. (April 06, 2023). <https://biblioguias.unav.edu>. Retrieved from <https://biblioguias.unav.edu>: <https://biblioguias.unav.edu>: [https://biblioguias.unav.edu/revisionessistematicas/herramientas\\_gratuitas](https://biblioguias.unav.edu/revisionessistematicas/herramientas_gratuitas)
- Academic Vice-Chancellor's Office, OAME. (2020). *Monthly Report Early Alternation System Accompaniment Learn Program and PACE ULS Program*. La Serena, Chile: Vice-Rectoría ULS.
- Vygotsky, L. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Massachusetts: Harvard University Press.
- Vygotsky, L. (1978). *Mind in Society: The Development of Higher Psychological Processes*. .: Massachusetts: Harvard University Press.
- WEACE.ORG. (January 05, 2023). <http://www.waece.org>. Retrieved from <http://www.waece.org>: <http://www.waece.org/diccionario/index.php>
- Yuan-Hsuan, L., & Huang-Yao, H. (2024). The intention of teachers in training for a constructivist integration of ICTs; implications of their epistemic beliefs on the Internet and the self-efficacy of Internet-based learning. *Interactive Learning Environments*. Vol 32, 102-114